

Pharmacological Review on Juniperus Communis

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Abstract: *Juniperus communis* contained monoterpenes, sesquiterpenes, essential and volatile oils, wide range of phenolic compounds and many other chemical constituents. It exerted many pharmacological effects included antimicrobial, antiparasitic, antifertility, antioxidant, cytotoxic, hepatoprotective, vessels and trachea protective effects in passive smoking, gastrointestinal, antidiabetic, antihyperlipidemic, anti - inflammatory, analgesic, diuretic, antiurolithiatic, anti - Parkinsonian, memory enhancing, tyrosinase suppressive activity and many other effects. The main compounds in the *Juniperus communis* essential oil are δ - 3 - carene, α - pinene, β - pinene, sabinene, β - phellandrene, myrcene, limonene, and *d* - germacrene. This chapter reviews the chemical composition and the biological activities of juniper oil. This review will highlight the chemical constituents and pharmacological effects of *Juniperus communis*. *Juniperus communis* is an evergreen shrub or a small tree indigenous to Europe, South Asia and North America. It is widely distributed throughout the northern hemisphere. This plant is used traditionally in the treatment of various diseases and disorders like anti - inflammatory, anti - diarrhoeal, astringent, menstrual irregularities and some abdominal disorders. In the last few years, this plant has been selected for various research activities.

Keywords: *Juniperus communis*, antimicrobial activity, essential oil, juniper berries, *aspergillus fumigatus*, deoxypodophyllotoxin, endophytic fungus.

1. Introduction

Herbal medicine the oldest form of medicine known to mankind, is still the most widely practiced form of medicine in the world today. Plants produce many metabolites which constitute an important source of many pharmaceutical drugs. *Juniperus communis* contained monoterpenes, sesquiterpenes, essential and volatile oils, wide range of phenolic compounds and many other chemical constituents. It exerted many pharmacological effects included antimicrobial, antiparasitic, antifertility, antioxidant, cytotoxic, hepatoprotective, vessels and trachea protective effects in passive smoking, gastrointestinal, antidiabetic, antihyperlipidemic, anti - inflammatory, analgesic, diuretic, antiurolithiatic, anti - Parkinsonian, memory enhancing, tyrosinase suppressive activity and many other effects. This review was designed to highlight the chemical constituents and pharmacological effects of *Juniperus communis*.

Plant Name: *Juniperus Communis*.

Synonym: Common juniper, juniper berry, mexican juniper, Drooping juniper, savin, creeping juniper, *Juniperus Sabina*.

Scientific Name: *Juniperus communis*.

Common name: Arabic: ArarAdi; Ararshia, Ararfeniki; English: juniper, common juniper, malchangel; French: genévrier, genièvrecommun; German: gemeineWacholder, HeideWacholder; Hindi: havuber, havubair; Italian: ginepro, gineprocomune; Portuguese: zimbreiro; Spanish: enebro, ginepronano.

Biological Source: *Juniperus communis* is a shrub or small evergreen tree, native to Europe, South Asia, and North America, and belongs to family Cupressaceae. It has been widely used as herbal medicine from ancient time.

Chemical constituents: *Juniperus communis* contained monoterpenes [the highest recorded values were α - pinene, cedrol, carene, α - terpinolen, and terpineol - 4, sesquiterpenes - beta - caryophyllene, deltacadinene, farnesol, gamma - elemente, gammamurolene, humulene

and pregeijerene. Diterpenes - sugiol, xanthoperol, 4 - epi - abietic acid, 4 - epi - dehydroabietic acid, 4 - epi - palustric acid, 4 - epi - abietinal, 4 - epiabietinol, isopimaric acid, isocommunic acid, [-] enttranscommunic acid and sandracopimaric acid. Neolignan glycosides - junipercomnoside A and B and icariside E4. it also contained lignans - podophyllotoxin, tannins, galloocatechins and flavonoids [scutellarein, luteolin - 7 - O - b - Dglucoside, nicotiflorin, kaempferol - 3 - O - β - Dglucoside, Kaempferol - 3 - O - arhamnopyranoside, Quercetin - 3 - a - O - L - rhamnopyranoside, Quercitrin, Isoquercitrin, Quercetin - 3 - O - arabinosyl - glucoside, rutin, quercetin, luteolin, apigenin, amentoflavone, isocutellarein, hypolaetin, kaempferol 3 - O - α - rhamnopyranoside, nicotiflorin and naringenin]. It also contained diterpenoisocupressic acid, the aryltetralinlignandioxypodophyllotoxin, Imbricatolic acid and dihydrobenzofuranlignan glycoside named juniperoside A.

