



Review Article

Izkhir (Lemongrass): an overview of scientific basis of its pharmacological activity.



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ARTICLE INFO	ABSTRACT
<p>Article History Received : 05-Nov-2022 Revised : 25-Nov-2022 Accepted : 28-Dec-2022</p> <p>Key words Izkhir, Lemongrass, Cymbopogon, Unani, Pharmacological activities.</p> <p>NonCommercial-ShareAlike 4.0 International License (CC BY-NC-SA)</p>	<p>Nature has numerous resources which are used for their valuable medicinal properties. These resources are mostly from plant origin, which are used for multiple purpose from time when early man existed. These natural resources are not only used for medicinal efficacy but also for clothing, fooding and many more things around the world. One among those is Izkhir (Lemongrass), mentioned in various classical Unani texts like Al-Qanoon Fit-Tibb, Zakhira Khawarzam Shahi, etc. for its wide range of benefits, like fragrances, perfumes, cosmetics, detergent, soaps, flavour and also in pharmaceuticals. This review paper on lemongrass is customised to concise its role on various pharmacological activities and other chemical uses in balancing the growing population's needs.</p>
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INTRODUCTION

The In the Unani system of medicine, the origin of medicines is broadly divided into three groups such as Nabati Advia (plant origin), Haiwani Advia (animal origin), and Madini Advia (mineral origin). There are abundant varieties of medicinal species of plant origin that are mentioned in classical Unani texts and are followed since a coon's age for their effective properties in preventive as well as curative medicine. One among those drugs is Izkhir (Lemongrass) which is said to have various functions in treating many diseases.

Morphological Characteristics of Izkhir

There are various species of Izkhir or Lemongrass that are now known and they can be compared with the morphological characteristics of *Cymbopogon jawarancusa*, *Cymbopogon citratus*, *Cymbopogon nardus*, *Cymbopogon martini*, *Cymbopogon flexuosus*, *Cymbopogon westratus*, *Cymbopogon winterianus*, and *Cymbopogon schoenanthus* etc.

Ibne Sina mentioned in his book Al-Qanoon Fit-Tibb, that Izkhir is of two types. The first type is one which has a unique smell with roots comparatively thick and firm. The second variety is odorless and its roots are thin in nature. Commonly the first variety

mentioned by Ibne- Sina is used for its medicinal purpose [1].

Cymbopogon citratus is commonly known as lemongrass which belongs to the Graminae (Poaceae) family and counts more than 635 genera and 9000 species. *Cymbopogon* is a genus of about 55 species, which are indigenous in tropical and semi-tropical areas of Asia and are cultivated in South and Central America, Africa, and other tropical countries. It is a tropical perennial grass cultivated in tropical regions. It is usually 1.5 -2 m high, with aromatic roots, densely tufted. The stems are firm and persistent. Open leaf sheaths, more or less widened below. Leaves are flat up to 60 cm long and 5mm broad. Panicles long, with very compressed, short, fascicled branches, bearing spathes about 5 cm long and spatheoles 6-18 mm long. Racemes 1.4-1.8 cm long, often 5 jointed. Spikelets 3-4 pairs partially hidden by villi on the joints and pedicles. Sessile spikelets 5 mm long, lower involucral glume flat or concave between the knees, nerves 2-4 or 0 between the knees [5]. The lemongrass plants we encounter typically do not produce flowers or flowering panicles are rarely formed. [6]

The annual world production of lemongrass oil is around 1000 t from an area of 16000 ha. First harvesting is done from the newly established plantation for 4-5 months of the plantation after that crop harvesting is done at the interval of 3-4 months. Thus a minimum of 3 and a maximum of 4 harvests are taken in a year. [7]

Temperament of Izkhir

Haar (Hot) 20 & Yabis (Dry) 20 [1] [8] [9].

