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Medicinal Herbs for Treatment of Cancer

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***Abstract*: Cancer is a disease that affects the human population worldwide. New medicines to treat and prevent this life-threatening condition are always in demand. Natural-derived substances are attracting scientific and academic attention since they are thought to have fewer hazardous side effects than conventional therapies like chemotherapy. Natural secondary metabolites produced by plants are being studied for their anticancer properties, which might lead to the creation of novel therapeutic medications. As a result of the success of these substances, which have been turned into standard cancer treatments, new technologies are developing to further advance the field. Nanoparticles for nanomedicines, for example, are a novel technology that aims to improve the anticancer properties of plant-derived pharmaceuticals by regulating the compound's release and studying new administration ways. The need for naturally produced chemicals from medicinal plants, as well as their features that make them possible anticancer therapeutic targets, are discussed in this study.**

***Keywords*: anticancer, antiproliferative, apoptosis, cytotoxicity, extract, cancer.**

1. Introduction

Cancer remains a major human killer, with millions of deaths every year worldwide. The main cause of deaths in developing as well as developed countries is cancer and it is growing rapidly. It is uncontrollable division of cells that spreads into surrounding tissues and destroy them. Multiple type of changes in genes leads to the development of Cancer cells.

According to *National Cancer Institute (NCI)*, cancer, that it is made up of billions of cells and can arise anywhere in the body. Human cells divide and proliferate to produce new cells, which take the place of old or damaged cells when they die. But sometimes, the damaged cells start to grow, when they should not. Then, those cells will form tumours i.e., tissue lumps, and those can be either cancerous or non-cancerous. Every year, around 11 million people are reported and 6.7 million of them die of cancer [1]. 19.3million cancer cases were documented worldwide in 2020 along with 10 million deaths. The most commonly diagnosed cancer in 2020 was Female Breast Cancer with 2.3 million cases (11.7%), followed by 11.4% Lung Cancer, 10.0% Colorectal, 7.3% Prostate and 5.6%of Stomach Cancer. The maximum rate of deaths was from Lung Cancer with 1.8 million deaths. By 2040, there are expected to be 28.5 million cancer diagnoses globally, up 47 percent from 2020, with 16.4 million cancer-related deaths [2]. With the increasing cancer cases worldwide, the interest in cancer prevention strategies has also increased.

The most widely used conventional cancer modern treatments are Surgery, Chemotherapy and Radiation [1]. The use of natural biological agents to reduce the risk of, or to delay the development of initial stages of cancer is known as Chemoprevention [3]. Cancer is somehow preventable in the developed countries but on the other hand it is dangerous and painful death sentence in developing countries due to lack of modern treatment, therapies and awareness [1].

On the basis of health of patient, how severe the cancer is and which stage is going on, the treatment is decided. According to Cancer Research UK, Cancer stages are divided into 5 stages, numbered from 0 to 4. Stage 0 is also referred as Carcinoma in situ. This stage means there's no cancer but the abnormal cells have the potential to develop into cancer in future. Stage 1 means the cancer is small and is limited to one area or the one organ. Stages 2 and 3 indicate that the cancer has spread to adjacent tissues and lymph nodes. Stage 4 means cancer has spread to the other body organs also and is known as Advanced or Metastatic Cancer. In spite of modern therapies and treatments, cancer is still known as one major cause of deaths worldwide.

Humanity has been fighting with diseases such as cancer for centuries and the use of medicinal plants for curing diseases is as old as mankind itself. In 5th century B.C Hippocrates listed 400 herbs used commonly. "Sushruta Samhita" written by Sushruta, 'the father of surgery' described about 700 medicinal herbs and 64 mineral sourced preparations in 6th century B.C. [4]. Traditional Chinese medicine (TCM) has a history of 3000 years which focusses on balancing the yin and yang representing different complementary forces to form one dynamic system [5].

Medicinal plants were slow in action so as modern science grew; synthetic medicines flooded the market due to their instant action despite of their side-effects. But in nineteenth century medicinal plants and their importance in disease treatment was reinvented and has been in research ever since. Research has been investigating the use of plant extracts which contain particular compounds called phytochemicals, that not only possesses antifungal, antibacterial, antiseptic properties but also anticancer properties. Many plant extracts and phytochemicals are already in use to develop anti-cancer medicines. Phytochemicals such as Polyphenols including tannins which can be found in oat leaves and black tea,

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curcumin, found in turmeric, resveratrol which can be found in grapes and peanuts, gallacatechins present in green tea leaves, are found to have apoptosis inducing properties. Research is being done on Brassenosteroids to treat various lines of cancer cells of lung carcinoma A-549, multiple myeloma RPMI 8226, prostate cancer and breast cancer [6].

