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CARUM CARVI A SALIENT AESCULAPIAN PLANT

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Abstract: Caraway oil is the essential oil obtained by steam distillation of the dried, ripe fruit of Carum carvi, one of the earliest cultivated herbs in Asia, Africa and Europe. It is commonly known as Caraway which is grown for its high content of essential oil present mainly in seeds. Caraway is normally a biennial much-branched herb, 30-80cm in height, with narrow finely grooved leafy stems. It produces a deep taproot and a rosette of dark green, finely cut, feathery leaves in the establishment year. Caraway is found in Europe, Siberia, the Caucasus, the near East, the Himalayas, Mongolia and Morocco The flowers are produced on umbels, are white and 2-3 mm across, the outer ones larger than the inner ones. They open from late April onwards and are succeeded by fruits which are 3-6 mm long, and light brown, ripening from early July. The major chemical constituents of Caraway are carvacrol, carvone, α-pinene, limonene, γ-terpinene, linalool, carvenone, and p-cymene. The flavonoid constituents of caraway includes quercetin-3-glucuronides, isoquercitrin, quercetin 3-0 caffeylglucoside, and kaempferol 3-glucoside. It was used in folk medicine for the treatment of many complaints. The previous studies showed that the plant contained many bioactive metabolites and exerted antimicrobial, anticancer, antioxidant, hypolipidemic, antidiabetic, analgesic, diuretic, gastrointestinal, bronchial relaxant effects and many other pharmacological activities.

Keywords: Caraway, Phytochemical constituents, Carvone, Pharmacological Activities.

Introduction

Ayurveda is an ancient Indian therapeutic system, which is based on the curative and prophylactive properties of plants and plant derived products. A very large number of medicinal herbs of various taxonomic genera are included in many forms in this traditional therapy, which are also relied upon in other indigenous systems of medicine practiced in South east Asia, such as Siddha and Unani systems. *Carum carvi*, belonging to the family Apiaceae [1] and according to recent articles Carum carvi belongs to the family Umbelliferae [2], is one of the earliest cultivated herbs in Asia, Africa and Europe [1]. Traditionally the dried ripe fruits and leaves of the plant are used in folk medicine especially in the treatment of digestive disorders. The *Carum carvi* has also been a mentioned vegetable in the preparation of soups, salads and sauces [3]. This oldest herb is full of specific pleasant aroma because of its aromatic properties, it is used as a flavorant in ice cream, candy, meat, cheese, condiments, soft drinks, alcoholic beverages and further used in liqueurs, mouthwashes, toothpastes, perfumes, soaps and cosmetics [2].

Scientific Classification [4] [5]

Kingdom: Plantae

Subkingdom: Tracheobionta

Super division: Spermatophyta

Division: Magnoliophyta

Class: Magnoliopsida

Subclass: Rosidae

Order: Apiales

Family: Apiaceae

Genus: Carum

Species: Carvi Linn

Carum carvi plant with flowers | Carum carvi leaves

Figure no. 1

Vernacular Names [5] [6]

English: Black Caraway, Caraway

Hindi: Kalajira, Shahjira

Sanskrit: Asitajiraka, Krishna jeeraka

Tamil: Karamjiragam, Shimaishambu

Telugu: Nalla Jeelakarra

Unani: Zeeraa Siyaah, Kamoon, Kamoon-roomi

Urdu: Kala Zira and Karo Jeero, Zira Siyah

Biological Source

Dried ripe fruits of *Carum carvi* Linn. It contains not less than 2.5% volatile oil [7].

Geographical Source

Figure no. 2

It is indigenous to Holland and Central Europe. It is cultivated in Central Asia, Europe and many other countries. In India, it is found wild in north Himalayan region, and is cultivated in Kashmir, Kumaon, Garhwal and Chamba, at an altitude of 3000 to 4000 metres [8].

Plant description

Carum carvi is the Biennial herb & multi branched [9]. Average height of herbs is 30 to 70 cm. It possess a deep tap root. It has a high vernalization requirement to flowering stems in the second year. Flowers are produced on Umbels. They are white & 2-3 mm across the outer ones longer than inner ones. Flowers open in April onwards & are succeeded by fruits which are 3-6 mm long. Fruit ripening from Early June & July [10]

Organoleptic characters:

Colour : Brown

Odour : Aromatic and characteristic

Taste : Hot, aromatic, spicy and characteristic

Extra features :

Cremocarp or mericarps, five primary ridges in each mericarp, curved smooth muscle shape and orthospermous seeds.

