

# A COMPREHENSIVE PHARMACOGNOSTICAL REVIEW ON VARIOUS HERBS USED IN TREATMENT OF NASAL CANCER

<sup>1</sup>Sakshi Gahukar, <sup>2</sup>Mr. V.M.Waghulkar, <sup>3</sup>Sakshi Dhamole, <sup>4</sup>Sakshi Vyas, <sup>5</sup>Sakshi Dhage

<sup>1,3,4,5</sup>Student, <sup>2</sup>Assistant Professor  
Vidyabharti college of Pharmacy  
Amravati.

**Abstract-** Nasal cancer is a rare cancer that affects the nasal cavity (the space behind your nose). Nasal cancer is different from cancer of the area where the nose and throat connect. All 22 studies reported herbs and decoctions, and *Radix glycyrrhizae*, *Salvia miltiorrhiza*, *Radix ophiopogonis* were the herbs most frequently used to treat NPC. Herbal medicines or supplements are natural compounds from plants' leaves, bark, roots, seeds, or flowers that people can use for medicinal purposes. They may offer therapeutic benefits when people use them as complementary medicine. Herbal medicines contain active ingredients from natural plants.

**Keywords:** Nasopharyngeal cancer, salvianoic acid, radix glycyrrhizae, pharmacological action.

## INTRODUCTION:

Nasopharyngeal carcinoma (NPC) is a malignancy arising from the nasopharynx, most commonly the posterolateral nasopharynx, pharyngeal recess, or fossa of Rosenmüller. The most common presentation is a palpable neck lump, with approximately 60% patients seeking medical attention when this occurs. Such lumps develop because of metastatic disease in the cervical lymph nodes. TCM makes use of herbs and herbal formulas to strengthen organ function and support good health. An understanding of the essence of various herbal components gives the TCM practitioner a way to create a healing effect that reaches beyond the chemical composition and physical properties of the herbs. *Glycyrrhiza Radix* is a commonly used Chinese herbal medicine, derived from the dried roots and rhizomes of *Glycyrrhiza glabra*. The main bioactive constituents of licorice are triterpene saponins and flavonoid. *Salvia miltiorrhiza* Bunge, also known as red sage or Danshen (Chinese Pinyin name), is a perennial plant in the genus *Salvia* of the mint family, Lamiaceae. *Salvianolic acid* is the active chemical constituent of *salvia miltiorrhiza*. *Mai Men Dong* (*Radix Ophiopogonis*) is from the root tuber of *Ophiopogon japonicus*, family Liliaceae. The roots are dug and collected in the summer. After the fibrous roots have been removed, it is cleaned, dried and used in its unprocessed form. Category: Tonifying – Yin Tonifying1.

## 1.RADIX GLYCYRRHIZAE:

*Glycyrrhiza glabra* (Fig. 1) is one of the useful medicinal plants. *Glycyrrhiza* is derived from the ancient Greek term *glykos*, meaning sweet, and *rhiza*, meaning root. *Glycyrrhiza glabra* is known as mulethi in north India. *Glycyrrhiza glabra*, also known as LICORICE and sweet wood, is native to the Mediterranean and certain areas of Asia. A number of traditional healers have claimed the efficacy of *Glycyrrhiza* species for a variety of pathological conditions as a diuretic, choloretic, used as insecticide, and indicated in traditional medicine for coughs, colds, and painful swellings2.



Kingdom : Plantae  
Division : Angiospermae  
Class : Dicotyledoneae

Order : Rosales S

Family : Leguminosae

Genus. : Glycyrrhiza Species : glabra Linn

Binomial Name: Glycyrrhiza glabra Linn.

Synonyms : Glycyrrhiza glandulifera.

● **Origin:** The roots are unearthed in the autumn of the fourth season. It is grown in India, Spain, Iran, Russia, China and Italy<sup>3</sup>.

● **Ecology:** Glycyrrhiza glabra enjoys fertile, sandy, and clay soil near a river or stream where enough water is available for the plant to flourish in the wild, or under cultivation where it can be irrigated.

● **Morphology:** Glycyrrhiza glabra is herbaceous perennial, growing to 1 m in height, with pinnate leaves about 7–15 cm long, with 9–17 leaflets. The flowers are 0.8–1.2 cm long, purple to pale whitish blue, produced in a loose inflorescence. The fruit is an oblong pod, 2–3 cm long, containing several seeds<sup>1</sup>. The Glycyrrhiza shrub is a member of the pea family and grows in subtropical climates in rich soil. Below ground, the Glycyrrhiza glabra plant has an extensive root system with a main taproot and numerous runners. The main taproot, which is harvested for medicinal use, is soft, fibrous, and has a bright yellow interior<sup>4</sup>.

● **Medicinal Parts Used:** Roots and Rhizome (powder, teas, tonic, extracts, tinctures, decoction)<sup>5</sup>.