A. Herbs with potential cytotoxicity towards cancer cells

1) Nigella sativa

Common names-black cumin, black seed, black caraway, Roman coriander, kalonji, fennel flower etc.

Nigella sativa is a black coloured seed that comes under *Ranunculacea* family. It is mainly known as Black cumin as well as Black seed. It is native to Southern Europe, Southern Asia and Northern Africa. It is used as spices as well as Herbal Medicine. *Nigella sativa* is considered as natural therapy for many diseases and disorders. But mainly used for the treatment of Asthma, Cough, Inflammation and many others. Muslims believes that, *N. Sativa* can be used to cure, or to treat all types of diseases and disorders except of death. This plant is used to cure allergies, hypertension, heart illness, vomiting, abdominal discomfort, and stomach ache in Traditional Moroccan Medicine. Black seed is composed of Flavonoids, Phenolic Acids (Non-volatile compounds) and terpene compounds (Volatile compound). Components like bioactive compounds, essential oils and various extracts are behinds it's antioxidant, antimicrobial, antiulcer, antiparasitic, antimutagenic, anti-inflammatory properties. [7].

Research evaluated that with an IC50 value of 43 g/ml, *N. sativa* oil showed a substantial inhibitory impact against the human lung cancer cell line A-549. *N. Sativa* oil and seed extract effectively lowers the viability of human lung cancer cells and alters the cellular shape of A-549 cells in a concentration-dependent way in a recent study.

Research looked at the effects of aqueous and alcoholic extracts of N. Sativa on MCF-7 (breast cancer cell line), and the results showed that N. sativa extracts are efficient at inactivating MCF-7 cells (103). In another study, MCF-7 (breast cancer cell line) was given aqueous and alcoholic extracts of N. Sativa, as well as H2O2 (oxidative stressor). The survivability of MCF-7 cells was tested using standard cell culture techniques at various concentrations and combinations, and the results revealed that *N. Sativa* extracts, alone or in combination with H2O2, are effective against MCF-7 cells and affect their survivability, making them a promising treatment for breast cancer therapy. The anti-cancer efficacy of N. supercritical-CO2 extract was investigated in a more recent investigation. The effects of *N. sativa* on the MCF-7 breast cancer cell line were examined, and the results revealed that the supercritical CO2 extract of *N. sativa* has anti-proliferative properties in MCF-7 cells and can be utilised to treat breast cancer [8].

An investigation was done to see if *N. sativa* could help Wistar rats with ferric nitrilotriacetate (Fe-NTA)-induced kidney carcinogenesis. The induction of Fe-NTA induced a number of alterations in the kidney's usual metabolic activities. A dose of 50 and 100 mg N. sativa crushed seeds / kg body weight restored normal metabolic processes, reducing the carcinogenic effect of Fe-NTA. The anti-cancer activity of the *N. sativa* seed hydro-alcoholic extract was tested against human renal carcinoma cells in a recent study, and the results revealed that the *N. sativa*seed extract greatly inhibited the proliferation of human renal carcinoma cells [9].

Green gold nanoparticles made from Nigella sativa oil are a type of ecologically friendly nanoparticle that may be made at room temperature. To synthesis spherical shaped AuNPs, 2ml of NSO gold metal ion concentration was determined to be optimal. At a concentration of 2ml of AuNPs metal ion, the AuNPs from NSO showed a surface plasmon resonance band at 545nm, with a particle size of 22.761.43 nm. The negative zeta potential value found for the synthesised AuNPs indicated that they were exceedingly stable (-39.4mV). TEM images clearly confirmed the spherical size of the nanoparticles formed at a concentration of 2ml NSO metal ion. The average crystallite size was 14.89nm. It also had antibacterial properties against gram-positive and gram-negative bacteria. The gold nanoparticles triggered cell death in the Hep-G2 cancer cell line at a concentration of 100 g/ml, with an IC50 value of 70.60 g/ml at 100 g. Thymoquinone is a bioactive molecule found in the NSO that has been shown to have antibacterial and anticancer activities (figure 1). [10]