Macroscopy

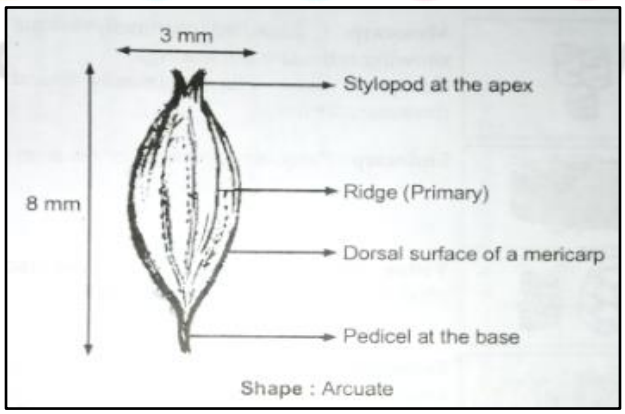

Figure.no. 3

Microscopy [7]

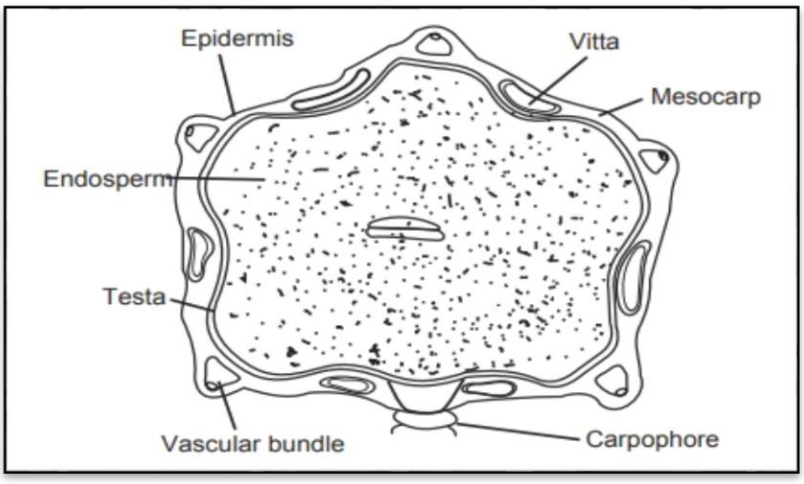

Figure.no.4

Cultivation & Collection [8]

Caraway is grown in dry & temperate climate. The dried seeds or sown by broadcasting method in rows. It needs Humus soil. The fruits are collected before ripening. The entire plants are dried & fruits are threshead. The yield is average 0.5 tonns per hectare.

Chemical composition

The main components of cumin are carvacrol, carvone, α-pinene, limonene, γ-terpinene, linalool, carvenone and p-cymene, while the main components of cumin are cuminaldehyde, limonene, α- and β-. Pinene, 1,8-cineole, o- and p-cymene, α- and γ-terpinene, safranal and linalool. Various flavonoids, isoflavonoids, flavonoid glycosides, monoterpenoid glycosides, lignins and alkaloids and other phenolic compounds have been found in aqueous and solvent-derived seed extracts. Cumin root has also been found to contain flavonoids. Of polyacetylene compounds. In a recent study, a non-specific lipid transfer protein was isolated from caraway seeds [11].

Several nutrients (vitamins, amino acids, proteins and minerals), starch, sugars and other carbohydrates, tannins, phytic acid and dietary fiber components have also been found in cumin seeds. A flavouring substance, a glucoside and a carbohydrate were isolated from the water-soluble part of the methanolic caraway extract (Carum carvi L.). Their structures were elucidated as 2-methoxy-2-(4'-hydroxyphenyl) ethanol, junipediol-A-2-O-beta-D-glucopyranoside, and L-fucitol. The flavonoid components of caraway seeds included quercetin-3-glucuronides, isoquercitrin, quercetin-3-0-caffeylglucoside and kaempferol-3-glucoside [11].

Caraway (Carum carvi L.) seeds essential oil components.