Medicinal Actions of Izkhir

In Unani classical literature, actions of Izkhir are mentioned as Muhallil (Anti-inflammatory) [1], Munzij (Concoctive) [1] [8], Mulaiyin (Demulcent) [1] [8], Mufatteh (Deobstruent) [1] [8], Musakkin-e-Alam (Analgesic) [1] [8], Kasir-e-Riyah (Carminative) [1] [8], Muqawwi-e-Meda (Gastric tonic) [8], Mushahhi-e-ta'am (Appetizer) [1], Mudirr-e-Haiz (Emmenagogue) [1] [8], Mudirr-e-Baul (Diuretic) [1] [8] [9], Mufattit-e-Hasaat (Lithotriptic) [1] [8], Qabiz (Astringent) [1] [8].

Uses of Izkhir

According to Unani physicians, Izkhir can be used as a healing agent in many diseases such as Nazf-ud-Dam (Haemorrhage) [8], Qurooh (Ulcers) [8], Awram-o-Busoor (Inflammations and Eruptions) [8],

Waja-ul-Mafasil (Arthritis) [8], Nafs-ud-Dam (Haemoptysis) [1] [8], Matli (Nausea) [1], Waram-e-Medah (Gastritis) [1][9], Waram-e-Jigar (Hepatitis) [1] [9], Waram-e-Raham (Metritis) [1], Dard-e-Gurda (Renal pain) [8], Istisqa (Ascites) [1], Awram-e-Maq'ad (Proctitis) [1], Tashannuj-e-Imtilae (Repletive spasm) [1] [8].

Chemical Constituents

The *Cymbopogon* genus is known for its essential oils and has been used for flavor, fragrances, cosmetics, perfumery, soaps, detergents, and pharmaceuticals for decades.

There are multiple studies that reported that numerous chemical constituents are present in lemongrass like Citral, Linalool, Geraniol, Citronellol, Nerol, Citronellal, Linalyl acetate, Geranyl acetate, Limonene, Caryophyllene, Myrcene, Terpenolene, Methyl heptanone, α -Pinene, α -terpineol, β -Ocimene, β -pinene, β -thujene, Nonan-4-ol, Camphene, 6-metil-hept-5-en-2-one, γ -muurolene [10] [11]. A study reported that Citral, Geraniol, Neral, and Myrcene are significant constituents of lemongrass [12].

Pharmacological Activities

Anti-Inflammatory Effect

A study by Onyedikachi, et al., reported that the essential oil of *Cymbopogon citratus* possess anti-inflammatory and antioxidant properties in vitro by the highly significant percentage inhibition of hemolysis of human red blood cell membrane. Total flavonoid and phenol contents were the possible reason for DPPH and FRAP oxidation [13].

A study, carried out by Talaei, et al., suggested that *C. schoenanthus* had an adequate anti-inflammatory effect in the first two hours of the carrageenan test. However, analgesic properties at the dose level of 50, 100, and 200mg/kg didn't have any positive effect. Thus, stated that the essential oils of *C. schoenanthus* do not possess any anti-nociceptive effect regardless it showed significant effects as an anti-inflammatory agent [14].

Anti-Fungal Effect

Sahal et al. evaluated that the biofilm coating of *Candida tropicalis* strains was formed using equilibrium contact angles of ultra-pure water with a sessile drop on different hydrophobic materials like polytetrafluoroethylene, silicone rubber, and hydrophilic material like glass. The application of

lemongrass oil showed a significantly decreased in the growth of *Candida tropicalis* and biofilm formation on different materials. Thus, the study showed its antifungal activity [16].

Antioxidant Effect

A study disclosed that the essential oil which was distilled by steam water distillation method of lemongrass stalk have antioxidant activity up to 72.724% inhibition which is higher when compared to the water distillation method. In the whole plant of lemongrass, the highest antioxidant activity was noted by water distillation which yielded 70.113 % inhibition [17].

In another study, the essential oil from *C. citratus* was extracted using steam distillation by Karlsruhe steam distillation method. The researchers observed, using antioxidant activity assay by DPPH method, that the essential oil of lemongrass possessed antioxidant activity against DPPH which was comparatively lower than ascorbic acid [18].