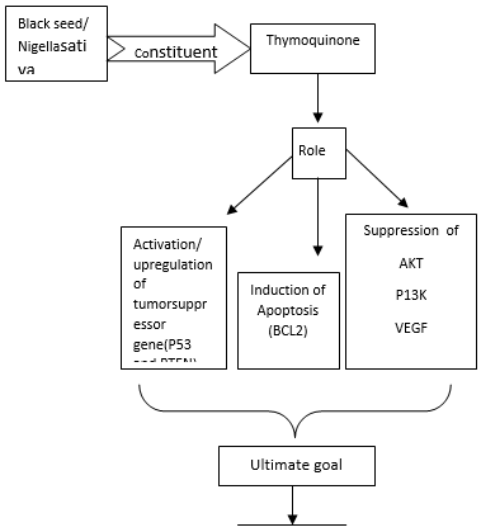


Fig. 1. Nigella sativa shows an effect in the prevention of cancer through upregulation of tumor suppressor gene [11]

According to the current study, gold nanoparticles generated from Nigella sativa oil could be employed as a treatment regimen for cancer therapy and as a medication delivery method. As a rival source for existing cancer medicines, this environmentally friendly nanoparticle would be a boost to the area of biomedicine [10].

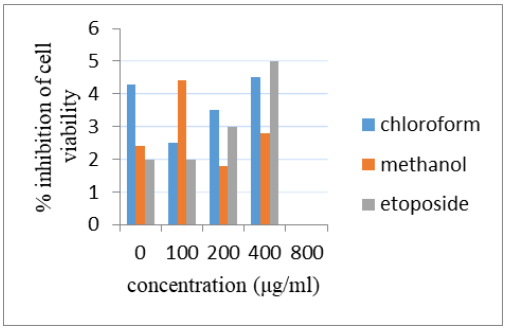
2) Ipomoea purpurealeaf extract

Common name: morning glory

Ipomoea genus comprises of huge number of species approximately around 500-600 species. It comes under Convolvulaceae family and the plants are herbaceous that depict leaves of heart shape and flowers of funnel shape. They are native to central and southern countries of America and

territories of tropical Africa but is naturalized in India on a wide scale. The species of this family i.e., Convolvulaceae release resin glycosides in the roots and foliar tissues of the plant. Ipomoea genus is used in rituals, medicines, nutrition and agricultural purposes from many past years [12]. Ipomoea purpurea is commonly known as Common Morning Glory. Its flowers possess antioxidant property, entheogen activity, anti-proliferative property and apoptosis inducing property due to the presence of cyanidins, pelargonidins, lysergol, derivatives of ergoline, ergine and isoergine. It was investigated that the cytotoxic extracts of leaves of Ipomoea purpurea has the potential to result apoptosis in Cancer cell lines of Humans. It has been examined that the liquid organic extract of I. purpurea leaves are effective to inhibit the activities of Lung Cancer, Liver Cancer and Breast Cancer [13].

Methanol and chloroform-based extracts of *Ipomoea purpurea* showed the highest cytotoxicity through inhibition against MDA-MB-231 (breast cancer lines) and A-549 (lung cancer lines). However, these extracts had very less cytotoxicity against MCF-10A cells, which means that the extracts were only toxic towards cancer cells and not towards normal cells and this effect was much higher in the 3D cell culture. However, these extracts showed anti proliferative effects in a concentration and time dependant manner. Today it is a fact that the results are more accurate on 3D cell culture as compared to traditional 2D cell culture. 3D cell culture used spheroids which highly resembles human tumour cells. The IC50 values of methanol and chloroform extracts on spheroids were around 4 to 5 times higher than those of 2D cell cultures, according to research done on A-549 and MDA-MB-231 spheroids. *Ipomoea purpurea* leaf extracts were also tested if they show any apoptosis properties and in most researches it has been found that *Ipomoea purpurea* leaf extracts can cause apoptosis in A-549 lung cancer cells via the intrinsic route, which involves death receptors on the cell membrane's surface. [13].



Graph 1. *In vitro* antiproliferative activity of chloroform, and methanol extracts of *I. purpurea* leaves on 3D spheroids of MDA- MB -231 and A-549, respectively, after 72 hrs of treatment [13]

3) Curcuma longa

Common name: turmeric

Curcuma Longa is a perennial plant that belongs to Ginger family; Zingiberaceae. Its common name is Turmeric and is also known as Haldi. Because of its medical properties, it is used as a herbal remedy against various diseases. It possesses various other properties, like: anti-tumour, wound healing, antioxidant, antimicrobial and gastro protective properties [14].

The roots and the underground stem of C. longa are firstly boiled, then dried and are then crushed into thin powdered form, which is used as cosmetic ingredient, food preservative and food colouring agent all over the world. A chemical named Curcumin is responsible for the yellow colour of C. longa and it is also reported to have a great impact in the treatment of various chronic disorders along with inflammation, arthritis, metabolic syndrome and widely in cancer treatment. The National Cancer Institute (NCI) investigated 40 agents in Curcuma longa through many clinical trials, and it was found that Curcumin, a phyto-constituent of C. longa is one of the agent having cancer chemopreventive property. In the previous few decades, the healing ability of Curcumin had been passed through various clinical trials, tests and investigation to cope with the cancer and its remedy related complications.