Compound	%
α-Pinene	0.3
Camphene	0.2
β-Pinene	0.1
β-Myrcene	0.1
Limonene	5.1
γ –Terpinene	12.6
β-Ocimene	0.1
p-Cymene	0.1
Terpinolene	0.1
limonene oxide	0.1
Camphor	0.2
Linalool	0.7
Linalyl acetate	0.3
Terpinene-4-ol	0.1
β-Caryophyllene	0.2
Dihydrocarvone	0.1
α-Terpineol	0.1
Germacrene-D	0.3
Carvone	70.1
β- Selinene	0.2
α- Farnesene	0.4
Citronellol	0.1
δ- Cadinene	0.3
γ –Cadinene	0.5
Cuminaldhyde	0.1
Nerol	0.2
Trans-carveol	0.1
Nonadecane	0.1
Spathulenol	0.3
Eugenol	0.2
Thymol	0.5
Carvacrol	0.2
Total	94.1

Table.no. 1

Biological and Pharmacological activities

Anti-Diabetic Activity

Carum carvi seed ethanol extract (0.2, 0.4 & 0.6g/kg i.p.) was tested on streptozotocin (70 mg/kg i.p.) diabetic rats. Plant seeds significantly reduce serum elevated glucose and plasma insulin levels in diabetic rats, but not healthy rats[18]. Aqueous extract of Carum carvi seed increases body weight Blood sugar. STZ (60 mg/kg)-induced diabetic rats were given aqueous extract of Carum carvi seed (1 g/kg; p.o.) for 21 days. It shows a significant reduction in blood increased glucose levels and weight compared to diabetic rats[19]. Administered caraway oil (5, 10, 20 mg/kg p.o.) in Streptozotocin-induced diabetic rats for 30 days. At the end of treatment, rats showed a significant reduction in blood glucose levels. The average weight of rats treated with caraway oil was compared to diabetic rats. Besides Elevated MDA levels were significantly reduced in rats treated with caraway oil compared to diabetic rats ($p<0.05$) and found significant induction of GSH-Px levels[20].

Antioxidant Activity

Caraway products (aqueous and solvent derived extracts) have proven full-size antioxidant interest in numerous check methods. Phenolic extract of caraway seeds has proven 50% DPPH scavenging interest at 2.7 mg/ml, the extract became additionally determined to scavenge superoxide anion radicals with an IC50 cost of 35 mg/ml. Further, Carum carvi phenolic extract successfully inhibited the increase of Gram +ve micro organism compared to Gram –ve micro organism envisioned through Foline Ciocalteau method[13,14,15] . A caraway fruit aqueous extract has additionally proven 50% scavenging of superoxide radicals at one zero five µg, 50% inhibition of lipid peroxide at 2100 µg. The amount wished for 50% inhibition of hydroxyl radicals became 1150 µg investigated in assessment with the regarded antioxidant ascorbic acid in in vitro studies[16] .The antiradical profile of caraway has been proposed because the underlying mechanism for his or her multifaceted pharmacological homes which

includes antimicrobial, antidiabetic, anticarcinogenic/antimutagenic, antistress, antiulcerogenic, etc. as mentioned with inside the succeeding sections.

Hepatoprotective Activity

Evaluate oral administration of 50% ethanolic extract of Carum carvi in paracetamol-induced liver damage. 50% ethanolic (aqueous-alcoholic) extract of Carum carvi (100, 200, and 400 mg/kg p.o.) once a day for 9 days, followed by a single dose of acetaminophen 3 g/kg p.o. on day 8 only.

Silymarin was 50 mg/kg p.o. in gum arabic (0.2%, w/v) as a reference standard. Carum carvi 50% ethanol extracts significantly reversed the elevated levels of SGOT, SGPT, ALP, bilirubin, triglycerides and lipid peroxidation and significantly increased the reduced levels of GSH and albumin.

To evaluate oral administration of 50% ethanolic extract of Carum carvi in thioacetamide-induced liver injury. The rats were treated with 50% ethanolic extract of Carum carvi for 8 days, followed by a single subcutaneous injection of thioacetamide (100 mg/kg in olive oil, 1:1) on the sixth day. Silymarin was 50 mg/kg p.o. in acacia gum (0,2% w/v) as reference standard. Pretreatment with 50% ethanolic carum carvi extract demonstrated inhibition of thioacetamide-induced hepatotoxicity, resulting in significant restoration of SGOT, SGPT, ALP, bilirubin, triglycerides, lipid peroxidation, GSH, and albumin levels.[17]

