Review Article
A Phytopharmacological Review on a Medicinal Plant: Juniperus communis

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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. Traditionally the plant is being potentially used as antidiarrhoeal, anti-inflammatory, astringent, and antiseptic and in the treatment of various abdominal disorders. The main chemical constituents, which were reported in J.communis L. are α-pinene, β-pinene, apigenin, sabinene, β-sitosterol, campesterol, limonene, cupressuflavone, and many others. This review includes the last 20 years journals and various books update on this plant, representing its pharmacological activity and health benefits against various diseases.

1. Introduction

Plants have been used as primary sources of disease treatments from ancient times and till to date a number of species have been reported to possess various pharmacological activities [1–3]. From ancient time herbs had been used by all cultures of the world including India that has one of the oldest, richest, and most diverse culture [4]. Advances in clinical research and quality control showed a greater value of herbal medicine in the treatment and overcome from many diseases [5]. Juniperus genus is a well-known source of cedarwood oil which is widely distributed in the North hemisphere and it is used in folk medicine [6, 7]. J. communis L. (Figure 1) is a shrub or small evergreen tree belonging to family Cupressaceae. The plant has been reported as diuretic, having anti-inflammatory properties [8, 9], antifungal activity [10], analgesic activity [11], hepatoprotective activity [12], antidiabetic and antihyperlipidemic activity [13], antimicrobial activity [14], antioxidant activity [15], antihypercholesterolemic activity [16], antibacterial activity [17], anticalcetepic activity, and neuroprotective activity in Parkinson’s disease [2, 18]. The analysis of the volatile fraction of J. communis berries was done by HS-SPME coupled to GC/MS for gin aromatization and more than 20 constituents have been reported [19].

2. Synonyms

(i) Sanskrit: Havusa, Matsyagandha
(ii) Assamese: Arar, Abahal, Habbul
(iii) Bengali: Hayusha
(iv) Eng: Juniper Berry, Common Juniper
(v) Gujriati: Palash
(vi) Hindi: Havuber, Havubair
(vii) Kannada: Padma Beeja
(viii) Marathi: Hosh
(ix) Punjabi: Havulber
(x) Telugu: Hapusha
(xi) Urdu: Abhal, Aarar.

3. Scientific Classification

(i) Species: Juniperus communis
(ii) Class: Pinopsida
(iii) Division: Pinophyta
(iv) Order: Pinales
Table 1: Traditional uses of *J. communis* L. plant.

| Part      | Traditional use                                                                 | Reference       |
|-----------|---------------------------------------------------------------------------------|-----------------|
| Berries   | Carminative, urinary antiseptic, diuretic, emmenagogue, sudorific, digestive, and anti-inflammatory. | [7, 13]         |
| Aerial parts | Used for acute and chronic cystitis, albuminuria, catarrh of the bladder, renal suppression, leucorrhoea, and amenorrhoea. |                |
| Fruit     | Used as antiseptic, stimulant, disinfectant, styptic, chronic Bright’s disease, migraine, dropsy, rheumatic and painful swellings, piles, and infantile tuberculosis. | [7, 14]         |
| Bark      | Nephrotic dropsy of children, asthma, gonorrhoea, pulmonary blennorrhoea, arthritis, respiratory affections, diabetes, bladder affections, chronic pyelonephritis, cough, abdominal disorders, and skin affections. |                |

(v) Family: Cupressaceae  
(vi) Genus: *Juniperus*  
(vii) Binomial name: *J. communis* L.

4. Distribution

*J. communis* is found in Himachal Pradesh at an altitude of 3000 m–4200 m. It is mainly distributed in Manimahesh in Chamba, Kullu, Churdhar in Sirmour, Chhota and Bara Bhngal in Kangra, and Kinnaur and Pattan valley in Lahaul-Spiti districts. The plant also grows in Europe south-western Asia, and North America [20].

5. Description

5.1. Macroscopic. Fruit subspherical, 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 terebinthine odour and bitter taste.

5.2. Microscopic. Seed coat shows 2-3 layers of thin-walled cells which are externally covered by a thin cuticle and which are internally followed by thick-walled 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 [21].

6. Traditional Uses

See Table 1.

7. Phytochemical Screening

Dried powder of *J. communis* stems (200 g) was successively extracted with petroleum ether chloroform and ethanol (soxhlet). The marc was obtained which was successively air dried. Water extract was successively obtained by boiling with distilled water (2 h). Than it was filtered, concentrated, and dried in an oven. After that all the extracts were dissolved in their relevant solvents and were screened for phytoconstituents [22] (Table 2).

8. Chemical Constituents

It contains various chemical constituents including flavonoids, volatile oil, and coumarins.

8.1. Flavonoids

8.1.1. Berries. They contain apigenin, rutin, luteolin, quercetin-3-O-arabinosyl-glucoside, quercetin-3-o-rhamnoside quercitrin, scutellarein, nepetin, amentoflavone, and bilobetin [3, 23–27] (Figure 2).
8.1.2. Leaves. They contain the cupressusflavone, hinokiflavone, biflavones, isocryptomerin amentoflavone, and sciadopitysin. The seeds contain haemagglutinin. Plant also contains several labdane diterpenes and diterpenoids (methanolic extract) [28].