**Chemical constituent:** Glycyrrhiza glabra of the Glycyrrhiza species has triterpene, saponin, polysaccharide, flavonoid, simple sugar, pectin, essential oil, protein, and starch. The taste of Radix Liquiritiae is sweet because of glycyrrhizin, a triterpenoid compound. Glycyrrhizin contains a mixture of potassium, calcium and magnesium salts of glycyrrhizic acid, which varies in the range of 225%. The yellow color of Radix Liquiritiae is due to liquiritin, isoliquiritin, and other flavonoids in its content. Among the isoflavones it contains, glabridin and hispaglabridins A and B which have antioxidant activity. Suzuki F and Maeda H. Suppressor macrophages: A role on the growth of transplanted tumors and regulation by an extract of licorice, glycyrrhizin. The roots of Glycyrrhiza glabra L<sup>6</sup>. contain Glycyrrhiza, a saponin 60 times sweeter than sugarcane sugar. Rich in flavonoids, its roots include lycortin, isolikirtin, liquiritigenin and ramnoliquirilin. Recently, glycolyktirine apioside, prenlycoflavone A, shinflavone, shinpterocarpine and 1-methyl phaseolina have been found from its roots. Glycyrrhizin and glycyrrhetic acid, a saponin compound, are found as calcium and potassium salts in Radix Liquiritiae. In a research conducted on Glycyrrhiza aspera roots in Japan, glycerin K-N have been isolated. The essential oil in Glycyrrhiza glabra leaves contains; benzoic acid, linalool, prasterone, iodoquinol, diethyltoluamide, and benzene. Isoniazid, diethyltoluamide, and benzoic acid are major constituents. While 82 different compounds have been identified in the essential oil of Glycyrrhiza glabra derived from the roots, the main compounds identified from the roots are; hexanoic acid, hexanol, and octanoic acid<sup>7</sup>.

**General mechanism of action:** Flavonoid extracted from the roots of licorice also induces apoptosis and suppresses the proliferation of MDA-MB-231 breast cancer cells by increased generation of ROS. The beneficial effects of licorice can be attributed to a number of mechanisms. Glycyrrhizin and glycyrrhizic acid have been shown to inhibit growth and cytopathology of numerous RNA and DNA viruses, including hepatitis A and C<sup>16</sup> herpes zoster, HIV, Herpes simplex 17, 18 and CMV<sup>19</sup>. Glycyrrhizin and its metabolites inhibit hepatic metabolism of aldosterone and suppress 5-[beta]-reductase, properties responsible for the well-documented pseudoaldosterone syndrome. The similarity in structure of glycyrrhetic acid to the structure of hormones secreted by the adrenal cortex accounts for the mineralocorticoid and gluco-corticoid activity of glycyrrhizic acid<sup>8</sup>. Licorice constituents also exhibit steroid-like anti-inflammatory activity, similar to the action of hydrocortisone. This is due, in part, to inhibition of phospholipase A<sub>2</sub> activity, an enzyme critical to numerous inflammatory processes. In vitro research has also demonstrated glycyrrhizic acid inhibits cyclooxygenase activity and prostaglandin formation as well as indirectly inhibiting platelet aggregation, all factors in the inflammatory process. Licorice constituents possess significant antioxidant and hepatoprotective properties. Glycyrrhizin and 3 glabridin inhibit the generation of reactive oxygen species (ROS) by neutrophils at the site of inflammation<sup>20, 21</sup>. In vitro studies have demonstrated licorice isoflavones, hispaglabridin A and B, inhibit [Fe.sup.3]- induced mitochondrial lipid peroxidation in rat liver cells. Other research indicates glycyrrhizin lowers lipid peroxide values in animal models of liver injury caused by ischemia reperfusion<sup>22</sup>. Licorice<sup>4</sup> constituents also exhibit hepatoprotective activity by lowering serum liver enzyme levels and improving tissue pathology in hepatitis patients<sup>9</sup>.

**Therapeutic Uses :**

- Antitussive Activity
- Antioxidant Activity:
- Antiviral activity
- Immunomodulatory Activity
- Anticarcinogenic and Antimutagenic Activity
- Antidepressant activity:
- Cardiovascular system:
- Side Effects and Toxicity Marketed products

- Inlife liquorice root extract(Capsule)
- Price: 318rs

SUPPLEMENT FACTS	
Serving Size: 1 Veg. Capsule	Serving Per Container: 60
Licorice (Yashtimadhu/Ghana Satva)	500 mg
Glycyrrhizinic acid > 20%	
Ayurvedic Shastric Yoga	
EACH CAPSULE CONTAINS: Licorice (Yashtimadhu/Ghana Satva) 500 mg	
Ref: AFI	
OTHER INGREDIENTS: Capsule (Vegetarian cellulose), 100% Vegetarian. No fillers, binders or common allergens.	
CONTAINS PERMITTED SYNTHETIC FOOD COLOURS.	
SUGGESTED USE: One capsule twice daily after meal or as advised by the healthcare professional.	
STORAGE: Store in a cool & dry place. Protect from light. Keep out of sight and reach of children.	



Dose : 1 -4 gm , thrice a day

Route of administration: Oral route

**2.SALVIA MILTIORRHIZA:** *Salvia miltiorrhiza*, named Danshen in Chinese, is a traditional Chinese medicinal herb. It is a perennial flowering plant in the genus *Salvia*, highly valued for its roots in traditional Chinese medicine. Native to China and Japan, it grows between 90-1200 m elevation, preferring grassy places in forests, hillsides, and along stream banks in the west and southwest provinces of China. The plant is a deciduous perennial. It grows to between 30–60 cm high. Leaves are simple or divided, depending on their position on the stem. Flower petals are purple or blue held within a dark purple calyx (Figure 4)<sup>24</sup>. The specific epithet *miltiorrhiza* means "red juice extracted from a root" (Clebsch et al., 2003). Danshen is the dried root of *S. miltiorrhiza* (Labiatae) and is one of the most versatile Chinese herbal drugs, sometimes described as Chinese sage or red sage root (Figure 5). Danshen was used infrequently in ancient Chinese's medicine, yet it has become an important herb in modern Chinese clinical practice. It has been used clinically to treat and prevent cardio-vascular disease, hyperlipidemia, and cerebrovascular disease throughout the world (Cheng et al., 2007). The transformation of Danshen from a rarely used and minor component of formulas to a key herb is a story that sheds light on the evolution of the Chinese medical tradition. Now, *S. miltiorrhiza* is often widely used in combination with other herbs<sup>25</sup>.



