Anticancer Properties of Different Species of Salvia

Farklı Salvia Türlerinin Antikanser Özellikleri

Review Article

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ABSTRACT

Historically, thousands of different species of plant have been reported as being useful for the treatment of cancer. Salvia species think among these plants. Salvia; “sage” are derived from the Latin salvere referring to remedy properties arrogate to the various Salvia species. Salvia is the largest genus of plants in the mint family, Lamiaceae. In this review we performed to report the anticancer features of different species of salvia

Key Words
Salvia, Anticancer activity.

ÖZET


Anahtar Kelimeler
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INTRODUCTION

Cancer; also known as a malignant tumor or malignant neoplasm, is a group of diseases involving abnormal cell growth with the potential to invade or spread to other parts of the body [1,2]. Recently, Cancer researchers have been tended to herbal medicine in treat cancer. Because they have therapeutic properties. Salvia species are among these plants. Salvia belongs to Lamiaceae family. In this review we performed to report the anticancer features of different species of salvia.

The information Literature

In a work; Salvia absconditiflora were investigated anti-tumor effect on the MCF-7 and MDA-MB-231 breast cancer cell lines. Cell proliferation was inhibited 50% by different IC\textsubscript{50} values calculated in different assays and different time intervals [3].

From isolated S. acetabulosa essential oil inhibited the vitality of amelanotic melanoma (C32) and large cell carcinoma COR-L23 cell lines with IC\textsubscript{50} values of 6.3 and 6.5 μg/mL. From isolated S. leriifolia exhibited a strong inhibitory activity on renal adenocarcinoma ACHN, large cell carcinoma COR-L23, amelanotic melanoma C32, and malignant melanoma A375 with IC\textsubscript{50} values of 6.8, 7.5, 9.1, and 12.5 μg/mL seriatim. Nevertheless both S. acetabulosa and S. leriifolia were not executing anti-proliferative activity against human skin fibroblast 142BR [4].

Aqueous extracts of Salvia chinensis specify anti-proliferative activity. Results indicate the potential use of traditional Chinese medicinal herbs as antineoplastic agents [5].

In a work; investigated of anticancer effect of Salvia cryptantha against breast cancer as in vitro and in vivo. Consequently; this plant had been exhibited antitumor activity [6].

Ethanolic extract of Salvia dominica, Salvia hierosolymitana, Salvia indica leaves and other plants were evaluated for their anti-proliferative activity on a breast cancer cell line (MCF7). This extracts were exhibited high cytotoxic activity [7]. From Salvia isolated different terphenoids emceed forceful anti-proliferative activity against the prostate cancer cell lines (PC3) with IC\textsubscript{50} of 3.9 ± 0.1, 6.2±0.1 and 2.8±0.1 μM, in order of, and cervical cancer cell lines (HeLa) with IC\textsubscript{50} of 8.0±0.3, 2.6±0.1 and 2.7±0.1 μM, respectively [8].

Wafica S. Itani et al., found that combining the three bioactive compounds of S. libanotica essential oil, Linalyl acetate (Ly) Terpeniol (Te) and Camphor (Ca) caused significant growth suppression of HCT116 p53+/+ cells in PreG1 (64% at 48 hours). In p53-/- cells, Ly + Te + Ca caused cell accumulation in PreG1 and G2/M phases [9].

Methanolic extract of Salvia eremophil, Salvia macrosiphon, Salvia reuterana, Salvia santolinifolia be labour cytotoxic effect on the Raji lymphoma cell line. This extracts More than 50% of Raji cells growth was inhibited [10].

In a work; the investigated of the anti-proliferative activity of ethanolic extracts of Salvia menthifolia on DBTRG-05MG cell line. Consequently; Salvia menthifolia towards this extremely aggressive human glioblastoma cell line. Suggested that a natural source of anti-tumor agents [11].

According to a study published in the 2011; Investigated of anticancer activity of Salvia officinalis essential oil against HNSCC cell line (UMSCC1). Consequently; Salvia officinalis essential oil to inhibit human HNSCC cell growth. And it has been suggested as therapeutic potential [12].