Antiulcerenogic Activity

On the basis of gastric emptying in fasted rats, animals were pretreated (30 min before the necrotizing agents) with aqueous extract of Carum carvi(250 and 500 mg/kg p.o.).then Ulcer was induced by 1ml of different necrotizing agent which contains 80% ethanol, 0.2MNaOH and 25% of NaCl. Gastric mucosal was measured according to the method of Sedlak and Lindsay (1968) to analyze the oxidant/antioxidant balance and Histopathology of gastric tissue was done. The decrease of gastric mucosa was significantly ($p<0.05$) replenished with the pretreatment of aqueous extract of Carum carvi at the high dose (500 mg/kg, body weight) as compared to the Ethanol (80%) induced there is decrease in gastric mucosal in the gastric tissue. Pretreatment of Carum carvi (500 mg/kg, body weight) in gastric emptying in fasted rats, animal was also found to completely protective from the different histopathological changes like hemorrhage, inflammatory, erosions and ulceration which can cause in the gastric mucosa of ethanol treated rats. In the study it was investigated whether the essential oil prepared from carum carvi seeds exhibit antiulcerogrnic activity or not.

The volatile oil of carcum carvi seeds was obtained by supercritical fluid extraction and by hydrodistillation. The analysis revealed that the essential oil which were extracted under supercritical fluid extraction (SFE) condition contain high Carbon and limonene contents.

The antiulcerogenic activity was found by the HCl/ethanol method and in which this causes injury to the gastric mucosa. Three treated groups which received the essential oil that is 100–300 mg/KG and the reference group received omeprazole is 30 mg/kg and the control group received NaCl. After 30 min, all the three groups were treated with HCl/EtOH for gastric ulcer induction. The results showed C. carvi, an essential oil, enhanced a significant inhibition of 47%, 81% and 88%, respectively, for three doses of essential oil used, which was similar to that induced by omeprazole (95%) ($p < 0.005$)[17][18].

Antimicrobial activity

Carum carvi seeds were collected, then dried and crushed. Grinned then the Grinned material is soaked in distilled water and this water mixture was placed in clevenger type apparatus. By using clevenger type apparatus the material get hydrodistilled and then the essential oil obtained from this Carum carvi was used for antibacterial activity test against 10 potential pathogenic bacteria.

The 10 potential pathogenic bacterias are Baccillus subtilis, B. cereus, Escherichia coli, Pseudmonos aeruginosa, Shigella dysenteriae, S. sonnei, Salmonella typhi, S. paratyphi, Staphylococcus aureus and Vibrio cholera and the six phytopathogenic fungi- Alternaria alternate kedissler, botryodiplodia Theobromae pat, Colletotrichum corchorikata, Curvularia lunata (wakker) boedijin, Fusarium equiseti (corda) saccc and Macrophomina phaseolina (maubl) Ashby.

The minimum inhibitory concentration (MIC), minimum bactericidal concentration (Yoshida MBC) and minimum fungicidal concentration (MFC) values of essential oil against 10 test bacteria and fungi were determined by micro and macro dilution broth techniques using mueller-hinton medium and sabouagar medium respectively[20].

Insecticidal Activity

Carum carvi fruit essential oil has strong contact toxicity against adults of Sitophilus zeamais and Tribolium castaneum with LD50 values of 3.07 and 3.29 µg/adult, respectively. Carum carvi fruit essential oil was also a potent fumigant against S. zeamais and T. castaneum adults with LC50 values of 3.37 and 2.53 mg/l, respectively. Carum carvi essential oil showed strong contact gas toxicity and repellency against several insects and mites[21].

Analgesic Activity

Analgesic effect of aqueous and 80% ethanol extract of Carum carvi. (100 and 200 mg/kg p.o.) were tested in rats using the hot water tail immersion method (55 ◦C). Carvi extract and the time taken to withdraw the tail from hot water (seconds) was recorded as tail flick tatency. Baseline was taken immediately before test and standard drug administration, and then at 15, 30, 5, 60, and 75 minutes after administration. Carvin aqueous and alcoholic extract (200 mg/kg p.o.) significantly increased (pandlt; 0.01) the tail-flick latency of after 5 min compared to control and standard [19]

Diuretic Activity

Urinary sodium and potassium concentrations were measured in each urine sample. On day 8, plasma sodium, potassium and creatinine levels were measured in rats. In urinary creatinine excretion was also determined and its elimination was calculated on day 8.Rats were observed daily for over toxicity. Single doses of Carum carvi extract (100 mg/kg body weight) showed a significant increase in diuresis (12.8 ± 0.1 ml) compared to control (7.7 ± 0.7 ml) and significantly increased urinary electrolyte excretion Na (138 ± 1.5 mmol/L) and K (75.0 ± 2.0 mmol/L) compared to the control group (89.7 ± 1.8 mmol/L and 62.9 ± 1.1 mmol/L).[25]

Renoprotective Activity

Diabetic nephropathy was induced by a single injection of standard STZ (60 mg/kg i.p.) after 1weeks of Carum carvi seed aqueous extract (30 and 60 mg/kg p.o.) for 60 days. Added serum glucose, urea, creatinine microalbuminuria, and urinary excretion levels were significantly (pandlt; 0.05) reduced by Carum carvi seed aqueous extract (30 and 60 mg/kg p.o.).

