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ANTI-CANCEROUS ACTIVITY OF MEDICINAL PLANTS

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ABSTRACT: The rising burden of cancer worldwide calls for an indispensable treatment result. Herbal drug provides a veritably doable volition to western drug against cancer. This composition reviews the named plant species with active phytochemicals, the animal models used for these studies, and their nonsupervisory aspects. This study is grounded on a scrupulous literature review conducted through the hunt of applicable keywords in databases, Web of Science, Scopus, PubMed, and Google Scholar. Twenty shops were named grounded on defined selection criteria for their potent anticancer composites. The detailed analysis of the exploration studies revealed that plants play a necessary part in fighting different cancers similar as bone, stomach, oral, colon, lung, hepatic, cervical, and blood cancer cell lines. The *in-vitro* studies showed cancer cell inhibition through DNA damage and activation of apoptosis- converting enzymes by the secondary metabolites in the plant excerpts. Studies that reported *in-vivo* conditioning of these plants showed remarkable results in the inhibition of cancer in animal models. Further studies should be performed on exploring further plants, their active composites, and the medium of anticancer conduct for use as standard herbal drug.

INTRODUCTION: The burden of cancer rose to 18.1 million new cases and 9.6 million deaths in 2018. With 36 different types, cancer mainly affects men in the form of colorectal, liver, lung, prostate, and stomach cancer and women in the form of breast, cervix, colorectal, lung, and thyroid cancer [1]. Treating cancer has come a whole new area of exploration. There are conventional as well as truly modern ways applied against cancers. A variety of ways i.e., chemotherapy, radiation remedy, or surgery are used for treating cancer. Still, all of them have some disadvantages [2]. The use of conventional chemicals bears side goods and venom [3].

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But as the problem persists, new approaches are demanded for the control of conditions, especially, because of the failure of conventional chemotherapeutic approaches. Therefore, there is a need for new strategies for the prevention and cure of cancer to control the death rate because of this complaint. In recent times there has been a raised trend in the use of medicinal shops in the developing countries because of their safety and lower adverse effect especially when compared with synthetic conventional drugs.

Sources and Methodology: The most applicable literature was recaptured through a scrupulous search on the electronic databases, Web of Science, Scopus, PubMed, and Google Scholar. The keywords and expressions used during the search were Medicinal plants, Anticancer exertion, Anticancer sauces, Anticancer plants, Medium of action, Animal models, *in-vitro* exertion, and *in-vivo* exertion.

The number of applicable papers perfected after extraction and analysis through the combination of the below keywords expressions and the addition criteria was 200. The addition was grounded on two sets of criteria.

A. According to the first set, i.e., general criteria, papers named for this handwriting had Reported the traditional anticancer exertion of plants and their corridor.

B. Reported the anticancer part of excerpt or pure composites from plants.

The alternate set of criteria was used for opting specific anticancer plants whose phytochemicals are bandied in detail. For this purpose, twenty plants were named for which recent papers were available that

A. Studied *in-vitro* and *in-vivo* anticancer conditioning of herbal products.

B. Reported the anticancer/ antitumor exertion of active composites from the plants.

C. Assessed the *in-vivo* anticancer exertion of the herbal anticancer products.

Activity of Plants against Several Types of Cancers:

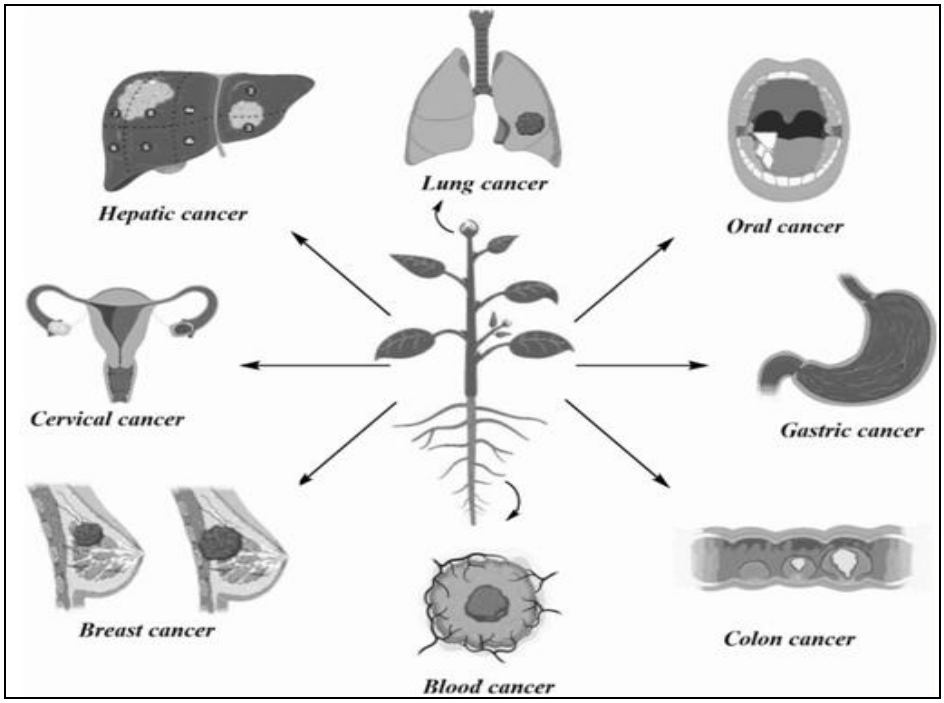

FIG. 1: ILLUSTRATION OF ACTIVITY OF PLANTS AGAINST SEVERAL TYPES OF CANCERS. The icons were taken from Bio-render illustrator [4]

Medicinal Plants and Cancer: The anticancer parcels of plants have been recognized for centuries. Sequestration of podophyllotoxin and several other mixes (known as lignans) from the common May apple (*Podophyllum peltatum*) ultimately led to the development of drugs used to treat testicular and small cell lung cancer. Till now(National Cancer Institute) NCI had excavated further than, 35000 plant species which reacted in the discovery of anticancer drugs analogous as Vincristine, Vinblastine, Taxol, Etoposide analogs, Indicine – N- oxide, Camptothecin and analogs and multitudinous others. With the knowledge of available traditional medicine, a new approach could be espoused which combine some or all of below methods [5]. Paclitaxel (Taxol TM) was originally isolated from *Taxus brevifolia* used in treatment of ovarian and bone cancers which was assumed to bind the tubulin subunit of microtubules and stabilizes the microtubule to normal disassembly [5-6]. Sauces these days are also being used as chemo- protectant against cytotoxicity that are caused by anticancer drugs. NCI has been honored, 3000 plant species have demonstrated reproducible anticancer exertion (data available at http//www.ars-grin.gov/duke/ Since, plants are a rich source of natural composites that are characterized by their remedial

goods, studying these composites is allowed to be a promising line for exploration on cancer [6-7]. In this environment, phytochemicals, secondary metabolites uprooted from shops, have different operations, including antidiabetic, anti-inflammatory, cardiovascular defensive, antioxidant, and anticancer effects [7]. In particular, these phytochemicals can be classified into different groups similar as flavonoids, alkaloids, phytosterols, terpenoids, sulfides, polyphenols, and others, which have been considered an important force for new anticancer agents [8-9]. Hence, factory secondary metabolites are honored with numerous properties similar as tumor growth inhibition, apoptosis induction, vulnerable modulation, and angiogenesis suppression [10]. As well, several epidemiological studies have reported the role of phytochemicals and their deduced analogues in modulating tumor cell- cranking proteins, enzymes, and signaling pathways, stimulating DNA form mechanisms, and conquering free radicals product [11, 12].

They also interact with numerous intracellular pathways that regulate cell growth, similar as the STAT3, PI3K/ Akt/ NF- κB signaling pathway, mTOR, and the Bcl- 2/ Bax mitochondrial pathway [9, 13, 14, 15] So, this present review aimed at exploring the implicit anticancer composites from the medicinal plants and we've tried to choose the most effective and well- known phytochemicals that display a distinctive anticancer activity. As well, we described these phytochemicals completely, starting with their chemical structure and ending with their antitumor exertion.

Plant Compounds with Anticancer Properties: Composites which have been linked and uprooted from terrestrial plants for their anticancer properties include Polyphenols, Brassinosteroids and Taxol's.

1. Polyphenols
2. Flavonoids
3. Brassinosteroids
4. Anticancer plant-derived drugs enhancing drug administration.

Polyphenols: Polyphenols are allowed to have apoptosis converting properties showing anticancer properties which can be employed. The mechanism in which polyphenols are allowed to carry out apoptosis inauguration is through regulating the rallying of bobby ions which are bound to chromatin converting DNA fragmentation. In the presence of Cu (II), resveratrol was seen to be able of DNA declination [16].

Example: curcumin treated cancer cells in various cells lines have shown suppression of the Tumour Necrosis Factor (TNF) expression through interaction with various stimuli [17].

Flavonoids: Flavonoids set up to demonstrate cytotoxicity on cancer cells and to have high free revolutionary scavenging activity [18]. Flavonoids inhibit the expression of NF- κB which is demanded for cancer cell survival and angiogenesis and proliferation Purified flavonoids have also shown anticancer conditioning against other mortal cancers including; hepatoma(Hep- G2), cervical carcinoma(Hela) and breast cancer(MCF- 7) [19]. The flavonoids uprooted from *Erythrina suberosa* stem bark (4 '- Methoxy licoflavanone (MLF) and Alpinumi so flavones (AIF)) were shown to have cytotoxic effects in HL- 60 cells (mortal leukemia) [20].

Brassinosteroids: Brassinosteroids have been used in examinations to treat a range of cancer cell lines which include; T- lymphoblastic leukemia CEM, multiple myeloma RPMI 8226, cervical carcinoma HeLa, lung carcinomaA-549 and osteosarcoma HOS cell lines (21). Also included are cell lines in breast cancer and prostate cancer. Estrogen receptor (ER), epidermal growth factor receptor (EGFR) and mortal EGFR- 2 (HER- 2) are some of the critical proteins which are targeted in treatment of breast cancer as they're abundant in breast cancer cells similar as MCF- 7, MDA- MB- 468, T47D and MDA- MB- 231. Brassinosteroids will interact or bind to receptors of these proteins and inhibit the growth of both hormone sensitive and hormone asleep cancer cells [22-23]. Also, Brassinosteroids overlook induce cell cycle blockage

Anticancer Plant-Derived Drug:

Plant: Deduced drugs are asked for anticancer treatment as they're natural and readily available. They can be readily administered orally as part of case's salutary input [24-25].