Kingdom. : Plantae

Division : Angiosperms

Class. : Eudicots

Order : Lamiales

Family : Lamiaceae

Genus. : *Salvia*

Species : *S. miltiorrhiza*

Binomial name: *Salvia miltiorrhiza*.

**Chemical constituent:** 1. *Salvianolic acid* (or *salvianolic acid B*) : It inhibits the production of inflammatory cytokines including IL-1 $\beta$  and TNF- $\alpha$  and decreases the levels of fibrosis markers such as  $\alpha$ -SMA and collagen. It exerts antifibrotic effects by inhibiting the activation of coagulation factors<sup>26</sup>. 2. *Dihydrotanshinone* : It has been widely used for treating cardiovascular diseases. Dihydrotanshinone I exhibits entry-blocking effect for MERS-CoV. 3. *Miltirone* :It is responsible for the reducing effect of its extracts on alcohol intake in different experimental models of excessive alcohol consumption. 4. *Tanshinone I* : It is flavonoid , helps to reduce the overexpression of proinflammatory

molecules such as NO, TNF- $\alpha$ , IL-1 $\beta$ , and IL-6 and inhibit the activation of NF- $\kappa$ B in LPS-induced BV2 microglia cells. 5-Tanshinone IIA :It have been widely used in clinic due to their proved anti-inflammation, antioxidation, and anti-fibrosis functions<sup>27</sup>

Mechanism of action: The protective effect of *S. miltiorrhiza* and its active components relied greatly on the amelioration of oxidative stress, which showed as the increase of antioxidant enzymes, such as superoxide dismutase (SOD), catalase, glutathione system, and a decrease in malondialdehyde – the biomarker of lipid peroxidate<sup>28</sup>



Therapeutic targets of *S. miltiorrhiza* in cardiovascular diseases. HIF1 $\alpha$ , hypoxia-inducible factor 1 $\alpha$ ; VEGFA, vascular endothelial growth factor A; NR2C2, nuclear receptor subfamily 2 group C member 2; FATP, fatty acids transport protein; CPTI, carnitine palmitoyltransferase I; PPAR $\alpha$ , peroxisome proliferator-activated receptor- $\alpha$ ; Cx43, 12 connexin 43; eNOS, endothelial nitric oxide synthase; SOD, superoxide dismutase; TG, triglycerides; TC, total cholesterol; LDL-C, low-density lipoprotein cholesterol; Lp(a), lipoprotein (a); GGT, gammaglutamyl transpeptidase; DBil, direct bilirubin; UA, uric acid; Hcy, homocysteine; HDL-C, high-density lipoprotein cholesterol; ApoA, apolipoprotein A; TBil, total bilirubin; IBil, indirect bilirubin; MMP, matrix metalloproteinase; Bcl-2, B-cell lymphoma 2; PKD1, protein kinase D1 protein; iNOS, inducible nitric oxide synthase; MPO, myeloperoxidase; IL-10, interleukin10; TNF, tumor necrosis factor; IL-1 $\beta$ , interleukin-1 $\beta$ ; IL-6, interleukin-6; H3K4me3, H3K4 trimethylation; H3K36me3, H3K36 trimethylation; Colla1, collagen type I alpha 1, Col3a1, collagen type III alpha 1; Acta2, actin alpha 2. Figure 6. Therapeutic targets of *S. miltiorrhiza* in cardiovascular diseases<sup>29</sup>. HIF1 $\alpha$ , hypoxia-inducible factor 1 $\alpha$ ; VEGFA, vascular endothelial growth factor A; NR2C2, nuclear receptor subfamily 2 group C member 2; FATP, fatty acids transport protein; CPTI, carnitine palmitoyltransferase I; PPAR $\alpha$ , peroxisome proliferator-activated receptor- $\alpha$ ; Cx43, connexin 43; eNOS, endothelial nitric oxide synthase; SOD, superoxide dismutase; TG, triglycerides; TC, total cholesterol; LDL-C, low-density lipoprotein cholesterol; Lp(a), lipoprotein (a); GGT, gamma-glutamyl transpeptidase; DBil, direct bilirubin; UA, uric acid; Hcy, homocysteine; HDL-C, high-density lipoprotein cholesterol; ApoA, apolipoprotein A; TBil, total bilirubin; IBil, indirect bilirubin; MMP, matrix metalloproteinase; Bcl-2, B-cell lymphoma 2; PKD1, protein kinase D1 protein; iNOS, inducible nitric oxide synthase; MPO, myeloperoxidase; IL-10, interleukin10; TNF, tumor necrosis factor; IL-1 $\beta$ , interleukin-1 $\beta$ ; IL-6, interleukin-6; H3K4me3, H3K4 trimethylation; H3K36me3, H3K36 trimethylation; Colla1, collagen type I alpha 1, Col3a1, collagen type III alpha 1; Acta2, actin alpha<sup>230</sup>.

