

“Vitamins and supplements for cancer treatment”

Varsha Maharudra solankar 1*, Sonal B Shinde 2*.

1*Student of Pratibhatai Pawar College of Pharmacy, WadalaMahadev, Shrirampur.

2*Assistant Professor at Pratibhatai Pawar College Of Pharmacy ,Wadala Mahadev, Shrirampur

3*Assistant Professor at Pratibhatai Pawar College Of Pharmacy ,Wadala Mahadev, Shrirampur

Corresponding author: Varsha Maharudra solankar

Submitted: 20-12-2024

Accepted: 25-12-2024

ABSTRACT:-

In the United States, about 10 million people have been diagnosed with cancer, and many of them take vitamin and mineral supplements. Studies show that between 26% and 77% of cancer patients use multivitamins. Vitamins play an important role in both preventing and treating cancer. Vitamins like A, B, C, D, E, and K are all linked to cancer. After a cancer diagnosis, 20% to 80% of people start taking nutritional supplements, with most of them being breast cancer survivors.

Keywords: cancer, vitamins, vitamin A, vitamin B, vitamin C, vitamin D, vitamin E, dietary supplements.

I. INTRODUCTION:-

Cancer happens when abnormal cells in the body grow and divide uncontrollably, damaging surrounding tissues. This usually starts because of changes, or mutations, in the DNA of cells. In breast cancer, for example, patients often take vitamins and supplements as part of their care. All types of cancer share one main feature: normal cells turn into harmful (malignant) ones and spread in the body. There are five main types of cancer: carcinoma, sarcoma, melanoma, lymphoma, and leukemia. In total, there are more than 100 types of cancer. Cancers are generally grouped into three categories:

1. Solid cancer – cancer that forms in tissues or organs.
2. Blood cancer – cancer that starts in the blood or bone marrow, like leukemia.
3. Mixed cancer – a combination of both solid and blood cancer. (1).

Causes of Cancer:-

- Changes in the DNA inside cells.
- Drinking too much alcohol.
- Too much exposure to sunlight.
- Genetic issues passed down from family.
- Certain viruses.

- Radiation from devices or machines.
- Harmful physical or chemical substances.
- Non-ionizing radiation (like UV rays)
- Smoking, using tobacco, and drinking alcohol.
- Lack of physical activity.
- Air pollution
- Infections
- Getting older

Sign and symptoms

- Local symptoms
- Cough
- Pneumonia
- Difficulty in swallowing
- Anemia
- Hemorrhage
- Localised pain

Systemic Symptoms

- Embrace fatigue
- Unintentional weight loss
- Skin changes
- Muscle loss and weakness

Prevention of cancer

1. Factors that are known to increase the risk of cancer
 - Cigarette smoking and tobacco use
 - Infection
 - Radiation
 - Immunosuppressive medicine after organ transplant
2. Factors that may affect the risk of cancer
 - Diet
 - Alcohol

Treatment of cancer

A. Drugs acting directly on cells (Cytotoxic drugs)

1. Alkylating agent

- e.g. cisplatin
- 2. Antimetabolite
 - e. g. Methotrexate
- 3. Purine analogue
 - e. g. Mercaptopurine
- 4. Vinca alkaloid
 - e.g. Vincristine, vinblastine
- 5. Tainhibi
 - e.g paclitax

- 6. Epipodophyllo toxin
 - e. g. Etoposide

- 7. Camptothecin analogue
 - e. g. Topotecan, Irinotecan

- 8. Antibiotics
 - e. g. Actinomycin D (Dactinomycin)
 - Doxorubicin, Daunorubicin

- 9. Miscellaneous
 - e. g. Hydroxyurea, Procarbazine,

B. Drugs altering hormonal milieu.

- 1. Glucocorticoid
 - e. g. Prednisolone
- 2. Estrogens
 - e. g. Fosfestrol, Ethinylestradiol
- 3. Selective Estrogen modulator receptor
 - e.g. Fulvestrant
- 4. Aromataseinhibitor
 - e. g. Letrozole, Anastrozole
- 5. Antiandrogen
 - e. g. Flutamide, Bicalutamide
- 6. 5- α reductase inhibitor.⁽²⁾

❖ VITAMINS FOR CANCER PATIENT :-

Vitamins are organic compounds required in the diet in small amount to perform specific biological function for the normal functioning of body.