There are exceptions similar as cyanogenetic glycosides, lectins, saponins, lignans, lectins and some taxanes [26-27]. Still, arenon-toxic to normal cell lines and show cytotoxicity in cancer cell lines, these medicines can be lead into clinical trials for further, if plant- induced drugs can demonstrate selectivity in exploration. herapeutic development. Plant- induced drugs can fall under four classes of drugs with the following conditioning; methytransferase impediments, DNA damage preventative medicines or antioxidants, histone deacetylases (HDAC) impediments and mitotic disruptors. Composites including sulforaphane, isothiocyanates, isoflavones and pomiferin are considered to be HDAC inhibitors. They inhibit the activity of carcinogenic proteins.

For Example: Sulforaphane has shown to inhibit important targets in breast cancer proliferation. Decreased expression of ER, EGFR and HER-2 resulted from HDAC inhibition by sulforaphane treatment in breast cancer cell lines [28]. Derivations of vinca alkaloids, vincristine, vinblastine, vinorelbine, vindesine and vinflunine are medicines which will inhibit the dynamics of microtubules by binding to β- tubulin. Taxanes similar as paclitaxel and its analogue docetaxel are also microtubule disruptors. These composites inhibit cell cycle phase transitions from metaphase to anaphase causing cell cycle arrest and apoptosis. Replication of cancer cells is reduced by paclitaxel as it stabilizes or polymerizes microtubules in the cells [29-31]. Paclitaxel was one of the first medicines to have a huge impact on cancer treatment and vincristine and vinblastine were two of the original medicines to be insulated.

Enhancing Drug Administration: With advancements and discoveries in naturally derived drugs new technologies are arising for the operation and lozenge of these anticancer composites. Administration of new medicines needs to be effective for the compound to be a successful alternative to current treatments similar as chemotherapy. Through the field of nanotechnology the use of nanoparticles (NPs), as a delivery system for drugs to reach target spots, is developing. Some composites that have demonstrated anticancer conditioning may be limited in their clinical development due to the need for high tablets. Bromelain, insulated from *Aanas comosus* was shown to be more effective as an anticancer agent in expression with NPs than free bromelain [32-33].

Mechanism on Cancer Therapy:

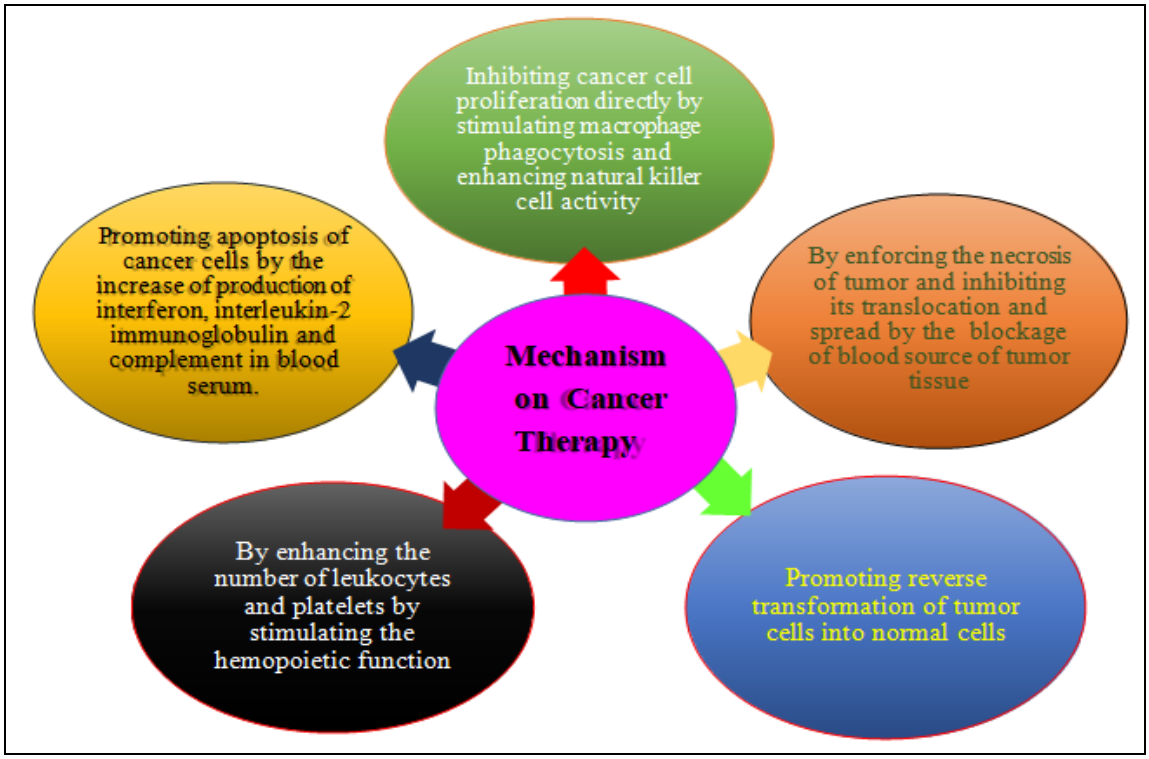

FIG. 2: MECHANISM ON CANCER THERAPY

Advantages of Herbal Drugs over Conventional Drugs:

- Common reasons for use of herbal medicines include.
- Health promotion.
- Disease prevention.
- Increasing costs of conventional cancer treatments.
- Lack of effective drugs to cure solid tumors encouraged.
- Less side effect comparison to conventional.
- Herbal formulation have cheapness comparison to conventional therapy.
- Poor outcomes.
- Limited treatment options for a serious illness.
- Exhaustion of conventional therapies.
- Dissatisfaction with, or inefficacious conventional therapies.
- Fatal side effects or risks associated with conventional medicine.
- Belief that herbal and natural products are better or safer.
- Preference for personal involvement in the decision making process.
- Cultural or spiritual preference.

Whereas side effects of allopathic medications vary wildly from mild to severe and there are many. These may include [34].

TABLE 1:

S. no.	Side Effect	S. no.	Side Effect
1.	Vomiting Fatigue	9.	Shoplifting
2.	Dry mouthDiarrhea	10.	Swelling
3.	Constipation	11.	Impotency
4.	Dizziness Suicidal	12.	Panic attacks
5.	thoughts	13.	Confusion Fainting
6.	Depression Mania	14.	and deathComa
7.	SeizuresAnemia	15.	HostilityInsomnia
8.	Hair loss		

Selected Plants and Their Anticancer Activity: Some of these plants and their composites prove to be veritably effective against one or further types of cancers. Grounded on their conditioning, the following plants are named for the *in-vitro* and *in-vivo* anticancer conditioning of their composites. The rest of the important plants shortlisted for their activities are presented in **Table 2** along with their activities.

1. *Artemisia annua*
2. *Coptis chinensis*
3. *Curcuma longa*
4. *Fagonia indica*
5. *Garcinia oblongifolia*
6. *Garcinia indica*
7. *Hedyotis diffusa*
8. *Loranthus parasiticus* and *Scurrulus parasitica*
9. *Morus alba*
10. *Paris polyphylla*
11. *Perilla frutescens*
12. *Platycodon grandifloras*
13. *Prunus armeniaca*
14. *Rabdosiae rubescens*
15. *Scutellaria baicalensis*
16. *Scutellaria barbata*
17. *Tripterygium wilfordii*
18. *Tussilago farfara*
19. *Wedelia chinensis*

***Artemisia annua*:** The genus Artemisia, wide in Europe, Asia, North America, and South Africa has roughly 400 species worldwide [34]. Plants of the genus were used for centuries in classical drug [35]. Artemisia annua is a periodic short- day plant that belongs to family Asteraceae, having a brownish rigid stem. *A. annua* is known as sweet wormwood (Chinese q ¯ ınghao) and dona in ¯ the Urdu language in India and Pakistan [36]. *Artimisia annua* also synthesize scopoletin and 1, 8- cineole composites. Also, semi-synthetic derivations of artemisinin are also generated similar as art ether, artemether, and artesunate. Artesunate has been studied to be a veritably effective anticancer compound [37]. Studied the effect of artesunate. On 55 different cancer cell lines including leukemia, melanoma, lung cancer, colon cancer, renal cancer, ovarian cancer, and excrescences of the central

nervous system. They suggested that artesunate was most effective against leukemia and colon cancers. Stem and leaves *A. annua* were subject to extraction with the help of 80 ethanol and water. Several quantitative phenolic compounds from *A. annua* were linked using high- performance liquid chromatography (HPLC). The extracts were tested against HeLa and AGS cell lines. The cell growth inhibition activity of stem extracts was lower compared to splint extracts. The ethanolic extracts of leaves lead to growth inhibitions (57.24 and 67.07) in HeLa and AGS cells, independently at a attention of 500 mg/ mL. HPLC analysis showed that the quantum of phenolic acids was lower in stem extract than in leaves extract of *A. annua*. It was concluded from the data that the antioxidant and anticancer capacity was the result of phenolic composites as well as unidentified composites within *A. annua* [38].

Coptis Chinensis: *C. chinensis* extract has wide use in the treatment of cholera, dysentery, diabetes, and blood and lung cancer because of its strong antibacterial activity [39]. Coptis genus contains the most important and active components, similar as an alkaloid i.e., berberine **Fig. 1**. Berberines alkaloids are used constantly as criteria in the quality control of Rhizoma cupids (Huang Lian) products and lead to the apoptosis of mortal leukemia HL- 60 cells by down regulating nucleophosmin/ B23 and telomerase activity.

Curcuma longa**:** *Curcuma longa* (Turmeric) belongs to the ginger family Zingiberaceae. It's a rhizomatous herbaceous imperishable plant [40]. It's naturally set up in Southeast Asia and the Indian key. These plants are annually collected for their rhizomes and are also propagated from some of those rhizomes [41]. *C. longa* possesses a broad range of pharmacological conditioning including anti-HIC (mortal immunodeficiency virus), anti-inflammatory, antioxidant goods, nematocidal and anti-bacterial conditioning. Curcumin, the main element of. Longa, plays an important part in the remedial conditioning of. Longa [42]. Curcumin shows anticancer andanti-inflammatory conditioning as reported by numerous different studies. Cyclooxygenase (COX) - 2 plays a vital part in the conformation of colon cancer. In a study conducted by Goel *et al.* [43], the HT- 29 colon cancer cells of humans were treated with different attention of curcumin to study the effect of curcumin on the expression of COX- 2.