The key element in Curcuma longa extract, has been extensively studied for its anti-inflammatory, antioxidant, anticancer, and antiandrogenic properties over the last several decades. Prostate cancer, breast cancer, colorectal cancer, pancreatic cancer, and head and neck cancer have all showed considerable anticancer advantages in vitro and in vivo. In addition, its effectiveness and safety in cancer patients have been established in several human clinical trials, whether alone or in combination with other anticancer drugs. Curcumin is hypothesised to have anticancer qualities by interfering with many cellular pathways and causing/inducing the production of particular cytokines, enzymes, or growth factors such MAPK, EGF, NFκB, PKD1, COX-2, STAT3, TNF-α, and IκKβ. [15]

Curcumin's anticancer potential has been limited by its low water solubility, which results in poor cellular absorption, oral bioavailability, and chemical stability. Different approaches, including as structural alteration and the use of drug delivery systems, have been taken to address these restrictions. The hydrogen donor group, the β-diketonemoiety, the phenyl rings, and the substituent groups on them are recognised to be important pharmacophores in curcumin's biological activity. Curcumin compounds with increased efficacy and/or improved water solubility or stability have resulted through chemical modification of these moieties. Furthermore, various delivery systems for curcumin delivery to cancer cells or animal xenografts have been developed using a variety of natural or synthetic polymers, lipids, or proteins, some of which have improved the stability and/or cellular uptake of curcumin, resulting in a stronger anticancer response. Despite the huge effort to improve curcumin's physicochemical and biological properties, there are still various difficulties to be resolved in terms of bioavailability, potency, and tissue selectivity. Curcumin derivatives are not more potent than curcumin. Medicinal chemistry efforts to enhance the pharmacological properties of curcumin have not been successful in considerably increasing its potency. Due to the low efficacy of curcumin and its derivatives, higher dosages are required to get a therapeutic response, which increases adverse effects and lowers patient compliance. Another downside of structural alteration is that it is difficult to strike a balance between efficacy and solubility, and in most situations, one is sacrificed in favour of the other. The bulk of structural modifications that increase curcumin

effectiveness reduce its solubility and make it more hydrophobic. As a result, further study in this area is required in order to tackle the problem. Although numerous drug delivery systems have been used to improve curcumin's cellular absorption and activity, most of these formulations have remained at the proof-of-concept stage and have not been tested in clinical studies. Before these curcumin delivery systems may make it to the pharmaceutical market, clinical trials are needed to assess their safety and efficacy in people. Furthermore, the majority of curcumin drug delivery methods now in development lack tissue selectivity. As a result, there is still a lot of opportunity for advancement in terms of selectivity for specific tumour tissues in curcumin delivery systems. Tissue-specific curcumin administration increases local drug concentrations at the site of action, resulting in greater efficacy (at lower curcumin dosages) and fewer side effects [15].

4) Linumusitatissimum

Common names: flax, linseed

Linseed is another name for flaxseed, and the two names are interchangeable. It belongs to family *Linaceae*. Flaxseed is the name for flax that is consumed by humans, whereas linseed is the term for flax that is utilised for industrial reasons. In Indian languages, it is referred as Alsi, Jawas, and Aksebija. *Linumusitatissimum* is the Latin word for flaxseed, which means "extremely beneficial."

Flaxseed was first brought to North America by colonists, who used it to produce clothing. Flaxseed was used to make cloth and paper, and oil as well as its derivatives are utilised in the production of animal feed.Due to the inclusion of physiologically active chemicals and elements such as linoleic acid, lignans, cyclic peptides, polysaccharides, alkaloids, cyanogenic glycosides, and cadmium, flaxseed and flaxseed oil are thought to provide potential health advantages (figure 2). [16]

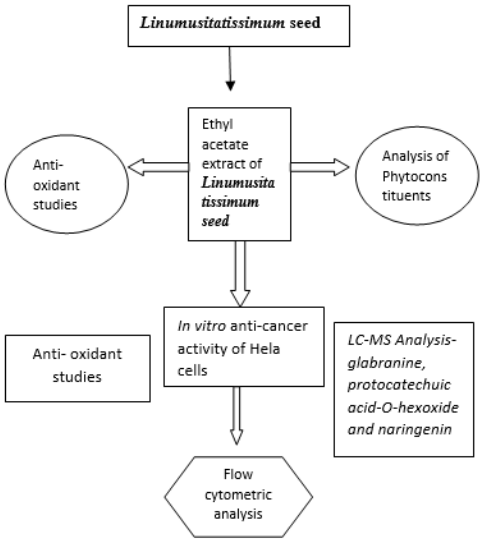


Fig. 2. Anticancer effect of *Linumusitatissimum* seed extract [17]