In a work publis in the 2013; methanol extracts prepared from Salvia officinalis L., on a non-Hodgkin’s B-cell lymphoma (Raji) and human leukemic monocyte lymphoma (U937), Human acute myelocytic leukemia (KG-1A) and Human Umbilical Vein Endothelial (HUVEC) cell lines. Consequently; The Salvia officinalis L. extract was found dose and time-dependently inhibits the proliferation of lymphoma and leukemic cells possibly via an apoptosis-dependent pathway [13].
Isolated from *Salvia radula* of betulafolientriol oxide and salvigenin inhibit 50% of cancer cells [14].

In a study published in the 2014, *Salvia atropatana*, *Salvia sclarea* *Salvia sahendica*, *Salvia hydrangea*, *Salvia xanthocheila*, *Salvia macrosiphon*, *Salvia glutinosa*, *Salvia chloroleuca* and *Salvia ceratophylla* species for their antioxidant and anti-proliferative activities. *S. ceratophylla* exhibited the strongest anticancer activity against C32 cells with an IC$_{50}$ value of 20.8 $\mu$g/mL, while *S. glutinosa* exhibited an IC$_{50}$ value of 29.5 $\mu$g/mL against ACHN cell line [15].

According to a study published in the 2006, evaluation of anticancer activity of methanolic extract of *Salvia dominica* L. leaves, *Salvia lanigera* Desf. Aerial parts, *Salvia menthaefolia* Ten roots, *Salvia palaestina* Benth. aerial parts, *Salvia sclarea* L. roots and *Salvia spinosa* L. aerial parts on glioblastoma (DBTRG-05MG, T98G, U-87MG), colorectal adenocarcinoma (WiDr and HT-29), prostate adenocarcinoma (MDA Pca2b), choriocarcinoma (JEG-3), endometrium adenocarcinoma (HEC-1A) and B lymphoblast (CIR). According to results, the genus *Salvia* could be considered a natural resource of potential antitumor agents [16].

Recently; shown that the oil extract of *Salvia triloba* has effect chemopreventive abilities in the DMBA/TPA mouse model of skin carcinogenesis [17].

*S. xanthocheila*, *S. aegyptiaca*, *S. aethiopis*, *S. atropatana*, *S. eremophila*, *S. hypoleuca*, *S. limbata*, *S. nemorosa*, *S. santolinifolia*, *S. sclarea*, *S. syriaca*, in localized in Iran. As used this plants extract appraised cytotoxic activity on HL60, K562 cells, Mcf-7 cells [18].

In a work; it was that mechanisms of actions and cell signaling pathways of anticancer of diterpenoids from Salvia species were determined [19].

Reported that hydrophilic phenolic acids of *Salvia miltiorrhiza* Bunge has anticancer effect [20].

In a work aimed to investigate the antitumor activity of Chi-Shen extract (CSE) from the water-soluble compounds of *Salvia miltiorrhiza* on HepG2 cells (hepatocellular carcinoma cell line). Consequently; demonstrated that CSE was able to inhibit the proliferation of HepG2 cells and cause apoptosis [21].

In a study investigated that antitumor activity of *Salvia menthifolia* ten of methanolic extraction on the DBTRG-05MG cell line (human glioblastoma cell line) In a result corrected that this *salvia* species is a natural source of anti-tumor agents [22].

Bauer et al. determined that Carnosol and Carnosic Acids from *Salvia officinalis* Inhibit Microsomal Prostaglandin E2 Synthase-1, which Prostaglandin E2 (PGE2), the most relevant eicosanoid promoting inflammation and tumorgenesis, is formed by cyclooxygenases (COXs). Consequently, identify that *Salvia officinalis* may critically contribute to the anti-inflammatory and anti-carcinogenic properties [23].

According to a work published in the 2011; *Salvia leriifolia* extracts and isolated constituents were evaluated for their cytotoxic activity against a panel of human cancer cell lines, including renal adenocarcinoma (ACHN), amelanotic melanoma (C32), colorectal adenocarcinoma (Caco-2), lung large cell carcinoma (COR-L23), malignant melanoma (A375), lung carcinoma (A549), and hepatocellular carcinoma (Huh-7D12) cells. In a result suggested that this components a selective activity against tumor cells [24].