Fagonia indica**:** *Fagonia indica*, locally known as "dhamasa" is a flowering plant and belongs to the family of caltrop, Zygophyllaceous [44]. Members of Fagonia rubric are known for their use as traditional drug and are set up effective in the treatment of numerous skin problems [44]. Traditionally, it was also used as a drug for curing cancer as well as ailments performing from venoms. Amino acids and proteins [45], flavonoids [46], alkaloids [47], saponins [48,] and terpenoid [49] are the phytochemicals set up in the Fagonia species. F. *indica* is set up to have liver defensive [50] and antioxidant properties as well [51]. The waterless extracts of *F. indica* have been set up veritably effective against different types of cancer specifically breast cancers. For case, Waheed *et al.* [52] Performed bioactivity- guided fractionation to insulate the active and potent bit of the *F. indica* extract. The activity was assessed against three cancer cell lines MCF- 7 estrogen-dependent breast cancer, MDA- MB- 468 estrogen-independent breast cancer, and Caco- 2 colon cancer cells.

Garcinia oblongifolia: *Garcinia oblongifolia* (Lingnan Garcinia) belongs to the family of Clusiaceae and has a wide range of pharmaceutical conditioning. The important metabolites of the *G. oblongifolia* species; polyisoprenylated benzophenones and xanthones have anticancer, antioxidant, antifungal, apoptotic, and anti-pathogenic properties [54]. *In-vitro* study showed that the bark of *G. oblongifolia* contains important secondary metabolites including oblongifolin A – G, oblongixanthones A – C along with other important composites. These metabolites showed maximum apoptotic conditioning in HeLa- C3 cell lines and cytotoxic properties in the cervical cancer cells [47, 48]. Li *et al.* [55] Insulated about 40 different composites from fruit, leaves, branches, and other corridor of *G. oblongifolia*. They noted veritably high cytotoxic conditioning of these metabolites in the tested MCF- 7 breast cancer cell line.

Garcinia indica: *Garcinia indica*, generally known as kokum, is also an important medicinal plant that belongs to the Garcinia genus. The garcinol of *G. indica* shows positive activities in the experimental HT-29 and HCT-116.

Colon cancer cells along with normal eternalized intestinal cells (IEC- 6 and INT- 407). In another study, the fruit extract of *G. indica* was used for the isolation of garcinol.

***Hedyotis diffusa*:** This herb entered significance for having antitumor properties and showed effective results in treating cancers of the liver, colon, lungs, brain, and pancreas [56]. *H. diffusa* contains important bioactive derivations of polysaccharides, triterpenes, and anthraquinones [57, 58]. Methyl anthraquinones are, one of the bioactive composites in *H. diffusa*, is responsible for apoptosis of numerous cancers. It shows apoptosis and inhibitory effect on the mcf- 7 cell line of breast cancer via activation of the caspase- 4/ ca2/ calpain pathway when applied in an attention of 18.62 µm for 24 h. It was observed that the s phase of the cell cycle and the chance of the apoptotic cells were markedly increased when methyl anthraquinone was applied to mcf- 7 cells [59].

***Loranthus parasiticus* and *Scurrulus parasitica*:** *Loranthus parasiticus*, also known as sang Ji Sheng (in Chinese), is a member of the Loranthaceae family and is extensively distributed in the South-western regions of China. *L. parasiticus* is a semi parasitic plant, historically used as traditional folk drug in China and Japan [60]. *L. parasiticus* has shown positive activity against ovarian cancer cell lines; SKOV3, CAOV3, and OVCAR- 3 [61].

Morus alba: *M. alba*, generally called white mulberry, is native to China, Japan, and India and is cultivated throughout the world where silkworm is raised. Their leaves are the main source of food for silkworms. Extracts from *M. alba* are traditionally used to cure cough, edema, wakefulness, bronchitis, asthma, nose bleeding, wound mending, eye infections, and diabetes [62]. *M. alba* contains numerous pharmaceutically important composites like kuwanol, hydroxymoricin, moranoline, morusin, calystegin, albafuran, and albanol. The leaves of *M. alba* contain some active composites similar as quercetin, rutin, apigenin, 1- deoxynojirimycin [62]. A study by Chon *et al.* [63]. On methanolic extract ofM. Alba leaves showedanti-proliferative goods on different mortal cell lines like pulmonary melanoma (Calu- 6), colon carcinoma (HCT- 116) and breast adenocarcinoma (MCF- 7).

Paris polyphylla: *Paris polyphylla* (called "Love Apple") belongs to family Liliaceae and contains 24 species throughout the world [64]. *P. polyphylla* is substantially used by Indian and Chinese traditional drug system for having implicit anticancer properties. *P. polyphylla* consists of important secondary metabolites similar as polyphyllin D, formosanin C, β- ecdysterone, dioscin, daucosterol heptasaccharide, oligosaccharides, octasaccharide, protogracillin, trigofoenoside A, yunnanosides G-J, padelaoside B, pinnatasterone, and other saponins [65]. Steroidal saponins are the main active components because of its structural diversity andbio-activities similar as antitumor, vulnerable-stimulator, analgesic, and hemostatic parcels [66-71]. Waterless and ethanol extracts of P. polyphylla showed implicit antitumor activity against mortal liver carcinoma (HepG2 and SMMC- 7721) cell line, mortal gastric (BGC- 823) cell line, mortal colon adenocarcinoma (LoVo and SW- 116) cell line, and mortal esophagus adenocarcinoma (CaEs-17) cell lines.

Perilla frutescences: *Perilla frutescence*, generally called perilla or Korean perilla or Beefsteak plant, is extensively distributed in Vietnam, China, Japan, and utmost Asian regions belong to the Labiatae family [72-73]. Economically, one of the most significant crops, civilization of *P. frutescence* in China and some other Asian countries is further than 2000 times old [74-75]. Stem, seed, and splint corridor of *P. frutescence* have been used to treat poisoning, cold, bloating, and headache [75]. Multiple *in-vivo* and *in-vitro* studies have been conducted to estimate the anticancer and antitumor eventuality of *P. frutescence*. Leaf extract of *P. frutescence* showed the loftiest anticancer activity in HepG2 cells through cell proliferation inhibition and up regulation of apoptosis- related gene expression [76].

***Platycodon grandifloras*:** Platy codon grandifloras, generally known as balloon flower, or Chinese bellflower, belongs to the family Campanulaceae, which is distributed through Northeast Asia. The rhizomes of *P. grandifloras* are veritably effective and are used as a traditional drug in China, North Korea, and Japan for treatment of different conditions like cough, sore throat, numbness, and other affections [77]. *P. grandifloras* contains numerous biologically active composites which include saponins, flavonoids, anthocyanins,

phenolic, and polysaccharide. These composites have significant vulnerable- stimulatory [78], anti-inflammatory [79], hepatoprotective [80], and antitumor conditioning. The antitumor exertion of P. *grandifloras* was shown in a cure- dependent manner by reducing PKC improvement of matrix metallopeptidases (MmP- 9 and MmP- 2), which caused the death of HT- 80 cells [81]. Yu and Kim [82] insulated platycodin D from the root of *P. grandiflorus* and treated MCF- 7 cells with a attention of 5 – 100 µM which reduce cell viability and proliferation in a cure-dependent and time-dependent manner as compared with controlled cells. Platycodin D is a triterpene saponin insulated from the roots of *P. grandiflorus* shows cytotoxic effects on the mortal leukemia cells. It inhibited telomerase activity and showed a cytotoxic effect in a cure-dependent manner with an attention of 10 – 20 µM. This was shown to be achieved through down regulating the expression of mortal telomerase rear transcriptase (hTERT) [83].

Prunus armeniaca: *Prunus armeniaca* (Armenian plum) belongs to an important plant family Rosacea. Colorful parts of the plant are used as the major source of some important antioxidant substances and are generally used against cancer and some other cardiovascular conditions [84]. The fruit part of *P. armeniaca* contains colorful important secondary metabolites like β- carotene, flavonoids, organic acids, thiamine, minerals, and oils [85]. The seeds of *P. armeniaca* contains plenty of cyanogenic glycosides, used against different types of cancers [86]. Amygdalin is one of the important glycosides of P. armeniaca, used for the treatment of prostate cancer [87]. Gomaa [88] reported the antioxidant and anticancer conditioning of *P. armeniaca* at different combinations of methanolic and ethanoic extracts with water.

Rabdosiae rubescens: *Rabdosiae rubescens* (Chinese Dong Ling Cao) is a Chinese medicinal herb that belongs to the family Lamiaceae. It possesses multiple natural activities like antibacterial, anti-inflammatory, anti-parasitic, and anticancer [89]. *R. rubescens* contain important chemical compounds including monoterpenes, sesquiterpene, diterpene, and terpenoids. Oridonin, a tetracyclic terpenoid, is the main active compound in *R. rubescens* [90]. Oridonin gained its attention because of the remarkable properties of growth inhibition and the induction of apoptosis in cancer cells. *In-vitro* and *in-vivo* studies showed the induction of apoptosis in a variety of cancer cells by oridonin as in hepatocellular carcinoma, breast, gastric, skin, and colorectal, gallbladder, and pancreatic cancers [91].

Scutellaria baicalensis: *Scutellaria baicalensis* is one of the important medicinal plants species of family Lamiaceae. It's generally known as Baikal skullcap or Chinese skullcap and is set up in different regions of the world including East Asia, Europe, and the Russian Federation. Its root part is known as Scutellariae radix and used as traditional Chinese drug for the treatment of hepatitis, respiratory, and gastrointestinal diseases [92]. The root parts have maximum flavonoid content having multiple pharmacological properties [93]. About 60 different flavonoids have been linked in *S. baicalensis* which showed maximum antioxidant activities [94]. The four flavones metabolites also showed antimutagenic properties [95]. Wo´zniak *et al.* [96]. Studied the antioxidant capabilities of four flavones baicalein, baicalin, wogonin, and their glucuronides compounds and wogonoside. These flavones have different antioxidant capacity depending on the chemical structure and mechanisms of activity.

Scutellaria barbata: *Scutellaria barbata*, the acerbic skullcap is a crucial medicinal plant species of family Lamiaceae, used to treat seditious and cancer diseases [97]. It's rich in important secondary metabolites like alkaloids, flavones, steroids, and polysaccharides [98]. *In-vitro* studies showed positive activities against a vast range of cancers i.e., colon cancer, lung cancer, hepatoma, and skin cancer [99]. The apigenin and luteolin insulated fromS. barbata gave cytotoxic activity against both mortal breast cancer cell line MDA- MB- 231 andnon-transformed breast cell line(MCF10A) [100]. Also, scutellarein was set up to retain stronganti-breast cancer activity demonstrated in MDA- MB- 468 cell lines [101]. Scutellarein increased the attention of mitochondrial superoxide and peroxide while dwindling the position of glycolysis, braking the growth of cancer cells by lowering ATP synthesis.