Because of its many applications, it has a high position among oilseeds. Because to its high level of alpha-linolenic acid (ALA), nutritional fibre, high-quality protein, and phytoestrogens, it has become a popular nutritious meal.

Flaxseed has attracted the attention of nutritionists and academics in the field of food and disease study during the last 2 decades because of the possible health advantages linked with certain of its bioactive components- Dietary fibre, ALA, and lignan-Secoisolariciresinoldiglycoside (SDG) [16].

Flaxseed has been extensively researched because of its possible link to breast cancer. Although some animal studies have been completed, only a few human clinical trials have been conducted with the goal of finding the effects of flaxseed on tumours and the risk of developing this type of cancer. Consumption of omega-3 fatty acids has been linked to a lower risk of breast cancer in several studies. ALA has been shown in animal tests to inhibit the growth, size, and proliferation of breast tumour cells while increasing their mortality. Flax seed boosts or maintains tamoxifen's efficacy in reducing tumour development, cell proliferation, and increasing apoptosis, according to the majority of experimental research. More clinical research is needed, however, to prove the link between flaxseed and tamoxifen and their respective efficacy. Flaxseed diets with 5 or 10% flaxseed (about 25–30 g flaxseed daily in people) reduced the development of ER+ in human breast cancer cells implanted in mice in multiple investigations. The same thing happened with the growth of ER-. Flaxseed also inhibited the spread of ER- breast cancer. Researchers have found that flaxseed has the ability to limit the growth of tumours in patients with breast cancer, mostly postmenopausal women, as well as reducing the risk of this form of cancer, after conducting clinical trials. Although majority of the research in this study indicated that flaxseed consumption is linked to a lower risk of breast cancer as well as a reduction in tumour growth and size, certain studies including premenopausal and postmenopausal women did not reach the same conclusion [18].

5) Ferula assa-foetida

Common names: Asafoetida - Devil's Dung,Hing (Indian), Asafetida

The oleo-gum-resin (called asafoetida) of *Ferula assa-foetida*, an Iranian indigenous medicinal plant from the Apiaceae family.

It has traditionally been used in the treatment of various diseases like asthma, gastrointestinal diseases, intestinal parasites, mental disorders, and epilepsy. The cytotoxic as well as anticancer activities of Ferula species, on the other hand, are the most prevalent biological features of the species. Asafoetida has been shown to have cytotoxic action against a variety of cancer cell lines, such as osteosarcoma cell line (HOS CRL), cervical cancer (HeLa), and colorectal cancer (SW620) in recent investigations. Asafoetida's phytochemical makeup as an oleo-gum-resin is extremely complex, with more than 72 components identified, 31 of which belong to the coumarin group of natural chemicals. Asafoetida also contains flavonoids, sulfur-containing chemicals, and sesquiterpenoids [19].

It is commonly known as Devil's Dung &Hing and this reflects the degree to which it has an unfavourable organoleptic feature. However, it's worth noting that asafoetida's another common moniker is 'Food of God,' owing to its medical and health advantages.Ferulaassa-foetida has been discovered to

have antioxidant, antiulcer, hepatoprotective, antimicrobial, and antimicrobial properties, while some recent research have revealed that it possesses antiviral activity toward influenza A (H1N1) virus. In contrast to the properties listed above, the oligo gum of Ferula foetida has been shown to improve intestinal health [20].

Researchers used the highly aggressive mouse mammary cancer 4T1 cells to test the antitumor effect of F. assafoetidaoleogumresin, its essential oil, and ferulic acid, one of the primary components of *F. assafoetida*oleogumresin. Asafoetidais a dry latex secreted from the living rhizome, rootstock, or taproot of an umbelliferous plant of several species. Their findings demonstrated that cell viability was considerably reduced 48 and 72 hours after incubation with asafoetida, relative to the control group, in a dosage and time dependent manner. Their findings were in line with those of other scientists. According to a study, the essential oil has the largest cytotoxicity effect on 4T1 cells at greater concentrations of 1 and 10 g/ml, out of all the components studied. Researchers previously discovered that this essential oil contains sulphur components, with E1propenyl secbutyldisulfide (40.15 percent) and Z1propenyl secbutyldisulfide (23.93 percent) being the most prominent. Organosulfur compounds may also alter the activity of numerous metabolising enzymes that activate (cytochrome P450s) or detoxify (glutathione Stransferases) carcinogens and limit the production of DNA adducts in a variety of target tissues, according to some data [21].