Therapeutic activity :

- Anti-cancer activity
- Anti-inflammatory activity
- Antimicrobial activity
- Antivirus activity
- Antioxidant activity

### Toxicity:

At the higher dosage levels, *S. miltiorrhiza* may on rare occasions cause dry mouth, dizziness, lassitude, numbness, shortness of breath, and other symptoms that will usually disappear spontaneously without interrupting the treatment. Rare Chinese Materia Medica notes that *S. miltiorrhiza* is not suitable for patients who have deficiency but not stasis, or deficiency accompanied by cold, or with tendency to bleed. *S. miltiorrhiza* has very low acute toxicity, with an LD50 by injection of 40-80 g/kg<sup>31</sup>. The Pharmacopoeia of the People's Republic of China indicates a recommended dosage of 9-15 g per daily dose in decoction form. In a few instances, higher doses are administered, up to 20 g per day, in the treatment of inflammatory diseases, including viral hepatitis. According to English-Chinese Rare Chinese Materia Medica, up to 30-60 g can be used in cases of angina and heat-type arthritis. The relatively high dosage of *S. miltiorrhiza*, compared to most other Chinese herbs may be attributed to the relatively low level of active constituents and their poor

solubility in water. It is recommended that *S. miltiorrhiza*, or its pre-preparations used for treatment of poor blood circulation, not be combined with coumadin (Warfarin), as there is a possibility of increasing the anticoagulant effects. Such effects may be rare and are likely to be dose dependent, as the mechanism appears to be a simple additive effect of anticoagulant activity of salvia along with that produced by Warfarin. Therefore, persons using coumadin should either avoid using *S. miltiorrhiza*, or use it in relatively low dosage while paying attention to blood coagulation tests that are routinely performed for persons taking the drug<sup>32</sup>. The doses are based on scientific research, publications or traditional use. Because most herbs and supplements have not been thoroughly studied or monitored, safety and effectiveness may not be proven. Brands may be made differently, with variable ingredients even within the same brand. Combination products often contain small amounts of each ingredient and may not be effective. The dosing for unproven uses should be approached cautiously, because scientific information is limited in these areas. There are no standard or well-studied doses of *S. miltiorrhiza*, and many different doses are used traditionally. Further studies through long-term bioassays are required to determine the chronic toxicity of the plant on the body<sup>33</sup>.

Marketed products :

### 1.Homeopathic dilution :

Categories : Homoeopathic Medicine,

Homoeopathic Dilutions

Brands: Bakson's Homoeopathy

Pack Size : 30 ml

Price : 100 rs. 8



### 2.Tincture:



### Route of administration: oral route

3.RADIX OPHIOPOGONIS: Radix Ophiopogonis (Mai Dong ) also known as Dwarf Lilyturf Tuber, Dwarf Lilyturf Root and Ophiopogon Japonicus Root, refers to the tuberous roots of Ophiopogon Japonicus, an evergreen perennial plant that belongs to the Liliaceae family. This plant has long, thin and green leaves, as well as tuberous white roots<sup>34</sup>. These roots are typically harvested in summer, cleansed and dried under the sun for medicinal usage. The name of Ophiopogon comes from the Greek words 'ophis' and 'pogon', where the former means snake and the latter means beard. Other than being used medicinally, Ophiopogon Japonicus is also grown in ornamental gardens as a ground cover and as a decorative plant for freshwater aquaria. However, as it is not a true aquatic plant, it can only live for a few months underwater before it dies. In Traditional Chinese Medicine (TCM), Mai Dong falls under the category of 'Tonic herbs for Yin Deficiency<sup>35</sup>'. Such herbs are used for patterns of deficiency to replenish one's 'Four Treasures' (qi, blood, yin, yang). Cool in nature, Mai Dong can help individuals who have too much Heat in their body, such as those experiencing a Yang Excess or a Yin Deficiency, to restore a harmonious yin-yang balance. Bitter and sweet in taste,

Mai Dong can cleanse the body by clearing Heat, drying Dampness and promoting elimination via urination or bowel movements. The herb can also slow down acute reactions, detoxify the body and has a tonic effect on the body by replenishing qi and blood. In particular, Mai DonHeart, the Lungs and the stomach<sup>36</sup> .



Kingdom: Plantae  
 Division: Angiosperms  
 Class : Monocots  
 Order : Asparagales  
 Family. : Asparagaceae  
 Subfamily: Nolinoideae  
 Genus : Ophiopogon  
 Species: *O. japonicus*  
 Binomial name: *Ophiopogon japonicus*

Chemical constituents: 1. Steroidal saponins (a) Ophiopogonin : Ophiopogonin D of *Ophiopogon japonicus* ameliorates renal function by suppressing oxidative stress and inflammatory response in streptozotocin-induced diabetic nephropathy rats - PMC<sup>37</sup> . (b) Ophiopogonoside : Ophiopogonoside is believed to have various health benefits, such as anti-inflammatory, antioxidant, and neuroprotective effects. It has been used in traditional medicine for conditions like respiratory problems, cardiovascular health, and as a general tonic<sup>38</sup> . 2. Polysaccharide : Radix *Ophiopogonis* polysaccharide (ROP), a highly hydrophilic macromolecule, has a unique anti-ischemic action in the myocardium<sup>39</sup> . 3 Homoisoflavonoid: (a) Methylphiopogonanone A: suppresses ischemia/reperfusion-induced myocardial apoptosis in mice via activating PI3K/Akt/eNOS signaling pathway<sup>40</sup> . (b) Methylphiopogonanone B: It shows antioxidative and anti-tumor properties<sup>41</sup> .