➤ VITAMINA :-

Vitamin A's function in retinoids:-

All-trans retinoic acid (ATRA) is a compound derived from vitamin A that plays a crucial role in regulating the immune system and other processes in the body. It works by binding to specific receptors in cells called retinoic acid receptors (RARs), which help control the activity of certain genes. These receptors are part of two families: RARs and retinoid X receptors (RXRs). Both families have three types of receptors (α , β , and γ), and these types are found in different tissues throughout the body. When vitamin A levels are low, the activity of these receptors can change, leading to different effects in various tissues. ATRA acts as a "key" that activates these receptors, helping them regulate gene expression and influence many bodily functions, such as immunity and cell growth.

Mechanistic and clinical investigations on retinoid use as chemopreventative agents. It is believed that retinoic acid inhibits the development of cancer. Numerous methods, such as the activation of apoptosis, the encouragement of differentiation, or the inhibition of proliferation, can prevent promotion. Rather than premalignant cells, tumor cells have been the subject of the majority of research describing these effects. Numerous studies demonstrate that retinoic acid can cause differentiation and limit the proliferation of various human cell types. Clinical research to evaluate how well retinoids work as a treatment ⁽⁴⁾

➤ VITAMIN B COMPLEX :-

Vitamin B complex is a group of water-soluble vitamins that work together to support your body's overall health. Here's a simple breakdown: B1 (thiamin), B2 (riboflavin), B3 (niacin), B5 (pantothenic acid), B6 (pyridoxine), B7 (biotin), B9 (folic acid) and B12 (cobalamin)

Vitamin B's involvement in breast cancer :- In today's world, breast cancer is a significant public health concern, with an increasing prevalence in the majority of nations. The B vitamins are a class of small molecule compounds that are soluble in water among vitamins.

These substances don't share any chemical structures. It needs to be received from the outside world because the human body is unable to produce it. It is extensively present in cereals, vegetables, animal liver, yeast, and other foods. Vitamins B1 (thiamine), B2 (riboflavin), B3 (niacin), B5 (pantothenic acid), and B6 (pyridoxine) are among those that the body uses primarily.⁽⁵⁾

Diseases such as beriberi, angular cheilitis, megaloblastic anemia, peripheral neuropathy, and oral ulcers can result from the body's lack of B vitamins. Furthermore, the serum's B vitamin content is also It has varying roles in the onset and progression of cancer and is associated with a range of malignancies. Through dose-response analysis, studies have demonstrated that consuming vitamins B2, B9, B6, and B12 can lower the risk of colorectal cancer .The risk of endometrial cancer rises with the consumption of vitamin B2, vitamin B6, folic acid, and vitamin B12 as well as with an increase in body content . Additionally, research has demonstrated a negative correlation between the body's level of nicotinamide, a vitamin B3 (VitB3) derivative, and the risk of Skin cancer not melanoma .(6). The risk of breast cancer Increases with plasma vitamin B12 levels. Additionally, there is a favorable correlation between the risk of invasive breast cancer and plasma VitB9 . Furthermore, there is no discernible relationship between plasma levels of folic acid and vitamin B12 and the risk of breast cancer as well as particular molecular subtypes of the disease . Additionally, research has shown no connection between the risk of breast cancer and the presence of B vitamin (7)

❖ VITAMIN D

Vitamin D's involvement in prostate cancer :-

Vitamin D plays a multifaceted role in prostate cancer, involving both potential protective effects and complex interactions with cancer progression.