Parts used:

Fruit: Used as antiseptic, stimulant, disinfectant.

Berries: Carminative, urinary antiseptic, diuretic.

Aerial parts: Used for acute and chronic cystitis.

Macroscopy: Fruit sub spherical, purplish - black showing a "bloom" (0.5–1.0 cm in diameter) at the base are six, small, pointed, bracts arranged in 2 whorls, occasionally 3 or 4 whorls present; apex shows triradiate mark and depression indicating the suture; three hard, triangular seeds are embedded in the fleshy mesocarp, having Fruit terebinthine odour and bitter taste.



Microscopy: Seed coat shows 2 - 3 layers of thin - walled cells which are externally covered by a thin cuticle and which are internally followed by thickwalled polygonal sclerenchymatous cells. Endosperm and embryo are not distinct. Outer layer of fruit shows 3 - 4 large cubic or tabular cells having thick, brown porous walls. Sarcocarp consists of large, thin - walled, elliptical, loosely coherent cells, containing prismatic crystals of calcium oxalate and drops of essential oil.

2. Pharmacological uses

Hepatoprotective Activity: The hepatoprotective activity of *J. communis* in rats was determined by given CCl₄ administration for 9 days. In CCl₄ treatment group was showed significant increase in serum glutamic oxaloacetic transaminase (SGOT), serum glutamic pyruvic transaminase (SGPT), total bilirubin (TB) and alkaline phosphatase (ALP) values when compared to control group. There was significant decrease in the level of SGPT, SGOT, TB, and ALP in silymarin treated group. The abnormal high level of SGOT, SGPT, ALP, and bilirubin observed was due to CCl₄ induced hepatotoxicity. *J. communis* reduced the increased levels of serum SGPT, SGOT, ALP, and bilirubin, which showed protection against hepatic cells.

Anti - Inflammatory Activity: Anti - inflammatory activity of *J. communis* fruit has determined using isolated cells and enzymatic test. The plant showed varying degree of activity at 0.2 mg/mL in prostaglandin test and 0.25 mg/mL in platelet activating factor (PAF) test (aqueous extract). *J. communis* showed 55% prostaglandin inhibition and 78% PAF exocytosis inhibition. The PAF activity was measured by inducing exocytosis of elastase. All plant extracts were studied on thin layer chromatography eluted with ethyl acetate/methanol/water.

Antioxidant Activity: Antioxidant activity has reported the in vitro antioxidant activity of plant using different assays like DPPH scavenging, superoxide scavenging, ABTS radical cation scavenging, and hydroxyl radical scavenging. The antioxidant effects of the oil were confirmed by in vivo study and created the possibility of blocking the oxidation processes in yeast cells by increasing the activity of the antioxidant enzymes.

Antidiabetic and Antihyperlipidemic Activity: *J. communis* was reported to have antidiabetic and antihyperlipidemic activity in streptozotocin - (STZ -) nicotinamide induced diabetic rats. *J. communis* (methanolic

extract, 100 mg/kg and 200 mg/kg p. o.) was administered except to the group that received (glibenclamide 10 mg/kg). Biochemical estimation and fasting blood glucose levels were estimated on the 21st day. The methanolic extract of *J. communis* mediated significant () reduction in blood glucose levels and increase in HDL levels in diabetic rats. Glibenclamide (standard drug) showed a significant decrease in the level of SGPT and SGOT. Methanolic extract of *J. communis* showed a significant anti diabetic and antihyperlipidemic activity.

Analgesic Activity: Banerjee and collaborators [11] reported the analgesic activity of *J. communis* using methanolic extract. The methanolic extract was given at a dose of 100 mg/kg and 200 mg/kg and evaluated for its analgesic activity. Acetylsalicylic acid was used as standard (100 mg/kg). *In vivo* the extract was evaluated by different tests like formalin test, acetic acid induced writhing, and tail flick tests. *J. communis* showed a significant () and dose dependent effect on inhibition of writhing response and dose dependent inhibition in the late phase as compared to aspirin (), formalin test. The blocking effect of naloxone (2 mg/kg i. p.) confirms the central analgesic activity. The plant showed significant antinociceptive activity and it has been established that the methanolic extract of *J. communis* acts both peripherally and centrally.