According to the findings, Ferula assa-foetida is a strong inducer of apoptosis that suppresses the development of PC12 and MCF7 cells, preventing cancer through the beginning of apoptosis. More study is needed to figure out how the Ferula assa-foetida extract triggers apoptosis. [22].

The possible mechanism by which asafoetida suppressed tumorigenic processes could be due to:

i. the presence of phenolic chemicals in it, it has the ability to intercept free radicals.
ii. Its ability to cause phase II enzymes like glutathione S-transferase and quinone reductase to be produced
iii. Its ability to prevent polyamine production and DNA synthesis.

However, the specific method by which Asafoetida inhibits tumour growth in mouse skin is unknown [23].

6) Glycyrrhizaglabra

Common names: *Licorice*, Liquorice, Sweetwood, mulethi, yasthimadhu

Liquorice, often known as liquorice, is a perennial herbaceous legume that is widely farmed across the world. Glycyrrhiza is a genus of roughly 30 species in the family to the Leguminosae family.

Glycyrrhizauralensis Fisch.,
Glycyrrhizainflata Bat.,
Glycyrrhizaglabra,
Glycyrrhizaaspera,
Glycyrrhizakorshinskyi, and *Glycyrrhizaeurycarpa* are the most frequent species.

Liquorice is frequently used in the food business as sweetening & flavouring agent, as well as in the tobacco industry as a de-bittering agent. The dried root and rhizome of Glycyrrhiza species contain around 400 bioactive components and secondary metabolites [24]. The principal chemicals in this plant have anti-atherogenic, anti-cancer, anti-diabetic, anti-microbial, antispasmodic, anti-inflammatory, and anti-asthmatic properties. In China, liquorice has been shown to aid with fatigue and debilitation. Liquorice also known for its anti, lowering allergic reactions and protecting the liver. According to the World Health Organization, liquorice is commonly used as a decongestant for sore throats and an expectorant for asthmatic catarrh and coughs. [25].

The anticancer properties of sixteen licorice flavonoids were summarised. Licochalcone A, licochalcone B, and isoliquiritigenin are the most studied flavonoids, with other flavonoids receiving less attention. These licorice flavonoids work against cancer by slowing the cell cycle and regulating various signal pathways. The MAPK pathway, the PI3K/AKT system, the NF-κB pathway, and the death receptor dependent and mitochondrial apoptosis pathways are among their targets. The flavonoids' effects on the key growth factor signalling and apoptosis pathways indicate that they have a lot of potential as cancer therapeutics. [26]

Furthermore, almost every flavonoid has several targets in cancer cells.The chemicals' unfavourable effects on various targets can be cumulative or synergistic, which could explain their powerful anti-cancer efficacy. However, the chemical mechanisms underlying the drugs' inhibitory action on several signalling pathways remain unknown. The flavonoid's direct targets in multiple pathways are still unknown. Some of the drugs' impacts on certain signalling pathways are likely secondary, resulting from changes imposed by the substances on other cellular processes. Furthermore, the flavonoids' multi-target activities raise concerns about potential toxicity and drug-drug interactions in clinical applications [27].

Food supplements and particular dietary components have not been adequately researched in terms of their long-term effects. According to the literature, many of liquorice components' anticancer activities appear to involve cell cycle arrest, apoptosis induction, and general antioxidant effects involving a variety of proteins, including many cell cycle-related proteins, apoptosis-associated proteins, MMP proteins, COX-2, GSK--β, Akt, NF-B, and MAP kinases, at least indirectly. PI3-K, MKK4, MKK7, JNK1, mTOR, and Cdk2 are direct licorice binding partners that have been found utilising novel computational and screening tools, leading in reduced carcinogenesis in multiple cell and mouse models with no obvious injury. [27].

In recent study serial concentrations of liquorice were plotted against their corresponding percent inhibition curve for the MDA-MB-231 cell line to assess its cytotoxic capability for possible medicinal and anti-cancer applications. Within the concentration range utilised, the liquorice extract reduced the proliferation of MDA-MB-231 cells in a dose-dependent manner. At various doses of liquorice extract, the highest impact was reached at around 100 g/mL. Morphological changes of MDA-MB-231 cells after exposure to various doses of licorice were investigated as a cytoxicological indication.