Mechanisms of Action

Vitamin D exerts its effects primarily through the active metabolite 1,25-dihydroxyvitamin D (calcitriol), which binds to the vitamin D receptor (VDR). VDR is expressed in prostate cells, allowing vitamin D to influence gene expression and cellular behavior.(8)

Analytic epidemiologic investigations have led to a consensus that low UV radiation and vitamin D levels are, in fact, linked to an elevated risk of prostate cancer in individual individuals. The way that we now understand the function of vitamin D in the epidemiology of rickets and prostate cancer has evolved in tandem. Ecological observations regarding UV radiation in both diseases came about before experimental observations and were then confirmed by them. Vitamin D is the name given to compounds (secosteroid) that function as prohormones for the

bioactive hormone calcitriol and have a structure similar to that of a steroid.The two physiologically significant forms of vitamin D in humans are vitamin D3 (cholecalciferol), which is generated in the skin when exposed to UV light from the sun, and vitamin D2 (ergocalciferol), which is produced in plants. D2 is a weaker prohormone than D3. In addition to natural production, food items (dairy products fortified with D3, fish liver oil, eggs, and fatty fish (9)

➤ VITAMIN E :-

Vitamin E's involvement in prostate cancer :-

The AlphaTocopherol and Beta-Carotene Cancer Prevention Study (ATBC Study) found that men who smoked and received 50 IU of vitamin E (as a-tocopherol) for up to 8 years had lower incidence and mortality rates of prostate cancer (1). The National Cancer Institute-sponsored Selenium and Vitamin E Cancer Prevention Trial (SELECT) was initiated in response to the unexpected decline in prostate cancer incidence and mortality (2).(10)The current SELECT experiment will look at the separate and combined effects of supplementing with selenium and vitamin E (a-tocopherol) in 32,000 men over a period of more than 12 years. The select trial's findings won't be accessible for several years, though. Research on the Molecular Mechanisms of Vitamin E in Prostate Cancer in Cancer Cells In vitro cell culture system investigations revealed that α -vitamin E or its derivative, VES, might suppress the proliferation of prostate cancer cells but not normal prostate cells, which is consistent with epidemiological and animal research (Israel 2000, Zhang 2002). Various research groups have hypothesized various pathways to explain the antiprostata tumor effect of α -vitamin E/VES (11)

➤ VITAMIN K

Vitamin K's involvement in lung cancer :-

Vitamin K is a fat-soluble vitamin 12 that can be obtained by Localised pain in vitro and in vivo on various cancer cell lines has demonstrated that vitamin K inhibits cell proliferation. Most of those experimental studies employed menadione (vitamin K3), asynthetic form of vitamin K with strong growth inhibitory effects on the initiation and proliferation of many cancer cell lines. Using information from a sizable Japanese population-based prospective cohort study, we looked into the possible link between total vitamin K intake and lung cancer risk in this study.ICD-10 version codes C330–C349. In several locations, the follow-up

study on the incidence and mortality of different cancers finished sooner than expected: by the end of 1994, 1997, 1999, 2000, 2002, 2003, 2006, and 2008 in one, four, one, one, eight, one, two, and two areas, respectively.⁽¹²⁾

The inverse relationship between vitamin K intake and lung cancer risk was not affected by participant age, BMI, or alcohol intake status, and it was statistically significant in men but not in women. It was also stronger in ever-than-never smokers. The evidence regarding the association between vitamin K intake through diet and the risk of cancer is preliminary and ambiguous. Numerous research works have examined the relationships between vitamin K consumption and cancer risk, encompassing prostate, breast, pancreatic, and overall cancer.²¹ A study from Heidelberg with 24,340 participants with a median follow-up of 10.2 years found a negative correlation between vitamin K and the risk of lung cancer death and incidence.^{incidence}