According to a work published in the 2014; investigated of antioxidant and anti-proliferative activities of *Salvia sclarea*, *Salvia atropatana*,
Salvia sahendica, Salvia hydrangea, Salvia xanthocheila, Salvia macrosiphon, Salvia glutinosa, Salvia chloroleuca and Salvia ceratophylla species. Consequently S. ceratophylla exhibited the strongest activity against C32 cells with an IC\textsubscript{50} value of 20.8 μg/mL, while S. glutinosa exhibited an IC\textsubscript{50} value of 29.5 μg/mL against ACHN cell line [26].

Reported that The acetone extract of Salvia officinalis L. exhibited the most potent cytotoxicity (IC\textsubscript{50} = 14 to 36 μg/mL) against three different cancer cell lines (B16F10, MCF-7 and HeLa) [27].

It has been shown that the oil extract of Salvia triloba has potential chemo-preventive talent in the DMBA/TPA mause of model skin carcinogenesis [28].

Reported that the ethanol crude extracts of S triloba showed anti-proliferative activity to MCF7 with IC\textsubscript{50} values, and 25.25 μg/mL [29].

Itani et al., investigated of anticancer effect of Salvia libanotica essential oil on colon carcinoma. Consequently to be that sage oil component as promising chemotherapeutic agents against colon cancer [30].

The Salvia libanotica essential oil has potential to prevent the proliferation of skin papillomas induced by 7,12 dimethylbenz[a]anthracene (DMBA) - and 12-O-tetradecanoylphorbol-13-acetate (TPA) in mice [31].

In a work; anti-proliferative activity of Salvia officinalis L. essential oil were determined against Human melanoma (A375, M14, and A2058) cell lines [32].

Reported that S. leriifolia exhibited a strong inhibitory activity on renal cell adenocarcinoma ACHN, large cell carcinoma COR-L23, amelanotic melanoma C32, and malignant melanoma A375 with IC\textsubscript{50} values of 6.8, 7.5, 9.1, and 12.5 μg/mL respectively. S. acetalblosa inhibited the viability of C32 and COR-L23cell lines with IC\textsubscript{50} values of 6.3 and 6.5 μg/mL. However, both S. acetalblosa and S. leriifolia couldn’t exert anti-proliferative activity against human skin fibroblast 142BR [33].

S. officinalis oil was able to inhibit the growth of renal cell adenocarcinoma with IC\textsubscript{50} of 100.70 μg/mL. The oil was unable to react with human breast cancer cell (MCF-7) and hormone dependent prostate carcinoma cell [34].

Salvia santolinifolia, Salvia eremophil, Salvia macrosiphon, Salvia reuterana, methanolic extracts of the plants were prepared and their cytotoxic effect determined on the Raji lymphoma cell line In result this extracts more than 50% of Raji cells growth was inhibited by 21 μg/mL of this extract. S. macrosiphon extract also showed a strong inhibitory effect on this tumor cell line (IC\textsubscript{50}= 77±1 μg/mL) [35].

In a work; cytotoxic properties of total methanol extract of Salvia chloroleuca were investigated on MCF-7, a breast carcinoma cell line. results exhibited a mechanism whereby S. chloroleuca induces apoptosis of MCF-7 human breast cells through a ROS-mediated pathway [36].

Russo and co-worker in their study the growth-inhibitory and pro-apoptotic effects of the essential oils from Sw and Sc S. verbenaca were evaluated in the human melanoma cell line M14, testing cell vitality, cell membrane integrity, genomic DNA fragmentation and caspase-3 activity. Both the essential oils were able to inhibit the growth of the cancer cells examined inducing also apoptotic cell death, but the essential oil from cultivated samples exhibited the major effects [37].

In a study publish in the 2014 year; the Salvia miltiorrhiza were informed to anticancer property [38].

In a study with Salvia dominica, its extracts exhibited potent anti-proliferative activity [39].

Sridharan et al., investigate of antitumor potential of Salvia leucantha Cav (EESL) ethanolic extract on Ehrlich Ascites Carcinoma cell lines. Consequently; suggested that Salvia leucantha Cav has dominant anticancer [40].