Mechanism of action:

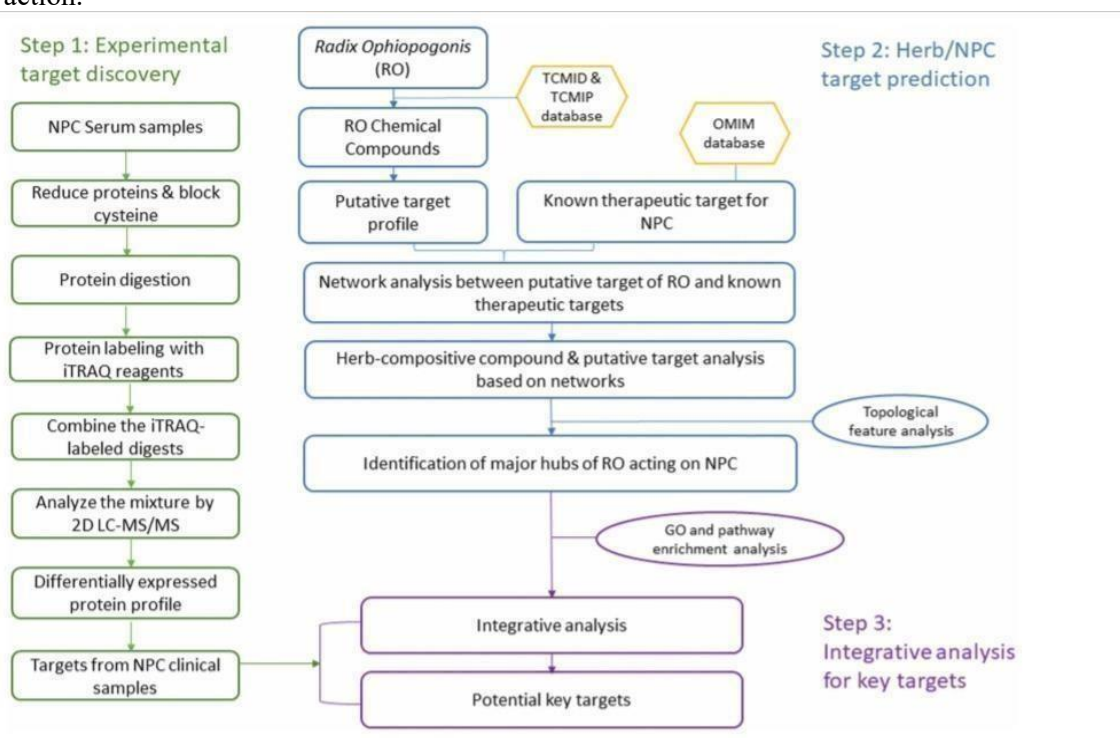
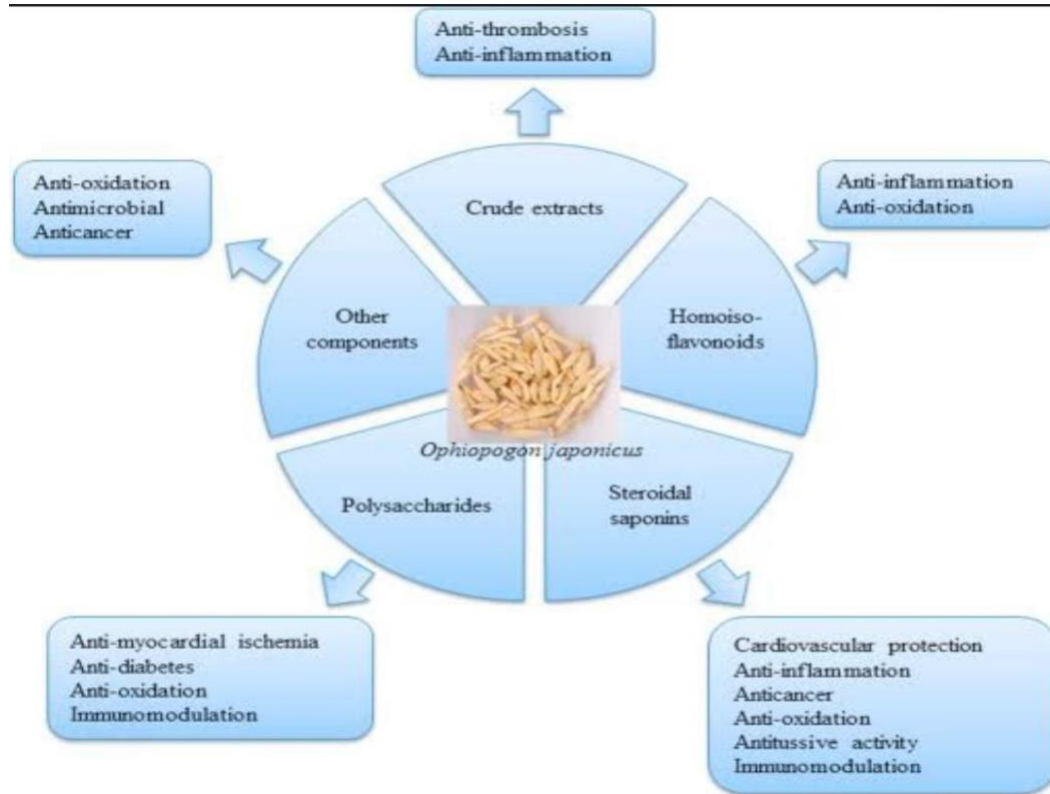