After 48 hours, the cells began to separate from the monolayer, rounded in shape, aggregated, and fluffed away from the plate's attached bottom. Even after 48 hours of incubation, the untreated negative control cells retained their original spindle structure [28].

2. Conclusion

Secondary metabolites present in plants such as polyphenols, flavonoids, and brassinosteroids have been studied for their potential as anticancer medicines. Antioxidant activity, cancer cell growth inhibition, apoptosis induction, target selectivity, and cancer cell cytotoxicity have all been discovered to be anticancer characteristics. Plant-derived medications have been produced as a result of favourable research findings and are now being tested in clinical studies. Drugs derived from vinca alkaloids were among the first to be used, and they are currently being tested in clinical Phase III studies with Pacitaxel and other anticancer drugs. These substances can be found in abundance in nature and are relatively non-toxic to healthy human cells.Novel technologies, such as nanoparticles, are also being developed for use in the delivery of anticancer medications and treatments. Their findings might be utilised to control medication release over time and help in the creation of tissue-specific therapies, reducing treatment side effects. Plant-derived medication demand is increasing, putting pressure on high-value medicinal plants and jeopardising their biodiversity. In developing countries, rising populations, urbanisation, and deforestation are all contributing to species extinction. Cryopreservation, tissue cultures, and plant part replacement procedures are all needed to aid in the protection of these species' germplasm. Conservation may also be aided by mass cultivation of therapeutic plant species and the use of raw by-products in industry.

Because they are excellent inhibitors of cancer cell lines, plant-derived anticancer medications are in great demand. To keep up with demand and be sustainable, the use of these agents must be controlled.

References

[1] George, B. P., Chandran, R., &Abrahamse, H. (2021). Role of phytochemicals in cancer chemoprevention: insights. *Antioxidants*, *10*(9), 1455.

[2] Sung, H., Ferlay, J., Siegel, R. L., Laversanne, M., Soerjomataram, I., Jemal, A., & Bray, F. (2021). Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA: a cancer journal for clinicians*, *71*(3), 209-249.

[3] Ranjan, A., Ramachandran, S., Gupta, N., Kaushik, I., Wright, S., Srivastava, S., & Srivastava, S. K. (2019). Role of phytochemicals in cancer prevention. *International journal of molecular sciences*, *20*(20), 4981.

[4] Loukas, M., Lanteri, A., Ferrauiola, J., Tubbs, R. S., Maharaja, G., Shoja, M. M., ... & Rao, V. C. (2010). Anatomy in ancient India: a focus on the Susruta Samhita. *Journal of anatomy*, *217*(6), 646-650.

[5] Gu, S., & Pei, J. (2017). Innovating Chinese herbal medicine: from traditional health practice to scientific drug discovery. *Frontiers in pharmacology*, *8*, 381.

[6] Greenwell, M., & Rahman, P. K. S. M. (2015). Medicinal plants: their use in anticancer treatment. *International journal of pharmaceutical sciences and research*, *6*(10), 4103.

[7] Dalli, M., Bekkouch, O., Azizi, S. E., Azghar, A., Gseyra, N., & Kim, B. (2021). Nigella sativa L. Phytochemistry and Pharmacological Activities: A Review (2019–2021). *Biomolecules*, *12*(1), 20.

[8] HammadShafiq, A. A., Masud, T., &Kaleem, M. (2014). Cardio-protective and anti-cancer therapeutic potential of Nigella sativa. *Iranian journal of basic medical sciences*, *17*(12), 967.

[9] Majdalawieh, A. F., & Fayyad, M. W. (2016). Recent advances on the anti-cancer properties of Nigella sativa, a widely used food additive. *Journal of Ayurveda and integrative medicine*, *7*(3), 173-180.

[10] Arumugam, G., & Many, J. N. (2020). Characterization of green synthesized gold nanoparticles from Nigella sativa oil and evaluation of its antibacterial and anticancer activity. J. Crit. Rev., 7, 1664-1679.

[11] Arshad H. Rahmani,Mohammad A. Alzohairy, Masood A. Khan, Salah M. Aly," Therapeutic Implications of Black Seed and its constituent Thymoquinone in the Prevention of Cancer through Inactivation and Activation of Molecular Pathways", Evidence-Based Complementary and Alternative Medicine, vol. 2014, 1 pages.

[12] Meira, M., Silva, E. P. D., David, J. M., & David, J. P. (2012). Review of the genus Ipomoea: traditional uses, chemistry and biological activities. *Revista Brasileira de Farmacognosia*, *22*, 682-713.