Tripterygium wilfordii: *Tripterygium wilfordii* of the family Celastraceae is also known as " Thunder God Vine, " and is native to Korea, China, and

Japan. It's generally used for the treatment of multiple conditions similar as rheumatoid arthritis, systemic lupus erythematosus, nephritis, asthma, and cancers [102]. *T. wilfordii* produces important bioactive emulsion triptolide which is used as an immunosuppressive and anti-proliferative agent [103]. It has a five- membered unsaturated lactone ring and is used against different bone cancer cells by activation of pro-apoptotic composites by modulating several signaling pathways [104-105]. *In-vitro* studies showed anti- proliferative and pro-apoptotic conditioning against excrescence cell lines [106-108]. He *et al.* The overall results showed that anticancer parcels of tri ptolide are directly identified with the blockage of two endothelial receptor- intermediated signaling pathways. Triptolide showed more negative conditioning against the proliferation of HUVECs as compared to normal cells like skin keratinocytes HaCaT cells and other liver cells L- 02 [109-110].

Tussilago farfara: *Tussilago farfara* (generally called coltsfoot) is one of the important medicinal shops, grown in Europe and colorful regions of western and central Asia, generally used against cancer. It possesses a high volume of flavonoids and other phenolic composites and some trace rudiments (Zn, Mg, and Se). The presence of these substances plays a crucial part in the anticancer conditioning of this factory. Maximum scavenging exertion was recorded in water excerpt as compared to ethanol excerpt. It shows a 20.9 antioxidant exertion. Further, this factory showed maximum antioxidant exertion both using DPPH and incentive model [111]. The quercetin- glycosides insulated from the flower cub of *T. farfara* shows the loftiest antioxidant exertion [112]. Lee *et al.* [113] reported the (TF) - convinced cytotoxic and apoptotic conditioning of the flower part ofT. farfara in mortal colon cancer cell line(HT- 29) by using a methanolic excerpt. Fatykhova *et al.* [114] showed the genotoxic exertion of *T. farfara* condiment juice against known genotoxic composites like nalidixic acid in SOS chromotest and furacilin in Rec assay. Their findings showed that dilution of the condiment juice gave maximum antimutagenic porperty in SOS chromotest as compared to furacilin in Rec assay.

Wedelia chinensis: *Wedelia chinensis* (Chinese Peng qi ju), indigenous to India, South- East Asia, and China, is one of the important anticancer plants belonging to family Asteraceae which is rich in numerous important secondary metabolites like phenol, flavonoids, and tannin [115]. The essential oils of *W. chinens* is give a positive effect on lung cancer during the *in-vitro* study. The GC- MS analysis recorded the presence of two important compounds carvacrol and trans- caryophyllene. Highanti-scavenging activities were set up at different levels of dose.

The study of B16F- 10 carcinoma metastatic cell line showed that the attention of some important antioxidant enzymes (including catalase, superoxide dismutase, and glutathione peroxidase) increased numerous crowds in the treatment groups. Also, the amount of glutathione also increased while the concentrations of other compounds similar as lipid peroxidation and nitric oxide were dropped. The histopathology studies further vindicated that these essential oils show negative effects on cancer development [116].

In-vivo **Studies of Anticancer Herbal Medicine: an Overview:** The herbal drugs are tested *both in-vitro* and *in-vivo*. The anticancer conditioning of the colorful medicinal plants have been tested in vivo using different animal models **Fig. 3**. There are numerous studies available on *in-vivo* experiments of the numerous different anticancer shops in mice models. For instance, dihydroartemisinin was reported to inhibit excrescence tissue, increase the position of interferon- gamma (IFN- γ), and decrease interleukin 4 (IL- 4) in excrescence- bearing mice [117]. also, artesunate, a outgrowth of artemisinin is also reported to be a promising medicine against angiogenic Kaposi0 s sarcoma [118], growth inhibition of A549 and H1299 lung excrescences by 100 mg/ kg cure [119], the repression of mortal prostate cancer xenograft [157] and the inhibition of leukemia growth in mice [120]. Irradiation of C57BL/ 6 mice combined with a cure of 2 mg/ kg doubly a week was proved effective against lung carcinoma [121]. The effectiveness of berberine was enhanced when it was used in combination with other agents. Coptisine, another alkaloid of Coptidis rhizoma is proved to have anticancer goods when used in attention of 150 mg/ kg against BALB/ c raw mice by suppressing excrescence growth and reducing cancer metastasis. The inhibition of the RAS- ERK

pathway was suggested as the medium for this exertion [122]. Another study was also performed on the raw mice on the HepG2 cells by applying the waterless excerpt of *H. diffusa* which inhibits proliferation of cells in a dose-dependent manner, also detention S phase and arrest cells in G0/ G1 phase [123].

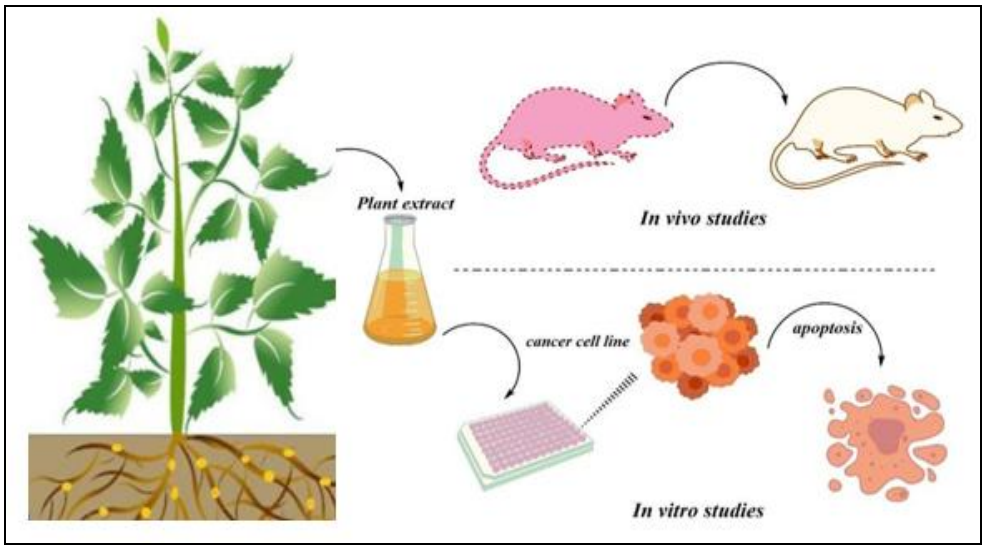

FIG. 3: A DEPICTION OF GENERAL STRATEGIES APPLIED FOR ASSAYING EXTRACTS/ PHYTOCHEMICALS FROM IMPORTANT MEDICINAL PLANTS FOR THEIR ANTICANCER ACTIVITY BOTH *IN-VITRO* AND *IN-VIVO*

Regulatory Aspects of Herbal Anticancer Drugs: It's generally established that the medicines including the anticancer composites bear phase III clinical exploration trials for marketing warrants. The Food and Drug Administration (FDA) and European Medicines Agency (EMA) guidelines require at least one controlled trial in Phase III with statistically significant results for the green signal to market them [124]. Except for exceptional circumstances, all the medicines need to go through all the phases of trials according to the guidelines of transnational agencies similar as the FDA and EMA. Still, it has been observed that pharmaceutical companies diverge from the standard protocol and start testing new compounds on mortal subjects before than the defined timeline. The reason for similar practices is to accelerate the approval of these composites under the pressure of investors [125]. This means that the medicine is presented for blessing with in adequate data on its quality, safety, and efficacy. Although plant-grounded composites have shown be less poisonous compared to conventional synthetic composites, there's growing substantiation on the side effects of the limited use of these plants against different conditions. The problem is that there's inadequate data available regarding the quality, safety, and efficacy of herbal medicines. *F. indica*, for case, has shown potent extract against breast cancer when tested in the MDA- MB- 231 cell line. *F. indicia* is used traditionally to treat numerous diseases and people have indeed started the use of its herbal tea against breast cancer. Still, the question remains that there are only a many reports available on the anticancer activity of the plant. Encyclopedically, the process of oncology medicine development and marketing is regulated through the involvement of experts and a premonitory process intermediated by nonsupervisory authorities [126]. There are several nonsupervisory frame models available for defining similar medicines but there's a need for harmony among regulating agencies and enhancement in the regulation process. For case, the FDA has lately espoused the questions and answers guidelines of the International Council for Adjustment on the nonclinical evaluation of medicines intended to treat cancer. These guidelines include 41 questions and answers which give fresh information about anticancer medicine development and are aimed at bringing adjustment in the process of anticancer medicine development [127].

Modern Trends in Traditional Medicine Informatics and Opportunities for Anticancer Plant Products: With the advancement of

information technology and bioinformatics, there's an adding trend to make resources and databases that report herbal formulations, active components of the herb, and affiliated information.

There are several efforts like Chinese Medicine Integrated Database (TCMID) [128], Collaborative Molecular Conditioning of Useful Plants (CMAUP) [128], SymMap [129], encyclopedia of traditional Chinese drug(ETCM) [130] *etc*. In addition, several experimenters have developed strategies for *in-silico* pharmacokinetic properties of motes/ medicines [131-136].

Similar approaches are also applicable to phytochemicals and plant- grounded active medicine factors for their virtual webbing, possible mode of action, and advanced medicine discovery [137-139]. Several factory- grounded anticancer composites have been estimated using *in-silico* and systems pharmacology tools [140-146].

The current study encourages farther studies on anticancer active constituents (of factory origin) for their *in-silico* webbing and pharmacokinetic conditioning. Considering the fact that factory-grounded medicine phrasings generally consists of several phytochemicals or indeed further than one shops. The major challenge on this direction would be to prognosticate the role of phytochemicals other than active composites and are present in the traditional drug.

COCLUSION: From the present review, it can be concluded that herbal medicinal plants and their derivations are active against colourful type of cancers like lymphomas, breast, ovarian, lung, liver, and stomach, prostate and testicular cancers. The cheap herbal medicinal treatment which may largely be recommended to the pastoral and poor people especially of developing countries to treat effectively the cancers of different type is an ideal choice.

The delved traditional medicinal plants in this composition could be a key to identify the composites with anti-cancer effects; thus, if their composites are examined, they might help to develop new, more effective medicines, in addition to contributing to identify the main mechanisms involved in cancer. This detailed analysis of different shops showed that medicinal sauces promise a huge anticancer eventuality.