Figure 12: A systematic workflow of the integrative approach for deciphering the pharmaceutical mechanism of herb Radix ophiopogonis on NPC<sup>42</sup>

Pharmacological action :

1. Anticancer activity
2. Anti-inflammatory activity<sup>43</sup>
3. Anti-microbial activity
4. Anti-oxidants activity
5. Anti-diabetic activity
6. Immunomodulation<sup>44</sup>
7. Cough Relief



### Toxicity and side effects:

1. Allergic Reactions: Some individuals may be allergic to Radix Ophiopogonis, which can result in skin rashes, itching, or other allergic symptoms<sup>45</sup>.
2. Gastrointestinal Upset: Excessive use may cause digestive issues like diarrhea or upset stomach.
3. Hypoglycemia: Radix Ophiopogonis can lower blood sugar levels, which may be a concern for individuals with diabetes or those taking medications to regulate blood sugar<sup>46</sup>.
4. Cardiovascular Effects: In some cases, it might affect blood pressure or heart rate, so individuals with heart conditions should use it with caution<sup>47</sup>.
5. Potassium Loss: Long-term or excessive use may lead to potassium loss in the body, potentially causing muscle weakness or irregular heart rhythms<sup>48</sup>.
6. Drug Interactions: Radix Ophiopogonis may interact with certain medications, so it's essential to consult a healthcare professional if you are taking any prescription<sup>49</sup>.

Marketed products: 1. Shri Ram herbal Radix ophiopogonis extract tablets

Product details :

Item Form. -Tablet

Brand - generic

Age Range -(Description)Adult

Special Ingredients Ophiopogonis

Pack of 180 Tablets (Each Tablets 550mg)

Natural Based Product An Organic Multipurpose Remedy Product<sup>50</sup>

Price : 2,290

Expiry :2025



## 2. Zyrex Radix ophiopogonis extract powder

Product details:

Item form - Powder

Brand - Zyrex

Pack size - 300gm

Price - 2,700

Expiry - sep 2025.



ZYREX  
ZYREX Radix Ophiopogonis Extract Powder-  
300gm Pack

Dose : 1 table per day or 3-4 gm powder formulation thrice a day

Route of administration: oral route

### Conclusion:

This study emphasizes the importance of recent studies on traditional and ancient medicinal plants for the creation of new traditional medicines. Above drugs pharmacological effects after isolation and assay can be challenging. To isolate, extracts are employed to treat many diseases and metabolites. Many extraction studies have not used experimental research, and few have been in conflict with one another. Different extraction techniques are advantageous in limiting illness. Compared to conventional medicines. At the time of this study, phytochemical concentrations in various plant organs were unknown, making it impossible to predict amounts based on conventional applications. Future research should concentrate on the relationship between various phytochemicals and various illnesses. Additional research and study are needed on the concentration of phytochemicals, extraction yield, and physiological activity, among other things. The knowledge gained from these discoveries will be crucial for developing new drugs or practicing preventative medicine. The Radix glycyrrhizae, Salvia miltiorrhiza, Radix ophiopogonis has a lot of unique traits and is impressive. The botanical, phytochemical, nutritional, and pharmacological potential of this drugs are tremendous. In the review paper, it is briefly addressed how anti-cancer I activities work. There is a lot of room for future research to clarify the mechanism of action of this plant and explore its further pharmacological effects. Future herbal medicine production for the pharmaceutical sector may rely heavily on this therapeutic plant. The plants possesses a variety of pharmacological effects, according to the current review. The biological activities are caused by the phytoconstituents that are present in them. The variety of phytochemicals found in this plant can be used as a drug lead for the creation of new therapeutics.

### ACKNOWLEDGEMENTS

I am very thankful to Mr. V. M. Waghulkar sir, Assistant Professor of Vidyabharti College of Pharmacy, Amravati for encouragement and providing the necessary facility for completion of this work.



**Disclosure of conflict of interest**

The authors have no conflict of interest to declare.

