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SHORT COMMUNICATION

EXTRACTION AND ASSESSMENT OF PHARMACOLOGICAL POTENTIAL OF *KAEMPFERIA GALANGA* L. ESSENTIAL OIL

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Abstract: *Kaempferia galanga* L., is known commonly as aromatic ginger or galangal. It is a medicinal plant with a long history of use in traditional medicine systems. This paper provides the extraction of essential oil from rhizomes of this medicinal plant and the results of gas chromatography-mass spectrometry (GC-MS) analysis of *Kaempferia galanga* essential oil. This discusses the major chemical components found in the rhizome oil, identified through GC-MS analysis and highlights the potential pharmacological applications of many compounds detected.

Keywords: *Kaempferia galanga*, Aromatic ginger, GC-MS, Galangal oil

INTRODUCTION

Kaempferia galanga (Aromatic ginger or galangal), the medicinal plant from the family Zingiberaceae, is a native to Southeast Asia. It is widely in use in traditional medicine for its anti-inflammatory, anticancer, antimicrobial, antioxidant and other therapeutic effects. The *Kaempferia galanga* rhizomes contain plenty of bioactive components, liketerpenoids, flavonoids, phenolics, and essential oils (Thankappan *et al*, 2016). The essential oil extracted from rhizomes of *Kaempferia galanga* is considered as one of its most important active components (Ravindran and Balachandran, 2005). The method of extraction is important in getting good quality oil. GC-MS analysis of the essential oil gives valuable information regarding its chemical composition. *Kaempferia galanga* essential oil exhibits wide range of pharmacological properties, making it a valuable natural product for various applications. It has demonstrated antimicrobial activity against wide spectrum of microbes, including fungi, bacteria and viruses. The essential oil also possesses anti-inflammatory effects, which have been attributed to its ability to inhibit pro-inflammatory mediators. Additionally, the oil has shown anticancer potential by inducing apoptosis and inhibiting tumor growth. Other activities, such as antioxidant, antidiabetic and neuroprotective effects, have also been reported. (Elshamy *et al*, 2019).

MATERIALS AND METHODS

Kaempferia galanga rhizomes were collected fresh on harvest from Kerala Agricultural University campus, Vellanikkara, cleaned, shade dried and powdered.

Extraction of *Kaempferia galanga* essential oil: Several extraction techniques can be employed to isolate essential oil from rhizomes like *Kaempferia galanga*. Hydrodistillation using Clevenger apparatus was used in the present study and the yield obtained was 0.89%. The extracted oil was dehydrated using sodium sulfate and used for gas chromatographic analysis (Fan *et al*., 2005).

Analysis by GC-MS :The extracted oil was dissolved in 0.5ml HPLC grade Hexane and filtered through a 13 mm Nylon syringe filter and injected to GC-MS Instrument Model -7890 A GC with 5975C , triple axis detector. Column used was DB 5MS 30 m x 0.250mm Diameter x 0.25 mm. Sample injected was 1 µL and Helium gas at a flow rate of 1 ml/min was used as the carrier gas. The spectral configurations obtained were compared with available mass spectral database (NIST -08 SPECTRAL DATA) to identify the different compounds.

RESULTS AND DISCUSSION

GC-MS analysis is a powerful tool for identifying and quantifying the volatile components present in essential oils. The GC-MS spectrum of *Kaempferia galanga* essential oil revealed the presence of thirty five different components with different retention times as shown in Figure.1.

Volatile oils are generally composed of hydrocarbons, esters, aromatic compounds andterpenes. The major compounds identified by GC-MS , in the galangal essential oil included

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sesquiterpenes (e.g., β-caryophyllene, α-humulene), monoterpenes (e.g., camphor, 1, 8-cineole), and phenylpropanoids (e.g., methyl cinnamate, elemicin). The chemical diversity of the essential oil contributes to its various biological activities. Thirty five different volatile chemical compounds detected in the essential oil of *Kaemferia galanga* in this study as enlisted in Table.1.The major component found was Cinnamic acid ethyl ester (23.62%) followed by n-pentadecane (21.83 %).