High dose of Carum carvi seed aqueous extract (60 mg/kg p.o.) showed anti-STZ-induced diabetic nephropathy in rats.

The renoprotective effect of Carum carvi essential oil (10 mg/kg p.o.) was investigated in experimentally induced diabetic nephropathy in rats.

Diabetic nephropathy was induced by subcutaneous injection of STZ (60 mg/kg). Carum carvi essential oil (10 mg/kg) orally for 21 days.

Animals were then tested for serum glucose and glutathione peroxidase levels. Elevated blood glucose levels of were significantly reduced (pandlt; 0.05) by treatment of with Carum carvin essential oil (10 mg/kg) and significantly induced a decrease in GSH levels.[27]

Molluscidial Activity

Carum carvi seed powder was extracted with 95% ethanol, 98% ether, 99.7% chloroform, and 98% Eton at room temperature for 2hours (maceration process). The solvent was removed under vacuum and the remaining dry portion was used to determine molluscicidal activity: Carum 95% ethanol - 385 mg, 99.7% chloroform - 370 mg, 98% ether - 05 mg, and 98 Eton - 370 mg. Toxicity experiments were performed according to the procedure[27]. Six tanks were set up for each plant-based molluscicide concentration. Ten experimental animals: Adult Lymnaea acuminata (2.25 ± 0.20 cm long) were housed in each glass aquarium containing 3 liters of dechlorinated tap water. Snails are exposed to different concentrations and C preparations. Carvi and mortality were observed at 2,872, and 96 hours.Control animals were housed in an equal volume of dechlorinated water under similar conditions without treatment. Snail mortality was determined by body contraction within the shell. There was no response to the needle probe as evidence of snail death. Toxicity of C. carvi seed powder and its organic solvent extract fraction to L. Condyloma acuminatum was time and concentration dependent. The LC50 for C. carvi seed powder was 269.96 mg/l after 2 hours and 10.58 mg/l after 96 hours. Ethanol extracts were more toxic than other organic extracts.LC50 of ethanol extracts of C. carvi was 130.61 mg/l after 2 hours and 58.98 mg/l after 50 hours after 96 when the test animals were sacrificed. There were no deaths in control animals up to 96 hours of exposure[28].

Endocrine Activity

Effect of aqueous and ethanolic extracts from seeds of Carum carvi. (150, 200, 250, and 300 mg/kg, p.o.) were evaluated for hormonal and reproductive parameters in female rats. Ethanol and aqueous extracts of seeds (150, 200, 250, and 300 mg/kg p.o.) were orally administered to female rats for her 30 consecutive days to demonstrate effects on ovarian endocrine. H. FSH, LH amount. The gonadotropins follicle-stimulating hormone (FSH) and luteinizing hormone (LH) were measured 2 hours after the last dose of drug. FSH and LH levels decreased significantly (pandlt;0.05) when treated with drugs, and estrogen levels increased only when treated with ethanolic extracts of drugs. Oestrus was blocked by treatment with both extracts. The drug also increased ovaries, uterus, and body weight, but uterine weight was increased in immature rats. Potential effects of cumin on hormones and reproduction.[29]

Anti-cholinesterase Activity

Cholinesterase (ChE) plays a role in terminating nerve impulse transmission at cholinergic synapses by rapid hydrolysis of acetylcholine (ACh). Carum carvi fruit extract potently inhibited AChE (.7 ± 1.23 etherine µmol dm-3, ~73%) and BChE (butyrylcholinesterase) (6.65 ± 0.87 etherine µmol dm-3, 77%) . This result supports that carumalbi fruit extract is a potential inhibitor of cholinesterase (ChE), which may restore cognitive function and improve memory.parameters were demonstrated possibly due to the presence of estrogenic isoflavonoids, luteolin and apigenin[30].