**REFERENCES:**

1. Yamamoto Y, Majima T, Saiki I, Tani T. Pharmaceutical evaluation of Glycyrrhiza uralensis roots cultivated in eastern Nei-Meng-Gu of China. *Biol Pharm Bull* 2003; 26(8):1144-9.
2. Tsuda T, Kubota K, Yasuda K, Sugaya A and sugaya E. Effect of Chinese herbal medicine on neuropharmacological tests. *Ethnopharmacol Mar* 1986; 15(3), 289-296.
3. Nishino H, shibata S, Hirabayashi K and Iwata S. Antitumor-promoting activity of glycyrrhetic acid related compounds. *Tyoto Furitcu Ika Daigaku Zasshi (Japn)* 1986; 95(11), 1563-1566.
4. Yasukawa K, Takido M, Takenchi M and Nakagawa S. Inhibitory effect of glycyrrhizin and caffeine on two-stage carcinogenesis in mice. *Jap Pharm J (Yakugaku Zasshi)* 1988; 108(8), 794-796.
5. Suzuki F and Maeda H. Suppressor macrophages: A role on the growth of transplanted tumors and regulation by an extract of licorice, glycyrrhizin. *Oncologia (Gann)* 1987; 20(5), 124-133.
6. Qing H, Zhang PY and Liang CD. Antitumor activity of sodium glycyrrhetinate. Programme and Abstracts of the Fifth Southeast Asian and Western Pacific Regional Meeting of Pharmacologists Beijing: China Pharmacological Society, 1988; 232, O35.08.
7. Takara K, Horibe S, Obata Y, Yoshikawa E, Ohnishi N, Yokovama T. Effects of 19 herbal extracts on the sensitivity to paclitaxel or 5-fluorouracil in HeLa cells. *Bio Pharm Bull* 2005; 28(1):138-42.
8. Niwa K, Lina Z, Onogi K, Yun W, Mori H, Tamaya T. Preventive effects of glycyrrhizin on estrogen-related endometrial carcinogenesis in mice. *Oncol Rep* 2007; 17(3):617-22.
9. Xiao PG, Liu CX. Pharmacology, pharmacokinetics, toxicology, and therapeutics of traditional Chinese medicines: Radix Glycyrrhizae *Asian Journal of Drug Metabolism and Pharmacokinetics* 2001; 1 (2) : 140-150. 15
10. Mo SJ, Son EW, Lee SR, Lee SM, Shin DH, Pyo S. CML-1 inhibits TNF-alpha-induced NF-kappaB activation and adhesion molecule expression in endothelial cells through inhibition of IkBalpha kinase. *J Ethnopharmacol* 2007; 109(1):78-86.
11. Eum HA, Lee WY, Kim SH, Kim JY, Park SW, Lee JS, Choi SM, Pyo S, Kang MJ, Min YD, Shim SH, Shin DH, Lee SM. Anti-inflammatory activity of CML-1: an herbal formulation. *Am J Chin Med* 2005; 33(1):29-40.
12. Takagi K, Okabe S, Kawashima K and Hirai T. Therapeutic effect of FM100, a fraction of licorice root, on acetic acid ulcer in rats. *Japn J Pharmacol* 1971; 21, 832-833.
13. Okabe S, Kunimi H, Nosaka A, Ishi Y and Nakamura K. Effects of FM 100, FM-100-deg and glycyrrhizin on gastric secretion and experimental gastric ulcers in rats. *CA* 1979; 92 157697e. 14. Gawron-Gzella A, Witkowska-Banaszczak E, Dudek M. Herbs and herbal preparations applied in the treatment of gastric hyperacidity, gastric and duodenal ulcer in cigarette smokers *Przegl Lek* 2005; 62(10):1185-7.
15. Nakashima H, Matsui T, Yoshida O, Usowa Y, Kido Y, Motoki Y, Ito M, Shigeta S, mori T and Yamamoto N. A new anti-human immunodeficiency virus substance, glycyrrhizin sulfate, 21 endowment of glycyrrhizin with reverse transcriptase inhibitory activity by chemical modification. *Japn Cancer Res* 1987; 78(8), 767-771.
16. Bada M and Shigeta S. antiviral activity of glycyrrhizin against varicellar virus in vitro *Antiviral Res* 1987; 792), 99- 107.
17. Akao T, Akao T and Kobashi K. Glycyrrhizin stimulates growth of *Eubacterium* sp. stain GHL, a human intestinal anaerobe. *Appl Environ Microbiol* 1988; 54(8), 2027-2030. (CA 109,186882m). 18. Pantazopoulos N, Antonakopoulos G Sofras F and Dimopoulos C. The effect of penosanpolysulphate and carbenoxolone on bacterial adherence to the injured urothelium. *Br J Urol* 1987; 59(5), 423-426.
19. Gao ZH, Yu B, Li Q, Wu YJ and Li XF. Antibiotic activity of glycyrrhizic acid in vivo. *Chin Phramcol Bull* 1996; 12(2), 192.
20. Li Y, Li J, Fang C. Inhibitory effects of anti-SARS traditional Chinese medicines on the UV irradiation of lambda-dalysogen. *Am J Chin Med* 2006; 34(1):147-55.
21. Filczewski M, Kosmala M and Oledzka K. Cardiovascular action of a new carbenoxolone derivative. *Pol J Pharmacol Pharm* 1988; 40(3), 233-239.
22. Vasilinko Yr, Stepanova EF, Skilte IV and Mezenova TD. Hypolipidemic activity of glycyrrhiza preparations in relation to biogenesis of its triterpenic compounds. *CA* 1988; 110, 51112k.
23. Khaltayev BS. Effects of 3-amino-3-deoxy-glycyrrhetic acid and polysaponin on the activity of superoxide dismutase in hypercholesterolemia. 1988; CA 109, 1632273z.].
24. Hu XY, Peng GP and Chen RY. Studies on antiarrhythmic action of total flavones of licorice. *Chin Trad Herb Drugs* 1996; 27(12), 733-735.
25. Cui ZQ, Guo SD, Zhang HR and Ye B. The effect of zhigancao and glycyrrhizic acid on transmural potential of reversioned mice. *Chin Trad Herb Drugs* 1995; 26(12), 643-644.