❖ SUPPLEMENTS FOR CANCEROUS PATIENTS :

A Garlic :-



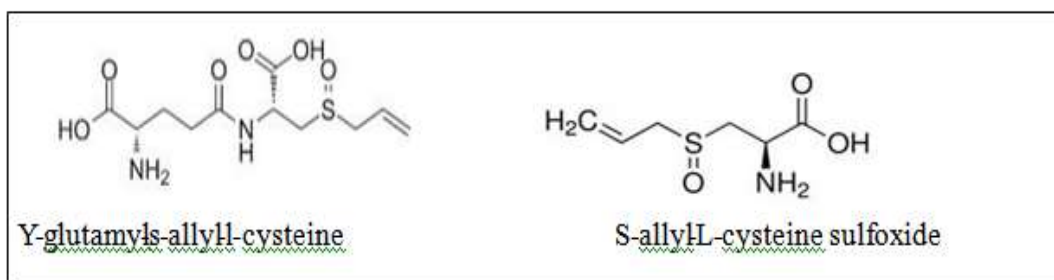
Fig :- garlic

Synonym:- Allium

Biological source:-bulbs of the plant *Allium sativum* linn

Family:- liliaceae

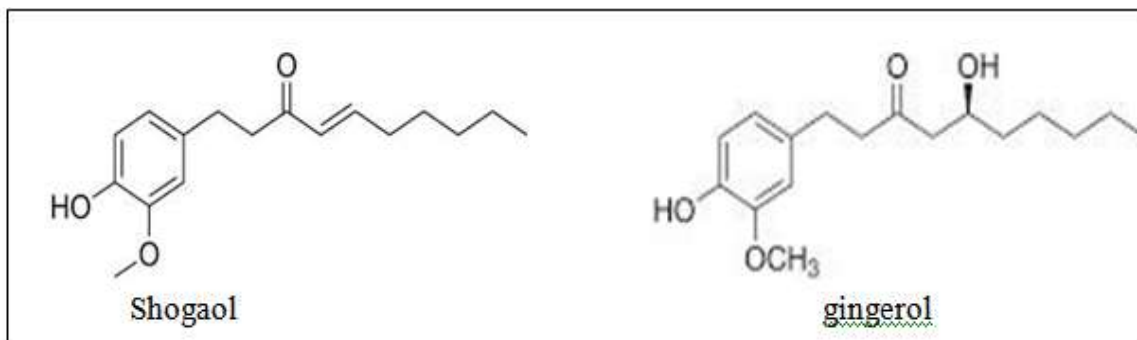
Chemical constituents:- Garlic's nutritional and medicinal properties are widely recognized. Some of the many phytoconstituents found in garlic, such as SAC, alliin, DAS, SAMC, DATS, and DADS, have potent anti-cancer properties.⁽¹⁴⁾



Role of garlic in cancer treatment :- Numerous pharmacological properties, such as antibacterial, antiarthritic, antithrombotic, anticancer, hypoglycemic, and hypolipidemic actions, are present in garlic (*Allium sativum* L.). Garlic's anticancer properties are probably the most well-studied of its many beneficial pharmacological effects, and using it significantly lowers the risk of getting cancer. Because of their multi-targeted actions and low toxicity, a number of garlic's active metabolites have been shown to be crucial in the death of cancerous cells. Allicin, diallyl mercaptan, diallyl disulfide, diallyl sulphide, and diallyl

trisulfide are among the bioactive substances in garlic that have anticancer effects.⁽¹⁵⁾

When compared to water-soluble organosulfur compounds, oil-soluble components of garlic, including DAS, DADS, and DATS, greatly inhibited the growth of CMT-13 (canine mammary tumor) cells. DAS and DADS were cytostatic, whereas DATS was cytotoxic. In addition to the quantity of sulfur atoms, an increase in intracellular GSH levels increased the cancer-suppressive efficacy.⁽¹⁶⁾



