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### OPINION

## Diet, Lifestyle and Cancer Prevention- A Personal Opinion

Gopinadhan Paliyath<sup>1\*</sup>

<sup>1</sup>University of Guelph, Guelph, Ontario, Canada

\*Corresponding author: Gopinadhan Paliyath, *Email: gpaliyat@uoguelph.ca*

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Cancer is nothing new to people of India. Samhitas by the sages Charaka and Sushruta provided the first descriptions of what could be considered as cancer, several millennia ago, even before a definition came up in the modern era. This essentially suggests that even at a time period where living conditions and food were pure; there were chances of developing these disorders. Cancer is a chronic condition, and in these days, most people will be familiar with situations where one in the family or a neighbour developed cancer. It is an extremely stressful condition for the patient, and the family members involved; and the treatment protocols are not always successful. Cancer is caused by errors in the biological processes, starting from gene mutations and aberrations that are either genetic or induced; biochemical processes involving receptor recognition and/or non-specific activation, loss of hormonal control; and abnormal signal transduction systems. Even though treatment strategies have improved, cancer cases are one of the highest among chronic diseases across the world; some regions showing a higher incidence of certain cancers. The treatment strategies are targeted to kill cancer cells; however, there is collateral damage to normal cells. Ability to withstand the treatment process more or less determines the survival of the patient. The treatment strategies in modern medicine are absolutely painful; the irony is that the treatment cocktails contain same old chemicals that were used half a century ago. Another major issue with cancer chemotherapy is the development of multiple drug resistance (MDR). Development of MDR is a natural process due to selective survival of cells that can escape injury from the treated chemicals. These cells express a special protein (P-glycoprotein) which helps the cells to pump chemother-

apy drugs out of the cells. This enables them to continue growth and multiplication even in the presence of drugs. Most fatalities from cancer chemotherapy are due to the development of multiple drug resistance. Initially, patients show promise to chemotherapy and go into remission, then cancer come back with a vengeance in difficult forms. It is very difficult to treat MDR cancers; however, novel strategies are under development. When it comes to cancer, it is better to prevent the occurrence of cancer, than developing it and trying to cure it. How can one prevent the development of cancer? Very few people really talk about it. Enormous amount of money is spent by the Government, Pharmaceutical industries, Social organizations etc., in drug discovery and regulatory approval, to assure that one drug works as well as an older one. Very few people talk about cancer prevention. It is not that we don't know what is causing this and how we can stop it; but the system is tailored to create a problem first where none existed before, and then try to fix it with another short-sighted method, which then creates a secondary problem; and this goes on and on. When I was growing up in the early fifties, I had rarely heard of cancer, I had heard of a few cases of heart-attack, As time went on, I observed the increase in cancer cases, including several in my family, some of whom did not survive the rigours of chemotherapy. So, what happened? Life style changed a lot within this 60-70 year. As I remember, in the fifties, life was simple. Diet was primarily rice-based, protein source was beans, and fish which is of extremely good quality, and lots of vegetables and fruits. Meat was a luxury, at least for us, probably 1-2 times a year, and that too chicken. Eggs were common, but not frequent enough. This was more like a subsistence

diet. The intake of meat and meat products have spiralled upwards in recent years, and could be a causative factor for the equally upward trend in obesity, type II diabetes, cancer and degenerative diseases. There is a clear relation between obesity and cancer-why? Both are caused by excessive inflammation in the body. So, controlling the inflammation (fire within) is the key to preventing the development of these diseases. Excess oxygen in the form of reactive oxygen species (free radicals) can cause havoc to the entire biological array of biological processes, derailing normal function. This is probably the major cause, if not the only one, for the development of cancer. Now, we know that biochemical pathways such as NF-kB pathway or STAT pathway are increased during cancer development. Early Ayurvedic texts had defined what the nature of the food should be, how much one should eat, how to eat and when to eat. All these aspects influence the outcome of the food consumption. At present, whether in the East or the West, the general trend is to eat more than needed, well after biological satiety is achieved. In the USA, the general portion size has increased 3 times in restaurants. Consuming more and more of unhealthy food may well result in chronic inflammation leading to cancer development. An early epidemiological study conducted on incidences of breast cancer development in Japanese women pointed towards the influence of diet on cancer development. Women who continued to stay in the island had a highly reduced level of cancer incidences when compared to women who migrated to Hawaii. Okinawan diet is more classic Japanese diet, while Hawaiian diet is more American. Several studies have shown similar trends. In early 1990s, systematic studies on the influence of consuming fruits and vegetables on the development of cancer were conducted. The results suggested that increased consumption of fruits, vegetables or their products was associated with a decreased development of cancer. Several studies have now conclusively demonstrated the anti-inflammatory properties of fruits, vegetables and their components, and their influence on decreasing the activity of inflammatory pathways, and potentially preventing cancer. The chemical components present in fruits, vegetables or plants in general are sometimes termed phytochemicals. Plants have the capacity to synthesize chemicals, referred to as secondary plant products, for various purposes. These may be for allelopathy, warding off harmful insects and pest, or helping in drought/cold/stress tolerance and for protection from Sun's harmful UV radiation, which include the vivid anthocyanin, betalain and carotenoid pigments. When it comes to biological activity, these are some of the components that show the highest degree of cytotoxicity to cancer cells when tested in culture. Phytochemicals from Annonaceae family (Annona, Soursop etc), contain components called annonacins which show the highest degree of potency against cancer cells (in picomolar levels). Some companies worked on these components for a while, found out that they cannot get patents on these and abandoned the study, in my lab, we investigated the anti-cancer properties of grape anthocyanins. What we observed was that the anthocyanins are toxic to cancer cells, but safe to normal cells. Somehow, anthocyanins tend to cause depletion in ATP production in cancer cells (probably through uncoupling electron transport in mitochondria). Cancer cells

need a lot of energy sources, the depletion of which causes necrotic process in them. We also were able to show that in a transplant model (where cancer cells are transplanted into athymic mouse) dietary supplementation of grape anthocyanins prevented the growth of tumour. Thus, it appears that when fruits and vegetables are consumed sufficiently, there is a threshold level of phytochemicals maintained within the body which help protect us from the development of abnormal cells that become cancerous. Despite this there may be situations where abnormal cells escape this screening process, in which case, other methods have to be explored. Because of the diversity of phytochemicals in fruits and vegetables, it is always recommended to consume a variety of these products daily (6-7 servings; 600-700g per day). In many parts of the world people generally do not look into preventive care; they leave everything to last minute and go to the doctor when situations become worse. Modern medicine is extremely good in diagnostics. Identifying an issue early can help prevent its getting worse. Now people also have the luxury of sequencing their genes, and if there are potential cancers causing genes, they have to watch the lifestyle. Some high profile people have even gone to the extent of getting a mastectomy, simply because of the presence of certain genes identified as markers of potential development of breast cancer. This is extreme, but having a healthy lifestyle is important. In Kerala especially, several people rely on public anecdotes about the efficacies of herbs. In some cases, use of herbs may help, but this is not predictable. From personal experience, I know that Ayurvedic medicines can provide equal or even better results than other medications. A difficulty with Ayurvedic medicines is that the chemical ingredients are not absorbed efficiently (low bioavailability). Adopting technology to enhance bioavailability of Ayurvedic medicines will bring them to the forefront of cancer treatment procedures.

## Further Readings

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2. Bonam SR, Wu YS, Tunki L, Chellian R, Halmuthur MS, Muller S, Pandey V (2018) What has come out from Phytomedicines and Herbal Edibles for the Treatment of Cancer? Chem Med Chem, 13, 1854-1872