This composition exhaustively highlights the medium of antitumor action of some of the important plants. This is generally done through regulating signaling pathways. Numerous studies have reported inhibition of enzymes that stops excrescence growth. These studies are substantially performed in mortal cell lines. It’s stressed that these plants play an important anticancer part through their different classes of secondary metabolites.

TABLE 2: SOME OF THE IMPORTANT ANTICANCER MEDICINAL PLANTS, THEIR ACTIVE COMPONENTS, AND *IN-VITRO* AND *IN-VIVO* ACTIVITY

S. no.	Plant Name	Parts Used	Active Components Used	References
1.	*Allium sativum*[Garlic]	Leaves	Allicin, flavonoids,and phenolic components	147
2.	*Alpinia galangal* [Lengkuas, greater galangal,and blue ginger]	Rhizomes	Chrysin	148
3.	*Alstonia scholaris* [Blackboard or devil’s tree]	Bark	-	149
4.	*Andrographis paniculata*[Creat or green chireta]	Ariel part	Diterpines	150
5.	*Angelica archangelica* [Garden angelica, wild celery and Norwegian angelica]	Root and rhizomes	Angelicin	151
6.	Aralia elata[Chinese angelica-tree, Japanese angelica-tree, and Korean angelica-tree]	Leaves	-	152
7.	Artemisia annua [Sweet wormwood, sweet annie, and sweet sagewort]		artimisinin	
8.	*Asclepia scurassavica*[Tropical milkweed]	Leave	B-sitosterol	153
9.	*Astragalus membranaceus* [Mongolian milkvetch]		pollysacharride	154
10.	*Copaifera multijuga* [Hayne oil, Copaiba]	Trunk of tree	Clerodane Diterpines	155
11.	*Curcuma longa*[Turmeric]		curcumin	42
12.	*Garcinia indica*[Kokum]	Fruit	Garcinol	156

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REFERENCES:

1. Bray F, Ferlay J, Soerjomataram I, Siegel RL, Torre LA and Jemal A: Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin 2018; 68: 394–424. [CrossRef] [PubMed]
2. Karpuz M, Silindir-Gunay M and Ozer AY: Current and Future Approaches for Effective Cancer Imaging and Treatment. Cancer Biother. Radiopharm 2018; 33: 39-51. [CrossRef] [PubMed]
3. Nobili S, Lippi D, Witort E, Donnini M, Bausi L, Mini E and Capaccioli S: Natural compounds for cancer treatment and prevention. Pharmacol Res 2009; 59: 365–378. [CrossRef] [PubMed]
4. Khan T and Ali Mohammad: anticancer plants: a review of the active phytochemicals, applications in animal models, and regulatory aspects. Biomolecules 2020; 10: 47.
5. Kaur R and Kaur H: The antimicrobial activity of essential oil & plant, extracts of *Woodfordia fruticosa*. Archives of Applied Sciences & Research 2010; 2: 302-9.
6. Fan W, Johnson KR and Miller MC: *In-vitro* evaluation of combination Chemotherapy against human tumor cells. Oncology Report 1998; 5(5): 1035-1042.
7. Iqbal J, Abbasi BA, Mahmood T, Kanwal S, Ali B, Shah SA and Khalil AT: Plant-derived anticancer agents: A green anticancer approach. Asian Pac J Trop Biomed 2017; 7: 1129–1150. [CrossRef]
8. Leitzmann C: Characteristics and health benefits of phytochemicals. Complementary Med Res 2016; 23: 69–74. [CrossRef] [PubMed]
9. Avato P, Migoni D, Argentieri M, Fanizzi FP and Tava A: Activity of saponins from Medicago species against HeLa and MCF-7 cell lines and their capacity to potentiate cisplatin effect. Anti-Cancer Agents Med Chem (Former. Curr. Med. Chem.-Anti- Cancer Agents) 2017; 17: 1508–1518. [CrossRef]
10. Joshi P, Vishwakarma RA and Bharate SB: Natural alkaloids as P-gp inhibitors for multidrug resistance reversal in cancer. Eur J Med Chem 2017; 138: 273–292. [CrossRef] [PubMed]
11. Talib WH: Anticancer and antimicrobial potential of plant-derived natural products. In Phytochemicals—Bioactivities and Impact on Health; Rasooli, I., Ed in Tech Rijeka, Croatia 2011; 141–158.
12. Talib WH, Alsalahat I, Daoud S, Abutayeh RF and Mahmod AI: Plant-Derived Natural Products in Cancer Research: Extraction, Mechanism of Action, and Drug Formulation. Molecules 2020; 25: 5319. [CrossRef] [PubMed]
13. Rayan A, Raiyn J and Falah M: Nature is the best source of anticancer drugs: Indexing natural products for their anticancer bioactivity. PLoS ONE 2017; 12: 0187925. Thakore P, Mani RK and Kavitha SJ: A brief review of plants having anti-cancer property. Int J Pharm Res Dev 2012; 3: 129–136.
14. Tariq A, Sadia S, Pan K, Ullah I, Mussarat S, Sun F, Abiodun OO, Batbaatar A, Li Z and Song DL: A systematic review on ethnomedicines of anti-cancer plants. Phytother Res 2017; 31: 202–264. [CrossRef] [PubMed]
15. Rana P, Shrama A and Mandal CC: Molecular insights into phytochemicals-driven break function in tumor microenvironment. J Food Biochem 2021; 45: e13824. [CrossRef] [PubMed]
16. Azmi AS, Bhat SH, Hanif S and Hadi SM: Plant polyphenols mobilize endogenous copper in human peripheral lymphocytes leading to oxidative DNA breakage: A putative mechanism for anticancer Properties. FEBS Letters 2006; 580: 533–538. [PubMed: 16412432]
17. Gupta SC, Tyagi AK, Deshmukh-Taskar P, Hinojosa M, Prasad S and Aggarwal BB: Downregulation of tumor necrosis factor and other proinflammatory biomarkers by polyphenols. Archives of Biochemistry and Biophysics 2014; 559: 91–99. [PubMed: 24946050]
18. Cao J, Xia X, Chen X, Xiao J and Wang Q: Characterization of flavonoids from Dryopteris erythrosora and evaluation of their antioxidant, anticancer and acetylcholinesterase inhibition activities. Food and Chemical Toxicology 2013; 51: 242–250. [PubMed: 23063594]
19. Wen L, Wu D, Jiang Y, Prasad KN, Lin S, Jiang G, He J, Zhao M, Luo W and Yang B: Identification of flavonoids in litchi (*Litchi chinensis* Soon.) leaf and evaluation of anticancer activities. Journal of Functional Foods 2014; 6: 555–563.
20. Agati G, Azzarello E, Pollastri S and Tattini M: Flavonoids as antioxidants in plants: Location and functional significance. Plant Science 2012; 196: 67–76. [PubMed: 23017900]
21. Malíková J, Swaczynová J, Kolář Z and Strnad M: Anticancer and antiproliferative activity of natural brasinosteroids. Phtyochemistry 2008; 69: 418–426.
22. Steigerová J, Oklešťková J, Levková L, Kolář Z and Strnad M: Brassinosteroids cause cell cycle arrest and apoptosis of human breast cancer cells. Chemico-Biological Interactions 2010; 188: 487–496. [PubMed: 20833159]
23. Steigerová J, Rárová L, Oklešťková J, Křížová K, Levková M, Šváchová M, Kolář Z and Strnad M: Mechanisms of natural brassinosteroid-induced apoptosis of prostate cancer cells. Food and Chemical Toxicology 2012; 50: 4068–4076. [PubMed: 22939933]
24. Cornblatt BS, Ye L, Dinkova-Kostova AT, Erb M, Fahey JW, Singh K, Chen MA, Stierer T, Garrett-Mayer E, Argani P, Davidson NE, Talalay P, Kensler TW and Visvanathan K: Preclinical and clinical evaluation of sulforaphane for chemoprevention in the breast. Carcinogenesis 2007; 28(7): 1485–1490. [PubMed: 17347138]
25. Amin A, Gali-Muhtasib H, Ocker M and Schneider-Stock R: Overview of Major Classes of PlantDerived Anticancer Drugs. International Journal of Biomedical Science 2009; 5(1): 1–11. [PubMed: 23675107]
26. Steigerová J, Oklešťková J, Levková L, Kolář Z and Strnad M: Brassinosteroids cause cell cycle arrest and apoptosis of human breast cancer cells. Chemico-Biological Interactions 2010; 188: 487–496. [PubMed: 20833159]
27. Steigerová J, Rárová L, Oklešťková J, Křížová K, Levková M, Šváchová M, Kolář Z and Strnad M: Mechanisms of natural brassinosteroid-induced apoptosis of prostate cancer cells. Food and Chemical Toxicology 2012; 50: 4068–4076. [PubMed: 22939933]