According to published in the 2015 year, polysaccharides from Salvia chinensis (PSSC)
suppressed in vivo proliferation of H22 cells with undetectable toxic effects on tumor-bearing mice, PSSC alleviated tumor transplantation-induced CD4+ T cell apoptosis and dysregulation of serum cytokine profiles, which elevated cytotoxic activities of natural killer and CD8+ T cells. PSSC reduced serum levels of prostaglandin E2 (PGE2). Injection of exogenous PGE2 completely abrogated the antitumor immunostimulatory activity of PSSC. Cyclic adenosine monophosphate (cAMP) is the second messenger of PGE2. In CD4+ T cells, PSSC substantially declined intracellular cAMP. This event elevated protein levels of JAK3, enhancing STAT5 phosphorylation and STAT5-dependent expression of anti-apoptotic genes. Cyclooxygenase-2 is the key enzyme mediating biosynthesis of PGE2. PSSC suppressed the transcription and translation of cyclooxygenase-2 in tumor associated macrophages [41].

Reported that Tanshinone IIA, extracted from the dried root of *S. miltiorrhiza*, is one of the potential anticancer components [42].

Wang and colleagues, Neo-tanshinlactone isolated from *S. miltiorrhiza* have property to in vitro against several human cancer cell lines, significant inhibition against two human breast cancer cell lines [43].

Hu and coworkers investigated the anthepatocellular carcinoma effects of Chi-Shen extract (CSE) from the water-soluble compounds of *Salvia miltiorrhiza* In a result identified that CSE was able to inhibit the proliferation of HepG2 cells and cause apoptosis [44].

In a work; the anti-proliferative and pro-apoptotic effects of water extracts of *Salvia fruticosa* (SF) and *Salvia officinalis* (SO) and of their main phenolic compound rosmarinic acid (RA) in two human colon carcinoma-derived cell lines, HCT15 and CO115, which have different profiles of constitutive activation of PI3K/Akt and MAPK/ERK pathways. Findings suggest that sage extracts inhibit proliferation in HCT15 cells due to their inhibition on KRAS with a consequent MAPK/ERK pathway down regulation and endorse the use of sage on anticancer therapy/prevention [46].

According to a work published in the 2012; The cytotoxic effect of *Salvia mirzayanii, Salvia macrosiphon, Salvia multicaulis* were studied against HepG2 Cells. In a result the extracts of *S. macrosiphon* and *S. multicaulis* had no significant cytotoxic effects against HepG2 cells [47].

In a work; the cytotoxic activity of the *Salvia verticillata* L essential oil was investigated against HT-29 (colon adenocarcinoma), Caco-2 (colorectal adenocarcinoma), T-47D (breast ductal carcinoma) and NIH-3T3 (Swiss mouse embryo fibroblast) cell lines. Consequently essential oil of *S. verticillata* showed higher cytotoxic effect on Caco-2 cell line [48].

Tanshinones are the major bioactive compounds of *Salvia miltiorrhiza* Bunge (Danshen) roots. In a work the antitumor effects of tanshinones on the highly invasive human lung adenocarcinoma cell line, CL1-5. Consequently; determined that Tanshinone I significantly inhibited migration, invasion, and gelatinase activity in macrophage-conditioned medium-stimulated CL1-5 cells in vitro and also reduced the tumorgenesis and metastasis in CL1-5-bearing severe combined immune deficient mice [49].

According to a work published in 2015 bioactive compounds isolated from the roots of *Salvia sahendica* Boiss and Buhse using bioassay-guided procedures and their biological effects against MCF-7 breast carcinoma cells. In comparison with other solvents, the hexane-based extraction resulted in the most potent anti-cancer activity were exhibited [50].
CONCLUSION

Plants, therapeutic purposes are among the latest trends in the world. Because plants are including a lot of metabolites. These metabolites are exhibit a lot pharmacological effect such as antioxidant, antimicrobial, antifungal, antibacterial, anti-inflammatory etc. also they have protect a lot of disease such as cancer, cardiovascular disease etc. Literature inform correct that salvia species effect of especially cancer a lot of illness. Frequent use of its, will be useful.

References

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