8.2. Volatile Oil. The juniper berry oil is largely comprised of monoterpene hydrocarbons such as β-pinene (5.0%), α-pinene (51.4%), sabinene (5.8%), myrcene (8.3%), and limonene (5.1%) [15] (Figure 3). The seeds and fruits of the plant contain d-α-pinene, camphene, pectins, glycolic acid, malic acid, formic acid, acetic acid, cyclohexitol, terpene, proteins, fermentable sugars, wax, gum, ascobic acid, dihydrojumene, β-pinene, hydrocarbon-junene, cadinene, juniper, and camphor [29].

8.3. Coumarins. They contain umbelliferone; see Figure 4 [23].

8.4. Bicyclic Diterpenes. They contain imbricatolic acid, Junicedral, trans-Communac acid, diterpenes, isocupressic acid, aryltetralin, and lignan deoxypodophyllotoxin [6, 29].
new diterpene acids have been identified as 15-dien-18-oic acid, 7-oxo-13-epi-pimara-8, 7α-hydroxysandaracopimaric acid [30–32].

9. Pharmacological Activities

9.1. Hepatoprotective Activity. The hepatoprotective activity of J. communis in rats was determined by given CCl₄ administration for 9 days. In CCl₄ treatment group was shown 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 (ethanol and aqueous extract show better protection) [12].

9.2. 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 [9].

9.3. 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 [15].

9.4. Antidiabetic and Antihyperlipidemic Activity. J. communis was reported to have antidiabetic and antihyperlipidemias 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 (P < 0.01) 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 [13].

9.5. 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 (P < 0.01) and dose dependent effect on inhibition of writhing response and dose dependent inhibition in the late phase as compared to aspirin (P < 0.01), 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 [11].

9.6. Antibacterial Activity. The leaf extracts (methanol, ethanol, chloroform, and hexane aequous) 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 (ampicillin 10 mcg and erythromycin 15 mcg) [17].

9.7. Antimicrobial Activity. The berries of J. communis were reported to have antimicrobial activity and volatile oils were analyzed by GC-FID and GC-MS. Its oil was investigated for its antimicrobial activity and the activity was tested against Escherichia coli, Staphylococcus aureus, Hafnia alvei, and Pseudomonas aeruginos. DMP solution with three different concentrations of essential oil (1, 3, and 5 mg/mL) was prepared which were applied on disc for the measurement of the diameter of the zone of inhibition around the disc. The chromatographic analysis of the essential oil of J. communis allowed identifying 41 components which represent 96% of the oil total composition (Table 3). The main chemical constituents in J. communis were α-cadinol (1.6%), α-pinene (36.2%), β-myrcene (21.1%), α-humulene (1.5%), epi-α-bisabolol (1.3%), germacre D (2.2%), spathulenol (1.4%), and germacre B (1.1%). The present study shows the chemical composition of J. communis from east part of Kosovo. J. communis was active against Escherichia coli, Staphylococcus aureus, and Hafnia alvei except Pseudomonas aeruginos which is resistant to J. communis [14].

9.8. 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 is mainly due to the presence of high content of oxygenated monoterpenes [8].
was administered by a gavage needle (dissolved in 0.5% addition to the 2% cholesterol-containing pellet chow. JCL J. communis chow containing 2% of cholesterol, and the third group is cholesterol group which was fed with pellet which the animal was fed with normal pellet chow. The animals were divided into 5 groups; first group is control group in which the animal was fed with normal pellet chow. The rats on kidney tissue were evaluated. Healthy Wistar albino rats of 200–250 gm in weight were used for this study. The rats were fed with 50, 100, and 200mg/kg J. communis for its antihypercholesterolemic activity. 

The biochemical parameters and the histopathologic effects of the animal were evaluated. The 200mg/kg JCL group showed a significant increase in blood urea nitrogen (BUN) and creatinine levels. The cholesterol group showed a significant increase in Ox-LDL levels. When the cholesterol was given along with 200 mg/kg J. communis then there was no significant increase in the level of Ox-LDL. So the study showed its antihypercholesterolemic effect [16].

9.11. Anticataleptic Activity. Anticataleptic study was carried out to evaluate the effects of methanolic extract of J. communis (MEJC) leaf in reserpine induced catalepsy in rats. Catalepsy was induced by intraperitoneal (i.p.) administration of reserpine (2.5mg/kg, i.p.). The methanolic extract at 100 and 200mg/kg (i.p.) was screened for its efficacy against reserpine induced catalepsy in rats. The MEJC extract was found to reduce catalepsy significantly (P < 0.001) as compared to the reserpine treated rats; maximum reduction was observed at a dose of 200 mg/kg [18].

9.12. Neuroprotective Activity. Neuroprotective activity of J. communis (MEJC) was evaluated in chlorpromazine (CPZ) induced Parkinson’s model in rats. The two doses (100 and 200mg/kg, i.p.) have been selected on the basis of lethal dose (LD₅₀) in mice. The plant was evaluated for various behavior parameters like catalepsy (bar test), muscle rigidity (rot rod test), and locomotor activity (actophotometer) and its effect on biochemical parameters (TBARS, GSH, nitrite, and total protein) in rats brain. J. communis showed a significant (P < 0.001) neuroprotective effect of MEJC against CPZ induced Parkinson’s like symptoms or anti-Parkinson’s activity [2].

10. Conclusion

The extensive literature survey revealed that J. communis L. is an important medicinal plant due to its traditional uses to treat diseases and presence of many active chemical constituents which are responsible for various medicinal and pharmacological properties. Further evaluation needs to be carried out on J. communis L. in order to confirm its medicinal uses and development of formulations containing this plant for their practical clinical applications, which can be used for the welfare of mankind.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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