B. Ginger :-



Fig :-Ginger

Synonym :- zingiber , zingiberis

Biological source:- fried or dried / peeled or unpeeled or coated rhizome of zingiber officinal

Family :- zingiberaceae

Chemical constituents :- Depending on the cultivation site and if the product is fresh, dried, or processed, this plant's chemical composition changes significantly (Singletary, 2010). More than 400 distinct compounds were found in *Z. officinale* var. *rubrum* after chemical investigation. Carbohydrates (50–70%), lipids (3–8%), terpenes (zingiberene, β -bisabolene, α -farnesene, β sesquiphellandrene, and α -curcumene), and phenolic chemicals (gingerol, paradols, and shogaol) are the main components of ginger rhizomes. . The other two varieties of ginger had higher concentrations of both shogaol and gingerols, with average levels of shogaol (18–25%) (16).

Role ginger of ginger in cancer treatment:-

Due to their effectiveness, safety, and reduced side effects, herbal medications are currently in high demand for primary healthcare in developed nations (Bhargava et al., 2012). Eighty percent of people in developing nations rely on herbal medicine for their primary medical

treatment, and eighty-five percent of herbal medicines are made from plants, according to a World Health Organization survey. An ingredient in Indonesian jamu is the rhizome of *Zingiber officinale*.⁽¹⁷⁾ This specific plant is divided into three varieties according to its size, rhizome colors, and chemical composition: *Z. officinale* var. *rubrum* (small red ginger, merah, or beureum), *Z. officinale* var. *amarum* (small white ginger, emprit), and *Z. officinale* var. *Roscoe* (big white ginger or giant ginger, badak or gajah) (Figure 1).⁽¹⁸⁾ The essential oils of the big white ginger is the lowest compared to the other types. While the other gingers are generally utilized for medicinal purposes, the large white ginger is frequently used for food and drink.⁽¹⁹⁾

C. Green tea:-



Fig :- green tea

Synonym :- camellia sinensis

Biological source :- leaves, buds and tender of camellia sinensis

Family :- theaceae

Chemical constituents :- Green tea is a rich source of many valuable substances, including polyphenols, flavonoids, flavonols, amino acids, organic acids, lipids, vitamins, polysaccharides, and thiamine. Among these, catechins, a type of polyphenol, are the main compounds responsible for its astringent taste. Catechins also influence genes related to cancer development and spread.

The key catechins In green tea are:

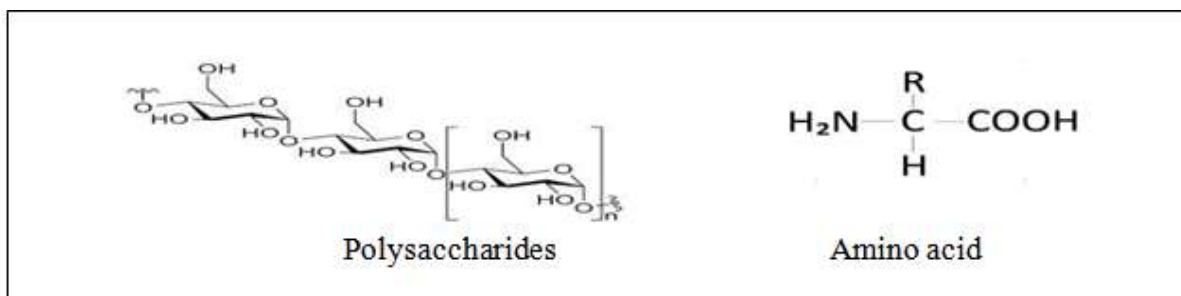
Epicanthic (EC)

Epicatechin-3-gallate (ECG)

Epigallocatechin (EGC)

Epigallocatechin-3-gallate (EGCG)

Phenolic compounds make up 30–42% of the dry weight of green tea, with EGCG being the most abundant, accounting for 50–80% of the total catechin content.⁽²⁰⁾