[13] Beheshti, F., Shabani, A. A., Akbari Eidgahi, M. R., Kookhaei, P., Vazirian, M., &Safavi, M. (2021). Anticancer Activity of Ipomoea purpurea Leaves Extracts in Monolayer and Three-Dimensional Cell Culture. *Evidence based Complementary and Alternative Medicine*, *2021*.

[14] Hosseini, A., &Hosseinzadeh, H. (2018). Antidotal or protective effects of Curcuma longa (turmeric) and its active ingredient, curcumin, against natural and chemical toxicities: A review. *Biomedicine & pharmacotherapy*, *99*, 411-421.

[15] Tomeh, M. A., Hadianamrei, R., & Zhao, X. (2019). A review of curcumin and its derivatives as anticancer agents. *International journal of molecular sciences*, *20*(5), 1033.

[16] Anurag, A. P., Prakruthi, M., & Mahesh, M. S. (2020). Flax Seeds (Linumusitatissimmum): Nutritional composition and health benefits. *IP Journal of Nutrition, Metabolism and Health Science*, *3*(2), 35-40.

[17] Joseph, A., Sridharan, S., Palanisamy, S., Ramalingam, S., Saravanan, R. (2020). Identification of anticancer compounds from Linumusitatissimum seed extract effect on HeLa cells. *Pharmacognosy Magazine*, 1-6.

[18] Calado, A., Neves, P. M., Santos, T., &Ravasco, P. (2018). The effect of flaxseed in breast cancer: a literature review. *Frontiers in nutrition*, *5*, 4.

[19] Iranshahy, M., Farhadi, F., Paknejad, B., Zareian, P., Iranshahi, M., Karami, M., &Abtahi, S. R. (2019). Gummosin, a sesquiterpenecoumarin from Ferula assa-foetida is preferentially cytotoxic to human breast and prostate cancer cell lines. *Avicenna Journal of Phytomedicine*, *9*(5), 446.

[20] Dissanayake, K. G. C., &Perera, W. P. R. T. (2020). Medicinal importance of Ferula asafetida oligo-gum resins against infective diseases. *Journal of Medicinal Plants Studies*, *8*(2), 135-139.

[21] Bagheri, S. M., Asl, A. A., Shams, A., Mirghanizadeh-Bafghi, S. A., & Hafizibarjin, Z. (2017). Evaluation of Cytotoxicity Effects of Oleo-Gum-Resin and Its Essential Oil of Ferula assa-foetida and Ferulic Acid on 4T1 Breast Cancer Cells. *Indian Journal of Medical and Paediatric Oncology*, *38*(02), 116-120.

[22] Abroudi, M., Fard, A. G., Dadashizadeh, G., Gholami, O., &Mahdian, D. (2020). Antiproliferative Effects of Ferula assa-foetida's Extract on PC12 and MCF7 Cancer Cells. *Int J Biomed EnggClinSci*, *6*(3), 60-67.

[23] Saleem, M., Alam, A., & Sultana, S. (2001). Asafoetida inhibits early events of carcinogenesis: a chemopreventive study. *Life sciences*, *68*(16), 1913-1921.

[24] Jain, R., Hussein, M. A., Pierce, S., Martens, C., Shahagadkar, P., &Munirathinam, G. (2022). Oncopreventive and oncotherapeutic potential of licorice triterpenoid compound glycyrrhizin and its derivatives: Molecular insights. *Pharmacological Research*, *178*, 106138.

[25] Wahab, S., Annadurai, S., Abullais, S. S., Das, G., Ahmad, W., Ahmad, M. F., & Amir, M. (2021). Glycyrrhizaglabra (Licorice): A Comprehensive Review on Its Phytochemistry, Biological Activities, Clinical Evidence and Toxicology. *Plants*, *10*(12), 2751.

[26] Zhang, Z., Yang, L., Hou, J., Tian, S., & Liu, Y. (2021). Molecular mechanisms underlying the anticancer activities of licorice flavonoids. Journal of Ethnopharmacology, 267, 113635.

[27] Bode, A. M., & Dong, Z. (2015). Chemo preventive effects of licorice and its components. *Current Pharmacology Reports*, *1*(1), 60-71.

[28] Hamad, G. M., AbdElaziz, A. I., Hassan, S. A., Shalaby, M. A., & Azim Mohdaly, A. A. A. (2020). Chemical composition, antioxidant, antimicrobial and anticancer activities of licorice (Glycyrrhizaglabra L.) root and its application in functional yoghurt. *J. Food Nutr. Res*, *8*(12), 707-715.