Antibacterial Activity: The leaf extracts (methanol, ethanol, chloroform, and hexane aqueous) of *J. communis* were evaluated against five pathogenic multidrug resistant bacteria (*Erwinia chrysanthemi*, *Escherichia coli*, *Bacillus subtilis*, *Agrobacterium tumefaciens*, and *Xanthomonas phaseoli*), by using disc diffusion method. It has been estimated that all extracts of leaves of *J. communis* were effective against the pathogenic bacteria except aqueous extract. The hexane extract showed more activity as compared to other extracts (hexane > ethanol > methanol > chloroform extract). The methanolic extract of *J. communis* was found to be very effective as compared to standard antibiotics.

Antifungal Activity: The aerial parts of *J. communis* were isolated by hydrodistillation for their essential oil with 0.1 and 0.3% yield. The oils were then tested for their antifungal (*in vitro*) activity against two fungi, *Rhizoctonia solani* and *Rhizopus stolonifer*. The essential oils obtained from *J. communis* showed antifungal activity against both fungi: *J. communis* (EC₅₀: 0.554 and 0.704 mg/mL). The antifungal activity of *J. communis* mainly due to the presence of high content of oxygenated monoterpenes.

Antimalarial Activity: The leaves and twigs (stems) of eight plants were isolated for their essential oil by hydrodistillation method (*Juniperus communis*, *Artemisia vulgaris*, *Myrtus communis*, *Lavandula angustifolia*, *Eucalyptus globulus*, *Rosmarinus officinalis*, *Origanum vulgare*, and *Salvia officinalis*) and were analyzed by GC - FID and GC - MS. The essential oil obtained from these plants was then tested for their antimalarial activity on *Plasmodium falciparum*. There were two strains of *Plasmodium falciparum*: FcBl Columbia and a Nigerian chloroquine - sensitive strain. Two concentrations ranged from 150 µg/mL to 1 mg/mL showed 50% inhibition of the

growth of the parasite (*in vitro*) and the effect was obtained after 24 and 72 h. *Myrtus communis* and *Rosmarinus officinalis* oils at a concentration ranged from 150 to 270 µg/mL showed best result against *Plasmodium falciparum*.

Cytotoxic effect: The cytotoxic activities of the ethyl acetate fractions of *Juniperus communis* leaves were investigated by cell viability assay on HepG2 cells. Results obtained from the WST - 1 proliferation assay clearly showed that EAF did not affect HepG2 cell viability after treatment for 24 h at all concentration tested [0 - 10 µg/ml] [67]. The cytotoxic activity of *J. communis* was screened using MTT [3 - [4, 5 - dimethylthiazol - 2 - yl] - 2, 5 - diphenyl tetrazolium bromide] in vitro assay against three cancer cell lines, human prostate cancer cells [PC3], human colon cancer cells [HCT 116] and breast cancer cells [MCF7]. The highest activity with the safest margin of use was recorded for the total methanolic extract against human breast cancer cell line.

Diuretic and antiurolithiatic effects: A 10% aqueous infusion of juniper, 0.1% aqueous solution of juniper oil [with 0.2% of Tween 20 solubilizer] and 0.01% aqueous solution of terpinen-4-ol were orally administered to rats at 5ml/100g bw to determine the effect on urine output. Compared to water, the 10% aqueous infusion of juniper and the 0.1% aqueous solution of juniper oil caused reductions of only 6% in diuresis over a 24 - hour period, equivalent to the effect of 0.004 IU/100g of ADH, while the 0.01% solution of terpinen-4-ol caused a reduction of 30% in diuresis.

3. Conclusion

Common juniper is well known medicinal plant, but studies regarding its biological activity are predominantly oriented toward essential oil features, especially the oil isolated from berries. This investigation highlighted significant biological activity of juniper methanol extracts, both from leaves and from berries. Furthermore, maturity and sex differences of extracts were noted, where extract obtained from old male plants showed highest biological activity. Results generated from analysis of antioxidant activity correlated with results regarding antimicrobial potential, where detected high flavonoid content in old male leaves showed high antibacterial activity against multi - resistant pathogens. This investigation confirmed previously known medicinal properties of common juniper, but also opened the possibility of wider use of its methanol extracts as natural and safe preparation in treating infection caused by microorganisms.

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