26. Zhu XW. Protective effect of sodium glycyrrhinic acid on injured myocardial cells from neonater rats. *Chin Pharmacol Bull* 1996; 12(1), 74-76.
27. Liu C and Zhang XM. (1996) Effects of saponins of Glycyrrhiza on the decrease of Na<sup>+</sup>, K<sup>+</sup>-ATPase activity induced by oxygen free radicals. *Chin Pharmacol Bull* 12(3), 277-278.
- 28.. Tamaya T, Sato S and Okada H. Inhibition by plant herb extracts of steroid bindings in uterus, liver and serum of the rabbit. *Acta Obstet Gynecol Scand* 1986; 65(8), 839-842. 16
- 29.Zhou YP and Zhang JQ. Oral bacalin and licorice liquid extract reduce sorbitol leels in red blood cells of diabetic rats. *Chin Med J* 1989; 102(3), 203-206.
30. Tutierrez C and Fernandez JM. Effect of carbenoxolone on glucose metabolism in rat adipose tissue. *Biochem Pharmacol* 1988; 37(7), 1299-1301.
31. Mishima M, Okada S, Wakita Y and Nakano M. Promotion of nasal absorption of insulin by gkycyrretinic aid derivatives. *J Pharmacobiodyn* 1989; 12(1), 31-36.
32. Ren J, Cheng JX and Wang ZG. The effect of ammonium glycyrrhizinate on biosynthesis of prostaglandins E2 and F2a. *Sci Bull* 1988; 33(8), 1561-1564.
33. Rhyu DY, Kang KS, Sekiya M, Yokozawa T. Antioxidant effect of Wen-Pi-Tang and its component crude drugs on oxidative stress. *Am J Chin Med* 2007; 35(1):127-37.
- 34.Sato Y, He JX, Nagai H, Tni T, Akao T. Isoliquiritigenin, one of the antispasmodic principles of Glycyrrhiza uralensis roots, acts in the lower part of intestine. *Bio Pharm Bull* 2007; 30(1):145-9.
35. He JX, Goto E, Akao T, Tani T. Interaction between Shaoyao-Gancao-Tang and a laxative with respect to alteration of paeoniflorin metabolism by intestinal bacteria in rats. *Phytomedicine* 2006; [Epub ahead of print ]. 22 Mazumder, P.M., et al., Evaluation of
- 36.immunomodulatory activity of Glycyrrhiza glabra L roots in combination with zing. *Asian pacific journal of tropical biomedicine*, 2012. 2(1): p. S15-S20.
37. LIU, L.-p., C.-a. REN, and H.-y. ZHAO, Research Progress on Immunomodulatory Effects of Glycyrrhizin [J]. *Chinese Journal of Experimental Traditional Medical Formulae*, 2010. 6.
- 38.Ayeka, P.A., et al., Immunomodulatory and anticancer potential of Gan cao (Glycyrrhiza uralensis Fisch.) polysaccharides by CT-26 colon carcinoma cell growth inhibition and cytokine IL-7 upregulation in vitro. *BMC complementary and alternative medicine*, 2016. 16(1): p. 1-8.
39. Sharma, V., R. Agrawal, and V.K. Shrivastava, Assessment of median lethal dose and antimutagenic effects of Glycyrrhiza glabra root extract against chemically induced micronucleus formation in Swiss albino mice. *International Journal of Basic & Clinical Pharmacology*, 2014. 3(2): p. 292.
- 40.Chin, Y.-W., et al., Anti-oxidant constituents of the roots and stolons of licorice (Glycyrrhiza glabra). *Journal of agricultural and food chemistry*, 2007. 55(12): p. 4691-4697.
- 41.Deng, Q.-P., et al., Effects of glycyrrhizin in a mouse model of lung adenocarcinoma. *Cellular Physiology and Biochemistry*, 2017. 41(4): p. 1383-1392.
- 42.Nagaraj, S.R.M., et al., MTA1 induced angiogenesis, migration and tumor growth is inhibited by Glycyrrhiza glabra. *IOSR J Pharmacy*, 2012. 2: p. 34-43.
- 43.Hasan, S.K., et al., Chemopreventive effect of 18β-glycyrrhetic acid via modulation of inflammatory markers and induction of apoptosis in human hepatoma cell line (HepG2). *Molecular and cellular biochemistry*, 2016. 416(1- 2): p. 169-177.
44. Kim, K.J., et al., The anti-angiogenic activities of glycyrrhizic acid in tumor progression. *Phytotherapy Research*, 2013. 27(6): p. 841-846.
45. Lin, D., et al., Involvement of BID translocation in glycyrrhetic acid and 11-deoxy glycyrrhetic acidinduced attenuation of gastric cancer growth. *Nutrition and cancer*, 2014. 66(3): p. 463-473. 17 46. Yo, Y.-T., et al., Licorice and licochalcone-A induce autophagy in LNCaP prostate cancer cells by suppression of Bcl-2 expression and the mTOR pathway. *Journal of agricultural and food chemistry*, 2009. 57(18): p. 8266-8273.
- 47.Zhang, Z., et al., Molecular mechanisms underlying the anticancer activities of licorice flavonoids. *Journal of Ethnopharmacology*, 2020: p. 113635.
- 48.Pharma, G., et al., 18β-glycyrrhetic acid induces apoptosis through modulation of Akt/FOXO3a/Bim pathway in human breast cancer MCF-7 cells. *Journal of cellular physiology*, 2012. 227(5): p. 1923-1931.
- 49.Dhingra, D. and A. Sharma, Antidepressant-like activity of Glycyrrhiza glabra L. in mouse models of immobility tests. *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, 2006. 30(3): p. 449-454.
- 50.Zhai, C.-l., et al., Glycyrrhizin protects rat heart against ischemia-reperfusion injury through blockade of HMGB1-dependent phospho-JHUJNK/Bax pathway. *Acta Pharmacologica Sinica*, 2012. 33(12): p. 1477-1487.