28. Pledgie-Tracy A, Sobolewski MD and Davidson NE: Sulforaphane induces cell type- specific apoptosis in human breast cancer cell lines. Molecular Cancer Therapeutics 2007; 6(3): 1013– 1021. [PubMed: 17339367]
29. Amos LA, Löwe J. How Taxol® stabilises microtubule structure. Chemistry & Biology. 1999; 6(3):65–69.
30. Jordan MA and Wilson L: Microtubules as a target for anticancer drugs. Nature Reviews: Cancer 2004; 4: 253–266. [PubMed: 15057285]
31. Khazir J, Mir BA, Pilcher L and Riley DL: Role of plants in anticancer drug discovery. Phytochemistry Letters 2014; 7: 173–181.
32. Bhatnagar P, Pant AB, Shukla Y, Chaudhari B, Kumar P and Gupta KC: Bromelain nanoparticles protect against 7,12-dimethylbenz[a] anthracene induced skin carcinogenesis in mouse model. European Journal of Pharmaceutics and Biopharmaceutics 2015; 91: 35–46. [PubMed: 25619920]
33. Abad MJ, Bedoya LM and Bermejo P: Essential Oils from the Asteraceae Family Active against Multidrug-Resistant Bacteria. In Fighting Multidrug Resistance with Herbal Extracts, Essential Oils and Their Components; Rai, M.K., Kon, K.V., Eds.; Academic Press: San Diego, CA, USA, 2013; 205–221.
34. Tan RX, Zheng W and Tang H: Biologically active substances from the genus Artemisia. Planta Med 1998; 64: 295–302. [CrossRef]
35. Inoue M, Suzuki R, Koide T, Sakaguchi N, Ogihara Y and Yabu Y: Antioxidant, gallic acid, induces apoptosis in HL-60RG cells. Biochem. Biophys Res Commun 1994; 204: 898–904. [CrossRef]
36. Efferth T: Mechanistic perspectives for 1, 2, 4-trioxanes in anti-cancer therapy. Drug Resist Updat 2005; 8: 85–97. [CrossRef]
37. Ryu JH, Lee SJ, Kim MJ, Shin JH, Kang SK, Cho KM and Sung NJ: Antioxidant and anticancer activities of *Artemisia annua* L. and determination of functional compounds. J Korean Soc Food Sci Nutr 2011; 40: 509–516. [CrossRef]
38. Tang J, Feng Y, Tsao S, Wang N, Curtain R and Wang Y: Berberine and Coptidis rhizoma as novel antineoplastic agents: A review of traditional use and biomedical investigations. J Ethnopharm 2009; 126: 5–17. [CrossRef]
39. Ammon HP, Wahl MA: Pharmacology of *Curcuma longa.* Planta Med 1991; 57: 1–7. [CrossRef]
40. Liu F and Ng T: Antioxidative and free radical scavenging activities of selected medicinal herbs. Life Sci 2000; 66, 725–735. [CrossRef]
41. Schinella G, Tournier H, Prieto J, De Buschiazzo PM and Rıos J: Antioxidant activity of anti-inflammatory plant extracts. Life Sci 2002; 70: 1023–1033. [CrossRef]
42. Goel A, Boland CR and Chauhan DP: Specific inhibition of cyclooxygenase-2 (COX- 2) expression by dietary curcumin in HT-29 human colon cancer cells. Cancer Lett 2001; 172: 111–118. [CrossRef]
43. Beier BA: A revision of the desert shrub Fagonia (Zygophyllaceae). Syst. Biodivers 2005; 3: 221–263. [CrossRef]
44. Akhtar N and Begum S: Ethnopharmacological important plants of Jalala, district Mardan, Pakistan. Pak J Pl Sci 2009; 15: 95–100.
45. Sharrma S, Gupta V and Sharma G: Phytopharmacology of *Fagonia indica* (L): A review. J Nat Cons 2010; 1: 143–147.
46. Ibrahim LF, Kawashty SA, El-Hagrassy AM, Nassar MI and Mabry TJ: A new kaempferol triglycoside from Fagonia taeckholmiana: Cytotoxic activity of its extracts. Carbohydr Res 2008; 343: 155–158. [CrossRef] [PubMed]
47. Sharawy SM and Alshammari AM: Checklist of poisonous plants and animals in Aja Mountain, Ha'il Region, Saudi Arabia. Aust J Basic Appl Sci 2009; 3: 2217–2225.
48. Shaker KH, Bernhardt M, Elgamal MHA and Seifert K: Triterpenoid saponins from *Fagonia indica*. Phytochemistry 1999; 51: 1049–1053. [CrossRef]
49. Perrone A, Masullo M, Bassarello C, Hamed AI, Belisario, MA, Pizza C and Piacente S: Sulfated triterpene derivatives from Fagonia arabica. J Nat Prod 2007; 70: 584–588. [CrossRef]
50. Bagban I, Roy S, Chaudhary A, Das S, Gohil K and Bhandari K: Hepatoprotective activity of the methanolic extract of *Fagonia indica* Burm in carbon tetra chloride induced hepatotoxicity in albino rats. Asian Pac J Trop Biomed 2012; 2: S1457– S1460. [CrossRef]
51. Eman AA: Morphological, phytochemical and biological screening on three Egyptian species of Fagonia. Acad Arena 2011; 3: 18–27.
52. Waheed A, Barker J, Barton SJ, Owen CP, Ahmed S and Carew MA: A novel steroidal saponin glycoside from Fagonia indica induces cell-selective apoptosis or necrosis in cancer cells. Eur J Pharm Sci 2012; 47: 464–473. [CrossRef]
53. Wu SB, Long C and Kennelly EJ: Structural diversity and bioactivities of natural benzophenones. Nat Prod Rep 2014; 31: 1158–1174. [CrossRef] [PubMed]
54. Hemshekhar M, Sunitha K, Santhosh MS, Devaraja S, Kemparaju K, Vishwanath B, Niranjana S and Girish K: An overview on genus Garcinia: Phytochemical and therapeutical aspects. Phytochem Rev 2011; 10: 325–351. [CrossRef]
55. Li P, AnandhiSenthilkumar H, Wu SB, Liu B, Guo ZY, Fata JE, Kennelly EJ and Long CL: Comparative UPLC-QTOF-MS-based metabolomics and bioactivities analyses of *Garcinia oblongifolia*. J Chromatogr B 2016; 1011: 179–195. [CrossRef]
56. Fang Y, Zhang Y, Chen M, Zheng H and Zhang K: The active component of *Hedyotis diffusa* Willd. Chin Tradit Plant Med 2004; 26: 577–579.
57. Ahmad R, Shaari K, Lajis NH, Hamzah AS, Ismail NH and Kitajima M: Anthraquinones from Hedyotis capitellata. Phytochemistry 2005; 66: 1141–1147. [CrossRef] [PubMed]
58. Li C, Xue X, Zhou D, Zhang F, Xu Q, Ren L and Liang X: Analysis of iridoid glucosides in *Hedyotis diffusa* by high-performance liquid chromatography/electrospray ionization tandem mass spectrometry. J Pharm Biomed Anal 2008; 48: 205–211. [CrossRef] [PubMed]
59. Liu Z, Liu M, Liu M and Li J: Methylanthraquinone from Hedyotis diffusa WILLD induces Ca2+-mediated apoptosis in human breast cancer cells. Toxicol Vitr 2010; 24, 142–147. [CrossRef]
60. Vidal-Russell R and Nickrent DL: Evolutionary relationships in the showy mistletoe family (Loranthaceae). Am J Bot 2008; 95: 1015–1029. [CrossRef]
61. Powell CB, Fung P, Jackson J, Dall'Era J, Lewkowicz D, Cohen I and Smith- McCune, K: Aqueous extract of herba Scutellaria barbatae, a Chinese herb used for ovarian cancer, induces apoptosis of ovarian cancer cell lines. Gynecol. Oncol 2003; 91: 332–340. [CrossRef] [PubMed]
62. Devi B; Sharma N; Kumar D and Jeet K: *Morus alba* Linn: A phytopharmacological review. Int J Pharm Pharm. Sci 2013; 5: 14–18

63. Chon SU, Kim YM, Park YJ, Heo BG, Park YS and Gorinstein S: Antioxidant and antiproliferative effects of methanol extracts from raw and fermented parts of mulberry plant (*Morus alba* L.). Eur. Food Res. Technol. 2009; 230: 231–237. [CrossRef]
64. Huang X, Gao W, Man S and Zhao Z: Advances in studies on saponins in plants of Paris L. and their biosynthetic approach. Chin Tradit Herb Drugs 1994.
65. Negi JS, Bisht VK, Bhandari AK, Bhatt VP, Singh P and Singh N: Paris polyphylla: Chemical and biological prospectives. Anti-Cancer Agents Med Chem 2014; 14: 833–839. [CrossRef] [PubMed]
66. Zhang XF, Cui Y, Huang JJ, Zhang YZ, Nie Z, Wang LF, Yan BZ, Tang YL and Liu Y: Immuno-stimulating properties of diosgenyl saponins isolated from Paris polyphylla. Bioorg Med Chem Lett 2007; 17: 2408–2413. [CrossRef] [PubMed]
67. Zhang T, Liu H, Liu XT, Chen XQ and Wang Q: Steroidal saponins from the rhizomes of Paris delavayi. Steroids 2009; 74: 809–813. [CrossRef] [PubMed]
68. Deng D, Lauren DR, Cooney JM, Jensen DJ, Wurms KV, Upritchard JE, Cannon RD, Wang MZ and Li MZ: Antifungal saponins from Paris polyphylla Smith. Planta Med 2008; 74: 1397–1402. [CrossRef] [PubMed]
69. Zhao Y, Kang LP, Liu YX, Liang YG, Tan DW, Yu ZY, Cong YW and Ma BP: Steroidal saponins from the rhizome of Paris polyphylla and their cytotoxic activities. Planta Med 2009; 75: 356. [CrossRef]
70. Fu YL; Yu ZY; Tang XM; Zhao Y, Yuan XL, Wang S, Ma BP and Cong YW: Pennogenin glycosides with a spirostanol structure are strong platelet agonists: Structural requirement for activity and mode of platelet agonist synergism. J Thromb Haemost 2008; 6: 524–533. [CrossRef]
71. Guo L, Su J, Deng B, Yu Z, Kang L, Zhao Z, Shan Y Chen, J, Ma B and CongY: Active pharmaceutical ingredients and mechanisms underlying phasic myometrial contractions stimulated with the saponin extract from Paris polyphylla Sm. var. yunnanensis used for abnormal uterine bleeding. Hum. Reprod 2008; 23: 964–971. [CrossRef]
72. Heci Y: Valuable ingredients from herb perilla: A mini review. Innov. Food Technol 2001; 29: 32–33.
73. Asif M and Kumar A: Nutritional and functional characterization of Perilla frutescens seed oil and evaluation of its effect on gastrointestinal motility. Malay J Pharm Sci 2010; 8: 1–12.
74. Lee JK and Ohnishi O: Geographic differentiation of morphological characters among Perilla crops and their weedy types in East Asia. Breed Sci 2001; 51: 247–255. [CrossRef]
75. Lee JK and Ohnishi O: Genetic relationships among cultivated types of Perilla frutescens and their weedy types in East Asia revealed by AFLP markers. Genet. Resour. Crop. Evol 2003; 50: 65–74. [CrossRef]
76. Mao QQ,Huang Z, Zhong XM, Feng CR, Pan AJ, Li ZY, Ip SP and Che CT:Effects of SYJN, a Chinese herbal formula, on chronic unpredictable stress- induced changes in behavior and brain BDNF in rats. J Ethnopharmacol 2010; 128: 336–341. [CrossRef]
77. Lin CS, Kuo CL, Wang JP, Cheng JS, Huang ZW and Chen CF: Growth inhibitory and apoptosis inducing effect of Perilla frutescens extract on human hepatoma HepG2 cells. J. Ethnopharmacol 2007; 112: 557–567. [CrossRef]
78. Zhang L, Wang Y, Yang D, Zhang C, Zhang N, Li M and Liu Y: Platycodon grandiflorus—An ethnopharmacological, phytochemical and pharmacological review. J Ethnophar 2015; 164: 147–161.
79. Han SB, Park SH, Lee KH, Lee CW, Lee SH, Kim C, Kim S, Lee HS and Kim HM:' Polysaccharide isolated from the radix of Platycodon grandiflorum selectively activates B cells and macrophages but not T cells. Int. Immunopharmacol 2001; 1: 1969–1978. [CrossRef]
80. Xie Y,Pan H, Sun H and Li D: A promising balanced Th1 and Th2 directing immunological adjuvant, saponins from the root of Platycodon grandiflorum. Vaccine 2008; 26: 3937–3945. [CrossRef] [PubMed]
81. Khanal T, Choi JH, Hwang YP, Chung YC and Jeong HG: Saponins isolated from the root of Platycodon grandiflorum protect against acute ethanol-induced hepatotoxicity in mice. Food Chem Toxicol 2009; 47:530–535. [CrossRef] [PubMed]
82. Lee KJ, Hwang SJ, Choi JH and Jeong HG: Saponins derived from the roots of Platycodon grandiflorum inhibit HT-1080 cell invasion and MMPs activities: Regulation of NF-κB activation via ROS signal pathway. Cancer Lett 2008; 268: 233–243. [CrossRef] [PubMed]
83. Yu JS and Kim AK: Platycodin D induces apoptosis in MCF-7 human breast cancer cells. J Med Food 2010; 13: 298–305. [CrossRef]
84. Yi ˘git D, Yi ˘git N and Mavi A: Antioxidant and antimicrobial activities of bitter and sweet apricot (*Prunus armeniaca* L.) kernels. Braz J Med Biol Res 2009; 42: 346–352. [CrossRef]
85. Hacısefero ˘gulları H, Gezer I, Özcan MM and Murat Asma B: Post-harvest chemical and physical–mechanical properties of some apricot varieties cultivated in Turkey. J Food Eng 2007; 79: 364–373. [CrossRef]
86. Yan J, Tong S, Li J and Lou J: Preparative isolation and purification of amygdalin from *Prunus armeniaca* L. with high recovery by high-speed countercurrent chromatography. J Liq Chromatogr Relat Technol 2006; 29: 1271–1279. [CrossRef]
87. Akcicek E, Otles S and Esiyok D: Cancer and its prevention by some horticultural and field crops in Turkey. Asian Pac. J. Cancer Prev 2005; 6: 224–230. [PubMed]
88. Gomaa EZ: *In-vitro* antioxidant, antimicrobial, and antitumor activities of bitter almond and sweet apricot (Prunus armeniaca L.) kernels. Food Sci Biotechnol 2013; 22: 455–463. [CrossRef]
89. Sun HD, Huang SX and Han QB: Diterpenoids from Isodon species and their biological activities. Nat Prod Rep 2006; 23: 673–698. [CrossRef]
90. Liu HM, Yan X, Kiuchi F and Liu Z: A new diterpene glycoside from Rabdosia rubescens. Chem Pharm Bull 2000; 48: 148–149. [CrossRef]
91. Zhang Y, Liang Y and He C: Anticancer activities and mechanisms of heat-clearing and detoxicating traditional Chinese herbal medicine. Chin Med 2017; 12: 20. [CrossRef]
92. Shang X, He X, He X, Li M, Zhang R, Fan P, Zhang Q and Jia Z: The genus Scutellaria an ethnopharmacological and phytochemical review. J. Ethnopharmacol 2010; 128: 279–313. [CrossRef] [PubMed]
93. Gasiorowski K, Lamer-Zarawska E, Leszek J, Parvathaneni K, Yendluri BB, Błach-Olszewska Z and Aliev G: Flavones from root of Scutellaria baicalensis Georgi: Drugs of the future in neurodegeneration? CNS Neurol. Disord. Drug Targets 2011; 10: 184–191. [CrossRef]
94. Matkowski A, Jamiolkowska-Kozlowska W and Nawrot I: Chinese Medicinal Herbs as Source of Antioxidant Compounds—Where Tradition Meets the Future. Curr Med Chem 2013; 20: 984–1004. [PubMed]