Role of green tea in cancer treatment :- Green tea is made from the *Camellia sinensis* plant and is enjoyed worldwide. While its exact effects on the body are still being studied, green tea has been shown to play an important role in controlling certain diseases, including cancer. Here are some possible ways it may help prevent or slow cancer:

1. **Activating tumor-suppressing genes:** Green tea can activate genes like p53 and PTEN/P21 that suppress tumors. It also helps regulate cell death (apoptosis) and blocks the growth of new blood vessels that feed tumors (angiogenesis).
2. **Neutralizing free radicals:** Green tea has strong antioxidants that protect cells by neutralizing harmful free radicals, preventing damage to important molecules and reducing the risk of tumors.
3. **Modulating cancer-related genes:** Green tea may influence genes involved in the start, growth, and spread of tumors.
4. **Inhibiting harmful pathways:** Green tea blocks pathways involving cyclooxygenase, lipoxygenases, tumor necrosis factor (TNF), and interleukins, which are linked to tumor growth and progression.⁽²¹⁾

D. Turmeric :-



Fig :- turmeric

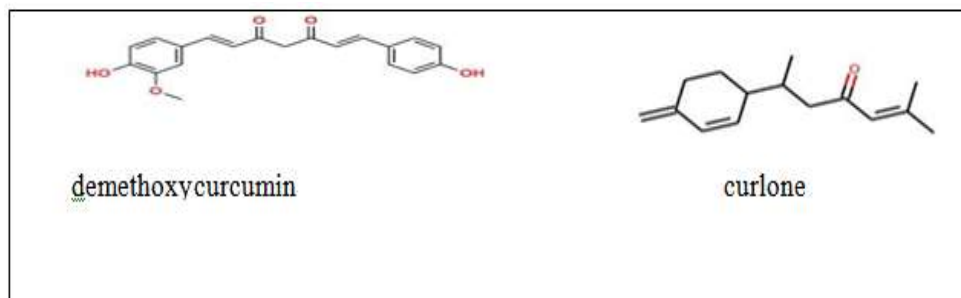
Synonym:- curcumin, haldi

Biological source:- turmeric consists of dried as well as fresh “rhizome” of the plant *curcuma longa*

Family:- zingiberaceae

Chemical constituents:-The main polyphenols found in turmeric roots are curcumin, demethoxycurcumin, and bisdemethoxycurcumin, which are collectively called curcuminoids (making up 3–6% of turmeric). Turmeric also contains other phenolic compounds, including 1-hydroxy-1 and

1,5-bis (4-hydroxy-3-methoxyphenyl); -7-(4-hydroxy-3-methoxyphenyl).(22)



Role of turmeric in cancer treatment :-

Turmeric has been shown to block certain processes involved in tumor growth. For example, studies by Huang et al. (1988, 1991, 1992) found that turmeric inhibits enzymes like epidermal ornithine decarboxylase (ODC) and reduces DNA synthesis in skin cells, preventing tumor development in mice. Research by Lin et al. (2000) and Johnson and Mukhtar (2007) showed that curcumin, the main compound in turmeric, can help prevent colon cancer. It also makes chemotherapy drugs more effective in killing prostate cancer cells. When curcumin is combined with traditional chemotherapy, the results are even better. Curcumin protects cells from damage caused by UV radiation by neutralizing harmful free radicals, which helps reduce the risk of skin cancer. In studies with rats, pure curcumin was found to prevent cancer by reducing the number of precancerous and cancerous lesions in the stomach (Lal et al., 2000). Ozaki et al. discovered that curcumin strongly inhibits two key proteins, nuclear factor kappa B and activated protein 1, which play important roles in cancer development.(24)