Antihyperlipidemic activity

The antihyperlipidemic effect of an aqueous extract of Carum carvi seeds (60 mg/kg p.o.) on diet-induced hyperlipidemia in rats was investigated. Hyperlipidemia was induced by feeding a 2% cholesterol diet for 6 weeks. After 6 weeks the lipid profile was determined and hyperlipidemic rats were included for further study. Rats were treated with standard drugs, an aqueous extract of Carum carviseds (60 mg/kg po) for 8 weeks and simvastatin (1 mg/kg po) for 8 weeks. Aqueous extract of Carumcarviseeds (60 mg/kg po) significantly (pandlt; 0.01) decreased cholesterol, triglycerides, and LDL levels and significantly (pandlt; 0.01) elevated HDL levels in compared with the control group. Compare. Carmcarbide is more effective than simvastatin in lowering lipid profiles[31].

Contradication and Precaution

It is not recommended to use a medicine containing cumin oil on broken skin, around the eyes or mucous membrane, and in patients with liver disease, achlorhydria, cholangitis, gallstones, and other diseases of the biliary tract [32]. Due to insufficient data, the use of cumin or cumin oil during pregnancy and breastfeeding is not recommended. There is caution against its use in patients with biliary obstruction, liver disease, cholangitis, liver stones, or other biliary diseases, as caraway has a complete inhibitory effect on liver emptying in healthy individuals [33]. It has been reported to be associated with kidney inflammation, and long-term overdose of cumin oil can cause kidney and liver damage[34].

Daily dose

For adults and the elderly, 0.15-0.3 ml of essential oil in three daily doses is recommended. Oral use of cumin essential oil is not recommended for children and adolescents under 18 years of age, during breastfeeding and pregnancy. Semi-solid preparations of caraway oil in a concentration of 2 n daily are used as a thin layer on the abdominal area of children, children, adolescents, adults and the elderly [89]. Cumin seeds (1.5-6 g) or its essential oil (0.15-0.3 ml) are described as indigestion, gastrointestinal discomfort, bloating, gas and bloating. 0.3 ml of oil corresponds to 273 mg of caraway oil (density 0.91 g/ml). Aqueous or ethanolic extracts showed estrogenic effects at doses above 200 mg/kg.

Toxicity

The acute oral and dermal LD50s for caraway oil in rats and rabbits were 3.5 and 1.78 ml/kg, respectively. Pure caraway oil did not irritate the backs of hairless mice. Raway oil in petroleum jelly he applied to 25 volunteers showed no irritation or sensitization effects in a 8 hour closed patch test[35]. The ESCOP monograph shows acute oral LD 50s of 3.5 and 7.5 ml/kg for caraway oil in rats from two different studies. The acute dermal LD50 for caraway oil in rabbits was 1.8 ml/kg. The intraperitoneal and intravenous LD50s of d-carvone in mice were 82.2 and 1500 mg/kg, and the oral LD50s of d-carvone in rats and guinea pigs were 160 and 766 mg/kg. The ADI (Acceptable Daily Intake) for d-carvone ranged from 0 to 1 mg/kg/day[33]. randomized, triple-blind, placebo-controlled studies evaluated the safety of cumin aqueous extract in 35 overweight and obese healthy women

compared to placebo. Patients took her 30 mL of cumin water or placebo (diluted cumin essential oil) for her 12 weeks, and general health status, urinalysis, blood pressure, heart rate, and blood chemistry were assessed. No adverse events were reported after 12 weeks of treatment. Heart rate, liver and kidney function were unaffected by the intervention. A significant difference in the distribution width of erythrocytes and platelets was observed between the two groups. A significant increase in red blood cells and a significant decrease in the breadth of platelet distribution were observed with cumin water, suggesting a possible beneficial effect of aqueous cumin seed extract for the treatment of anemia associated with decreased platelet distribution[36]. Cumin is well tolerated at therapeutic doses and has shown no toxic effects in humans[37]. Acute toxicity of cumin showed that the maximum non-lethal dose for cumin essential oil and water extract was 400 and 3200 mg/kg, respectively[38]. The established ADI for d-carvone is 0.6 mg/kg body weight/day[39].

Conclusion:

Caraway (C. Carvi) seeds are rich source of essential or aromatic oils containing diverse group of phytoconstituents. It has a wide spectrum of pharmacological effect in treatment of traditional healing systems worldwide. A natural product used in conventional treatment provides intimation for the existence of phytochemical constituents. The present review co-operate the step in that direction or motivate to open a new insight for therapeutic efficacy of this marvelous plant.

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