Neurobehavioral Effect

In a neurobehavioral study, experimental animals were exposed to Social Defeat Stress (SDS) which was accomplished using the resident intruder model. The groups were then treated with an aqueous extract of leaves of *C. citratus* at 50, 100, and 200mg/kg body weight for 14 days. The light-dark box test was used to analyze the effect of *C. citratus*, which was found that at the dose of 100 and 200mg/kg body weight, the treated group showed improvement in anxiety-like behavioral changes. The experimental animals exposed to extract not only impaired the effect of SDS on memory performance in Y-maze test but also reduced the oxidative stress in the brain of mice which was significantly evaluated with an increase in GSH and reduced MDA level. Thus, stating that *C. citratus* can be used in treating neuropsychiatric disorders [19].

Antidepressant Effect

The antidepressant effect of *C. citratus* was evaluated in albino mice. The test groups of mice were treated with 5mg/kg aqueous extract of lemongrass orally. Later after one hour, the tail suspension test, which is widely used to test anti-depressant activity, was performed and observed for a period of immobility. The aqueous extract of lemongrass at 10 mg/kg body weight, given orally for 15 days, showed a more significant decrease in the immobility period when compared to the standard drug imipramine.

However, the results were synergistic when lemongrass extract was given in combination with imipramine. Hence, proving that an aqueous extract of lemongrass acted as an anti-depressant drug when used individually [19].

Antiparkinsonian Effect

To assess the anti-parkinsonism effect in a study, Sprague Dawley rats were injected with reserpine 5mg/kg body weight intraperitoneally for 5 days and haloperidol 1mg/kg body weight intraperitoneally for inducing Parkinson's symptoms. The ethanolic extract of leaves of *C. citratus* was administered at the dose of 100, 200, and 400mg/kg body weight orally. Also, results were compared with L-dopa and carbidopa-treated group which was considered the standard group. Thus, concluded that the extract of *C. citratus* at doses of 200, 400mg/kg body weight and L-dopa-Carbidopa showed a significant decrease in symptoms of parkinsonism after treatment [20].

Anxiolytic Effect

An experimental study of the anxiolytic properties of *C. citratus* was carried out by Hacke et al. In this study, the hydroalcoholic extract and essential oil of *C. citratus* were obtained from 70% ethanol and by hydrodistillation respectively. The zebrafish were kept tested in light-dark test to check their anxiety-like behavior. The anxiolytic effect of *C. citratus* was tested in various concentrations which included essential oil, hydroalcoholic extract, citral, and geraniol. The results suggested that these compounds/ extracts exhibited anxiolytic action, which may be probably due to synergistic effects and the involvement of GABAA receptors [21].

Antihyperlipidemic Effect

A scientific study, led by Abbas et al., revealed that there was a decrease in the cholesterol level of adult Albino rats of the Wistar strain. The rats were administered the extract of *Cymbopogon citratus* root and flower. It showed significant antihyperlipidemic activity [22].

Antidiabetic Effect

Garba et al. in their study revealed that phytochemicals like alkaloids, flavonoids, tannins, and total phenolics were present in lemongrass tea when compared to cold water extract of lemongrass. However, saponins were found slightly higher in cold water extract in comparison to lemongrass tea. Ultimately, when introduced in the diabetic-induced rat model, it showed a significant response in

improving body weight and reducing food and fluid intake. It also showed an effect as well in improving hyperglycemia, β -cell functions, insulin sensitivity, glucose tolerance ability, and dyslipidemia [23].

In another anti-diabetic study on *C. citratus*, diabetes was induced with the administration of 170 mg/kg body weight of alloxan in experimental mice. There was a steady decrease in fasting blood glucose level when administered with crude water extract and ethyl acetate fractions of *C. citratus* at 400 mg/kg body weight within 90 mins of treatment. Thus, this study stated that *C. citratus* extract is possibly effective in treating insulin-dependent hyperglycemia [24].

Anticancer Effect

The essential oils of *C. citratus* from different regions of Vietnam were analyzed using GC/MS. The oil produced a strong cytotoxic effect against different lung cancer cell lines which was mediated by the induction of cell cycle arrest and apoptosis in lung cancer cells [25].