E. Ginseng:-



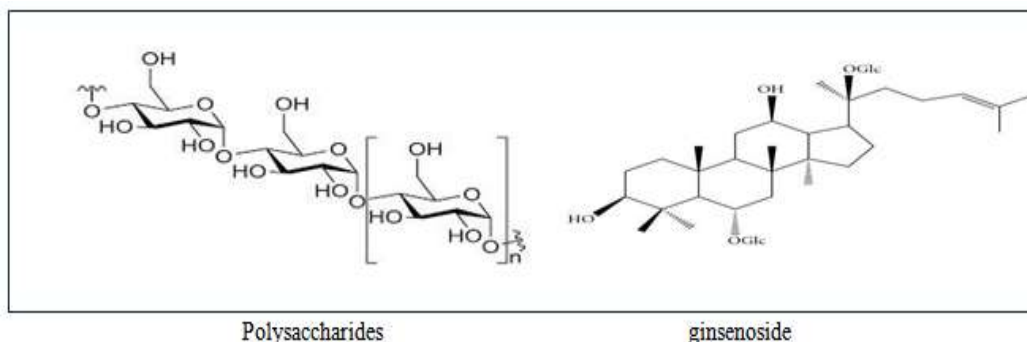
Fig:- Ginseng

Synonym :- liquorice , mulethi.

Biological source:- it consists of dried, peeled or unpeeled root and stolon of glycyrrhiza glabra

Family:- leguminosea.

Chemical constituents :-Polysaccharides, ginsenoside, peptides, ligans, and other kinds of chemicals have all been identified in ginseng .alkaloids, glucoside,(25).



Role of ginseng in cancer treatment :- It been demonstrated that ginseng has potent anticancer

effects. It has been shown that ginseng root saponin and non-saponin chemicals exhibit cytotoxic

properties against a variety of cancer cell lines in vitro.⁽²⁶⁾ One Chemotherapy is currently the cornerstone of cancer care. However, there are a number of drawbacks of chemotherapy: (1) Chemoresistance development is nearly unavoidable.⁽²⁷⁾

It has also been demonstrated that ginseng protects against mammary gland cancer in rats given N-methylN-nitrosourea injections.⁽²⁸⁾ Initially, precancerous inflammation has the potential to exacerbate genetic and epigenetic harm. Second, inflammation may result from abnormal oncogene activation. To accelerate the development of cancer and produce the entire malignant phenotype, including tissue remodeling,⁽²⁹⁾

II. CONCLUSION: -

Vitamins and supplements benefits for cancer patients, their use must be approached cautiously and tailored to individual needs. More robust clinical trials are needed to establish clear guidelines on their efficacy and safety in cancer care. While some supplements show promise in supporting cancer patients, others lack evidence or carry risks. More high-quality clinical trials are needed to establish their safety and efficacy. Open communication between patients and healthcare providers is crucial to ensure safe and effective use. No serious adverse effects have been associated with dietary supplementation. Further research is needed to identify the efficacy and safety of these Supplements to be able to give clear evidence-based Recommendations.⁽³⁰⁾

Future aspects :-

The use of vitamin and mineral supplements during cancer treatment is controversial. Potential advantages: Certain vitamins and supplements may lessen the negative effects of cancer treatment and help avoid cell damage. Vitamin C, for instance, may improve longevity by slowing the growth of tumors. Supplements do not, however, appear to increase survival or reduce the chance of recurrence. Possible dangers: Excessive intake of certain vitamins and minerals may be detrimental or possibly accelerate the development of cancer. For instance, patients who already have cancer may be at risk from taking too much folic acid. Furthermore, certain vitamins and minerals may affect the effectiveness of cancer medications. Future studies: The effectiveness of vitamin and mineral supplements for cancer patients requires further investigation. It is necessary to use

randomized controlled trials to ascertain the effectiveness of bioactive vitamin therapies in pancreatic cancer, randomized controlled trials are required. The possible positive or negative effects of aspirin and nutritional supplements on cancer survivors require more research⁽³¹⁾.

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