95. Wozniak D, Lamer-Zarawska E and Matkowski A: Antimutagenic and antiradical properties of flavones from the roots of Scutellaria baicalensis Georgi. Food/Nahrung 2004; 48: 9–12. [CrossRef]
96. Wo´zniak D, Dry´s A and Matkowski A: Antiradical and antioxidant activity of flavones from Scutellariae baicalensis radix. Nat Prod Res 2015; 29: 1567–1570. [CrossRef]
97. Suh SJ, Yoon JW, Lee TK, Jin UH, Kim SL, Kim MS, Kwon DY, Lee YC and Kim CH: Chemoprevention of Scutellaria bardata on human cancer cells and tumorigenesis in skin cancer. Phytother Res 2007; 21: 135–141. [CrossRef]
98. Qu GW, Yue XD, Li GS, Yu QY and Dai SJ: Two new cytotoxic ent- clerodane diterpenoids from *Scutellaria barbata*. J. Asian Nat Prod Res 2010; 12: 859–864. [CrossRef]
99. Dai ZJ, Gao J, Li ZF, Ji ZZ, Kang HF, Guan HT, Diao Y, Wang BF and Wang XJ: *In-vitro* and *in-vivo* Antitumor Activity of Scutellaria barbate Extract on Murine Liver Cancer. Molecules 2011; 16: 4389–4400. [CrossRef]
100. Chen V, Staub RE, Baggett S, Chimmani R, Tagliaferri M, Cohen I and Shtivelman E: Identification and Analysis of the Active Phytochemicals from the Anti- Cancer Botanical Extract Bezielle. PLoS ONE 2012; 7: 30107. [CrossRef]
101. Androutsopoulos VP, Ruparelia K, Arroo RR, Tsatsakis AM and Spandidos DA: CYP1-mediated antiproliferative activity of dietary flavonoids in MDA-MB-468 breast cancer cells. Toxicology 2009; 264: 162–170. [CrossRef]
102. Qiu D and Kao PN: Immunosuppressive and anti-inflammatory mechanisms of triptolide, the principal active diterpenoid from the Chinese medicinal herb Tripterygium wilfordii Hook. f. Drugs R D 2003; 4: 1–18. [CrossRef]
103. Brinker AM, Ma J, Lipsky PE and Raskin IJP: Medicinal chemistry and pharmacology of genus Tripterygium (Celastraceae). Phytochemistry 2007; 68: 732–766. [CrossRef] [PubMed]
104. Ziaei S and Halaby R: Immunosuppressive, anti-inflammatory and anti-cancer properties of triptolide: A mini review. Avicenna J. Phytomed 2016; 6: 149. [PubMed]
105. Sarkar S and Paul S: Triptolide Mediated Amelioration of Breast Cancer *via* Modulation of Molecular Pathways. Pharmacogn J 2017; 9: 838–845. [CrossRef]
106. Kiviharju TM, Lecane PS, Sellers RG and Peehl DM: Antiproliferative and proapoptotic activities of triptolide (PG490), a natural product entering clinical trials, on primary cultures of human prostatic epithelial cells. Clin Cancer Res 2002: 8: 2666–2674.
107. Chang WT, Kang JJ, Lee KY, Wei K, Anderson E, Gotmare S, Ross JA and Rosen GD: Triptolide and chemotherapy cooperate in tumor cell apoptosis A role for the p53 pathway. J Biol Chem 2001; 276: 2221–2227.
108. Lou YJ and Jin J: Triptolide down-regulates bcr-abl expression and induces apoptosis in chronic myelogenous leukemia cells. Leuk. Lymphoma 2004; 45: 373-376. [CrossRef]
109. He MF, Huang YH, Wu LW, Ge W, Shaw PC and But PPH: Triptolide functions as a potent angiogenesis inhibitor. Int J Cancer 2010: 126: 266–278. [CrossRef]
110. Yao J, Jiang Z, Duan W, Huang J, Zhang L, Hu L, He L, Li F, Xiao Y and Shu B: Involvement of mitochondrial pathway in triptolide-induced cytotoxicity in human normal liver L-02 cells. Boil Pharm Bull 2008; 31: 592–597. [CrossRef]
111. Ravipati AS, Zhang L, Koyyalamudi SR, Jeong SC, Reddy N, Bartlett J, Smith PT, Shanmugam K, Münch G and Wu MJ: Antioxidant and anti-inflammatory activities of selected Chinese medicinal plants and their relation with antioxidant content. BMC Complement. Altern Med 2012; 12: 173. [CrossRef] [PubMed]
112. Kim MR, Lee JY, Lee HH, Aryal DK, Kim YG, Kim SK, Woo ER and Kang KW: Antioxidative effects of quercetin-glycosides isolated from the flower buds of *Tussilago farfara* L. Food Chem Toxicol 2006; 44: 1299–1307. [CrossRef]
113. Lee MR, Cha MR, Jo KJ, Yoon MY and Park HR: Cytotoxic and apoptotic activities of *Tussilago farfara* extract in HT-29 human colon cancer cells. Food Sci Biotechnol 2008; 17: 308–312.
114. Fatykhova DG, Karamova NS, Abdrahimova YR and Ilinskaya ON: Evaluation of antigenotoxic effects of juices of plants *Chelidonium majus* L., *Plantago major* L. и *Tussilago farfara* L. Ecol. Genet 2010; 8: 56–65. [CrossRef]
115. Nair NC and Sheela D: Quantification of secondary metabolites and anti-oxidant potential of selected members of the tribe Heliantheae. J. Pharmacogn. Phytochem 2016; 5: 163–166.
116. Manjamalai A and Grace V: Antioxidant activity of essential oils from *Wedelia chinensis* (Osbeck) *in-vitro* and *in-vivo* lung cancer bearing C57BL/6 mice. Asian Pac J Cancer Prev 2012; 13: 3065–3071. [CrossRef]
117. Noori S and Hassan ZM: Dihydroartemisinin shift the immune response towards Th1, inhibit the tumor growth *in-vitro* and *in-vivo*. Cell Immunol 2011; 271: 67–72. [CrossRef] [PubMed]
118. Dell'Eva R, Pfeffer U, Vené R, Anfosso L, Forlani A, Albini A and Efferth T: Inhibition of angiogenesis *in-vivo* and growth of Kaposi's sarcoma xenograft tumors by the anti-malarial artesunate. Biochem. Pharmacol 2004; 68: 2359–2366. [CrossRef] [PubMed]
119. Katiyar SK, Meeran SM, Katiyar N and Akhtar S: p53 cooperates berberine- induced growth inhibition and apoptosis of non-small cell human lung cancer cells *in-vitro* and tumor xenograft growth *in-vivo*. Mol Carcinog 2009: 48, 24–37. [CrossRef] [PubMed]
120. Choi MS, Oh JH, Kim SM, Jung HY, Yoo HS, Lee YM, Moon DC, Han SB and Hong JT: Berberine inhibits p53-dependent cell growth through induction of apoptosis of prostate cancer cells. Int J Oncol 2009: 34: 1221–1230.
121. Harikumar KB, Kuttan G and Kuttan R: Inhibition of progression of erythroleukemia induced by Friend virus in BALB/c mice by natural products— Berberine, Curcumin and Picroliv. J Exp Ther Oncol 2008; 7: 275–284.
122. Peng PL, Kuo WH, Tseng HC and Chou FP: Synergistic Tumor-Killing Effect of Radiation and Berberine Combined Treatment in Lung Cancer: The Contribution of Autophagic Cell Death. Int J Radiat Onco 2008; 70: 529–542. [CrossRef]
123. Huang T, Xiao Y, Yi L, Li L, Wang M, Tian C, Ma H, He, K, Wang Y and Han B: Coptisine from *Rhizoma coptidis* Suppresses HCT-116 Cells-related Tumor Growth *in-vitro* and *in-vivo*. Sci Rep 2017; 7: 38524. [CrossRef]
124. Chen XZ, Cao ZY, Chen TS, Zhang YQ, Liu ZZ, Su YT, Liao LM and Du J: Water extract of *Hedyotis diffusa* Willd suppresses proliferation of human HepG2 cells and potentiates the anticancer efficacy of low-dose 5-fluorouracil by inhibiting the CDK2-E2F1 pathway. Oncol Rep 2012; 28: 742–748. [CrossRef]
125. Apolone G, Joppi R and Garattini S: Ten years of marketing approvals of anticancer drugs in Europe:

Regulatory policy and guidance documents need to find a balance between different pressures. Br J Cancer 2005; 93: 504. [CrossRef] [PubMed]
126. Farrell A, Papadouli I, Hori A, Harczy M, Harrison B, Asakura W, Marty M, Dagher R and Pazdur R: The advisory process for anticancer drug regulation: A global perspective. Ann Oncol 2005; 17: 889–896. [CrossRef] [PubMed]
127. Mezher M: FDA Adopts ICH Guideline on Nonclinical Evaluation for Anticancer Drugs; Regulatory Affairs Professional Society: Rockville, MD, USA, 2018.
128. Huang L, Xie D, Yu Y, Liu H, Shi Y, Shi T and Wen C: TCMID 2.0: A comprehensive resource for TCM. Nucleic Acids Res 2018; 46: D1117–D1120. [CrossRef]
129. Zeng X, Zhang P, Wang Y, Qin C, Chen S, He W, Tao L,Tan Y, Gao D and Wang B: CMAUP: A database of collective molecular activities of useful plants. Nucleic Acids Res 2018; 47, D1118–D1127. [CrossRef]
130. Wu Y, Zhang F, Yang K, Fang S, Bu D, Li H, Sun L, Hu H, Gao K and Wang W: SymMap: An integrative database of traditional Chinese medicine enhanced by symptom mapping. Nucleic Acids Res 2018; 47: D1110–D1117. [CrossRef] [PubMed]
131. Xu HY, Zhang YQ, Liu ZM, Chen T, Lv CY, Tang SH, Zhang XB, Zhang W, Li ZY and Zhou RR: ETCM: An encyclopaedia of traditional Chinese medicine. Nucleic Acids Res 2018, 47, D976–D982. [CrossRef] [PubMed]
132. Jia CY, Li JY, Hao GF and Yang GF: A drug-likeness toolbox facilitates ADMET study in drug discovery. Drug Discov. Today 2019 [CrossRef] [PubMed]
133. Keefe LJ and Stoll VS: Accelerating pharmaceutical structure-guided drug design: A successful model. Drug Discov. Today 2019; 24: 377–381. [CrossRef]
134. Ferreira LLG and Andricopulo D: ADMET modeling approaches in drug discovery. Drug Discov. Today 2019; 24: 1157–1165. [CrossRef]
135. Bergström F and Lindmark B: Accelerated drug discovery by rapid candidate drug identification. Drug Discov. Today 2019; 24: 1237–1241. [CrossRef]
136. Fang J, Liu C, Wang Q, Lin P and Cheng F: *In-silico* polypharmacology of natural products. Brief. Bioinform. 2018; 19: 1153–1171. [CrossRef]
137. Yang B, Mao J, Gao B and Lu X: Computer-Assisted Drug Virtual Screening Based on the Natural Product Databases. Curr. Pharm. Biotechnol 2019; 20: 293–301. [CrossRef]
138. Qu Y, Zhang Z, Lu Y, Zheng D and Wei Y: Network Pharmacology Reveals the Molecular Mechanism of Cuyuxunxi Prescription in Promoting Wound Healing in Patients with Anal Fistula. Evidence-Based Complement. Altern Med 2019; 2019: 3865121-9. [CrossRef]
139. Lv Y, Hou X, Zhang Q Li, R, Xu L, Chen Y, Tian Y, Sun R, Zhang Z and Xu F: Untargeted Metabolomics Study of the *In-vitro* Anti-Hepatoma Effect of Saikosaponin d in Combination with NRP-1 Knockdown. Molecules 2019; 24, 1423. [CrossRef]
140. Wang Y, Jafari M, Tang Y and Tang J: Predicting Meridian in Chinese traditional medicine using machine learning approaches. PLoS Comput Boil 2019; 15: e1007249. [CrossRef] [PubMed]
141. Gaur R, Yadav DK, Kumar S, Darokar MP, Khan F, Bhakuni RS: Molecular modeling based synthesis and evaluation of *in-vitro* anticancer activity of indolyl chalcones. Curr Top Med Chem 2015; 15: 1003–1012. [CrossRef] [PubMed]
142. Tabana YM, Hassan LE, Ahamed MB, Dahham SS, Iqba, MA, Saeed MA, Khan MS, Sandai D, Majid AS and Oon CE: Scopoletin, an active principle of tree tobacco (*Nicotiana glauca*) inhibits human tumor vascularization in xenograft models and modulates ERK1, VEGF-A, and FGF-2 in computer model. Microvasc Res 2016; 107: 17–33. [CrossRef] [PubMed]
143. Sharma P, Prakash O, Shukla A, Rajpurohit CS.; Vasudev PG, Luqman S, Srivastava SK, Pant AB and Khan F: Structure-Activity Relationship Studies on Holy Basil (*Ocimum sanctum* L.) Based Flavonoid Orientin and its Analogue for Cytotoxic Activity in Liver Cancer Cell Line HepG2. Comb. Chem. High Throughput Screen 2016; 19: 656–666. [CrossRef] [PubMed]
144. Ntie-Kang F, Simoben CV, Karaman B, Ngwa VF, Judson PN, Sippl W and Mbaze LM: Pharmacophore modeling and *in-silico* toxicity assessment of potential anticancer agents from African medicinal plants. Drug Des Dev Ther. 2016; 10: 2137– 2154. [CrossRef]
145. Li Y, Wang J, Lin F, Yang Y and Chen SS: A Methodology for Cancer Therapeutics by Systems Pharmacology-Based Analysis: A Case Study on Breast Cancer-Related Traditional Chinese Medicines. PLoS ONE 2017; 12: 0169363. [CrossRef] +
146. Sharma P, Shukla A, Kalani K, Dubey V, Luqman S, Srivastava SK and Khan F: *In-silico* & *In-vitro* Identification of Structure-Activity Relationship Pattern of Serpentine & Gallic Acid Targeting PI3Kgamma as Potential Anticancer Target. Curr. Cancer Drug Targets 2017; 17: 722–734. [CrossRef]
147. Shirzad H, Taji F and Rafieian-Kopaei M: Correlation between antioxidant activity of garlic extracts and WEHI-164 fibrosarcoma tumor growth in BALB/c mice. J Med Food 2011; 14: 969–974. [CrossRef]
148. Lakshmi S, Suresh S, Rahul B, Saikant R, Maya V, Gopi M, Padmaja G and Remani P: *In-vitro* and *in-vivo* studies of 5, 7-dihydroxy flavones isolated from *Alpini galanga* (L.) against human lung cancer and ascetic lymphoma. Med Chem Res 2019; 28: 39–51. [CrossRef]
149. Jagetia GC and Baliga MS: Evaluation of anticancer activity of the alkaloid fraction of Alstonia scholaris (Sapthaparna) *in-vitro* and *in-vivo*. Phytother. Res Int J Devoted Pharmacol Toxicol Eval Nat Prod Deriv 2006; 20: 103–109.
150. Kumar RA, Sridevi K, Kumar NV, Nanduri S and Rajagopal S: Anticancer and immunostimulatory compounds from *Andrographis paniculata*. J. Ethnopharmacol 2004; 92: 291–295. [CrossRef] [PubMed]
151. Oliveira CR, Spindola DG, Garcia DM, Erustes A, Bechara A, Palmeira- dos-Santos C, Smaili SS, Pereira GJ, Hinsberger A and Viriato EP: Medicinal properties of *Angelica archangelica* root extract: Cytotoxicity in breast cancer cells and its protective effects against *in-vivo* tumor development. J Integr Med 2019; 17: 132–140. [CrossRef] [PubMed]
152. Li F, Wang W and Xiao H: The evaluation of anti-breast cancer activity and safety pharmacology of the ethanol extract of *Aralia elata* Seem. leaves. Drug Chem. Toxicol 2019; 1–10. [CrossRef] [PubMed]
153. Baskar AA, Ignacimuthu S, Paulraj GM and Al Numair KS: Chemopreventive potential of β-sitosterol in experimental colon cancer model-an *in-vitro* and *in-vivo* study. BMC Complement. Altern Med 2010; 10: 24. [CrossRef]
154. Yang B, Xiao B and Sun T: Antitumor and immunomodulatory activity of *Astragalus membranaceus* polysaccharides in H22 tumor-bearing mice. Int J Biol Macromol 2013; 62: 287–290. [CrossRef]
155. Lima SR, Junior VFV, Christo HB and Pinto AC: Fernandes, P.D. *In-vivo* and *in-vitro* studies on the

anticancer activity of *Copaifera multijuga* Hayne and its fractions. Phytother Res 2003; 17: 1048–1053. [CrossRef]

156. Hong J, Kwon SJ, Sang S, Ju J, Zhou JN, Ho CT, Huang MT and Yang CS: Effects of garcinol and its derivatives on intestinal cell growth: Inhibitory effects and autoxidation-dependent growth-stimulatory effects. Free Radic Biol Med 2007; 42: 1211–1221. [CrossRef]

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