Hepatoprotective Effect

Citral, a major chemical constituent of *C. citratus*, was studied for antioxidant and hepatoprotective activity. The antioxidant activity was noted by the effect of DPPH scavenging activity. For evaluation of the hepatoprotective effect, the liver of experimental mice was damaged by administrating acetaminophen overdose, which was ultimately noted by the high levels of liver enzymes like ALT, AST, ALP, and γ GT. Acetaminophen at the dose of 250mg/kg body weight caused acute liver injury in mice. However, pretreatment with citral significantly showed decreased levels of ALT, AST, ALP, and γ GT in acetaminophen-induced acute liver injury in mice. This showed hepatoprotective activity of citral which may be due to the reduction of oxidative stress [26].

Nephroprotective Effect

C. citratus also showed a protective effect against nephrotoxicity. In a study, a single dose of Cisplatin 5mg/kg body weight induced nephrotoxicity in male Albino rats. They were then investigated. There was a decrease in feed intake in the cisplatin-treated group, while rats in the group of aqueous extract of lemongrass had improved in their feed intake. There was a marked reduction in values of serum creatinine, BUN, and uric acid in the group treated with an aqueous extract of lemongrass. Also, histopathological findings of the experimental rats

suggested that the aqueous extract of lemongrass has a protective action against nephrotoxicity. This protective effect may be probably due to the antioxidant and free radical scavenging properties of lemongrass [27].

Anthelmintic Effect

The study on *C. citratus* for anthelmintic activity evaluated the efficacy of *C. citratus* decoction, *C. citratus* essential oil, and citral against *Haemonchus contortus* using in vitro egg hatch test (EHT) and larval development test (LDT) and an in vivo test using a *Meriones unguiculatus* (gerbil) model. The results of this study suggested that it may be possible to use *C. citratus* essential oil to control of *H. contortus* parasite of small ruminant [28].

Miticidal and Ovicidal Effects

Li et al. in their study proclaimed that the lemongrass exhibited a significant miticidal effect against all life stages of *S. scabiei* depending on the concentration of lemongrass essential oil. Lemongrass oil killed all mites in 10 min at 10% and in 25 min at 5%. Also, the hatching rate of *Sarcoptes* eggs, significantly decreased when exposed to lemongrass oil at all concentrations [29].

Antiplasmodial Effect

The experimental study carried out by Arome et al. revealed that at the level of the highest experimental dose of the extract of lemongrass (800 mg/kg) as well as the standard drug, chloroquine showed the same suppressive effect of 100% with a decreased level of parasitemia. It also stated that the mice showed some behavioral signs of toxicity which included sedation, weakness, and restlessness at 5000 mg/kg of the aqueous extract leaf and root extract of *C. citratus*, which ultimately revealed that the LD50 was estimated to be >5000 mg/kg in aqueous extract of lemongrass [30].

Repellent Effect

Kimutai revealed that oils of *C. citratus* and *Tagetes minuta* were dominated by monoterpene hydrocarbons, in which higher percentage of geranial (20.45%), myrcene (14.24%), neral (11.57%), and verbenene (9.26%) were obtained from monoterpene fraction of cymbopoa *C. citratus*. While, dihydro-tagetone (21.15%), (Z)- β -ocimene (9.84%), limonene (7.40%), allo-ocimene (6.69%), (E)-tagetone (16.21%), (Z)- tagetone (14.99%), and (Z)-ocimene (4.12%) were characterized from *Tagetes minuta* monoterpene fractions. After the test was carried

out, it manifested that oils of *C. citratus* and *T. minuta* showed strong repellency against adult sandflies at a relatively physiological dose [31].

CONCLUSION

Izkhir (Lemongrass) was mentioned hundreds of years ago in texts of Unani literature at a time when there was a lack of advanced technology. Unani Physicians introduced its numerous health benefits and actions on the human body, just merely by their observations and trials on patients. However, those activities are now proven by many researchers for their pharmacological activity efficiently. This study has shown the same and can be helpful in proving its effect on other diseases as mentioned in this paper for future studies.

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