Table 1. The volatile compounds (by GC-MS) present in *K.galanga* essential oil

Sl. No:	Retention time in GC-MS	Compound	Content in percentage (%)	Reported pharmacological activity of the compound
1	10.93	α-Pinene	0.24	Anti-inflammatory and analgesic effects
2	11.55	Camphene	0.35	Camphor is known for its cooling and analgesic properties. It is used topically for pain relief and as a counterirritant
3	12.37	o-Cymene	0.08	Anti-inflammatory , anti oxidantand analgesic
4	12.58	β-Pinene	0.12	Anti-inflammatory and analgesic effects
5	13.73	3-Carene	1.39	Anti-inflammatory bronchodialator and analgesic
6	14.47	D-Limonene	0.16	Anti-inflammatory and, anti oxidant
7	14.60	Cineole	2.20	Antimicrobial, anti-inflammatory, and bronchodilator properties. It is often used for respiratory issues and as an analgesic
8	19.69	Borneol	1.44	Anti-inflammatory and analgesic
9	20.38	p-Cymen-8-ol	0.14	Anti microbial , anti-inflammatory and analgesic
10	20.75	α-Terpineol	0.24	Sedative, , anti-inflammatory and anti oxidant
11	21.53	Eucarvone	0.33	Anti spasmodic and anti emetic
12	23.65	Verbenone	0.13	Insect repellent
13	30.28	α-Terpineol acetate	0.06	Anti inflammatory
14	31.12	Ylangene	0.13	Anti inflammatory
15	31.96	β-Elemene	0.20	Anti cancer
16	32.37	(-)-α-Gurjunene	1.21	Anti inflammatory
17	32.49	Tetradecane	0.92	-
18	32.92	Caryophyllene	0.07	Anti inflammatory
19	33.27	γ-Elemene	0.09	Anti cancer
20	33.44	α-Guaiene	0.06	Anti-inflammatory
21	34.01	α-Humulene	0.12	Anti-inflammatory
22	34.13	L-alloaromadendrene	0.05	-
23	34.74	**Cinnamic acid, ethyl ester**	**23.62**	Anti-inflammatory and antioxidant .Used in skin care products
24	34.89	α-Curcumene	0.91	Anti-inflammatory and antioxidant, anti microbial
25	35.76	**n-Pentadecane**	**21.83**	**-**
26	35.85	γ-Cadinene	1.00	Anti-inflammatory, anti microbial , analgesic
27	36.48	Germacrene D-4-ol	0.34	Anti-inflammatory and antioxidant, antitumour
28	38.23	Caryophyllene oxide	0.55	Anti-inflammatory and analgesic properties and is a known cannabinoid receptor modulator
29	39.76	Cubenol	0.18	Anti inflammatory and antioxidant, analgesic and neuro protective
30	42.05	2-Propenoic acid, 3-(4-methoxyphenyl)-, ethyl ester	0.67	Antioxidant and anti-inflammatory
31	42.64	6, 9-Heptadecadiene	0.38	-
32	43.28	5-Cyclohexadecenone	1.60	-

33	44.20	6-Dodecanol	0.11	-
34	44.74	Heptadecane	1.35	-
35	54.03	Biformene	0.42	-

The compounds pinene, cymene, pinene, careen limonene, cineole, cymenol, borneol, terpeneol, gurjunene, caryophyllene, guaiene, humulene, curcumene, cinnamateesters, cardinene, germacreneol, cubenol and propionic acid esters were having anti inflammatory properties as per reports. Some compounds like curcumene, cubenol, cymeme, limonene, terpeneol etc. were reported to be both anti inflammatoryand antioxidant. A few compounds showed only chemical activity, no pharmacological activities. Elemene, celemene, germcreneD-4-ol, were reported to have anticancer activities.Cineol, cymenol, curcumene, cadinene were reported to exhibit antimicrobial action. (Carson *et al*, 1995, Xue Y and Chen H, 2002).

The study done by Fan *et al* in China , found the presence of only 30 components in the oil of *K. galanga* which are mainly cis-p-methoxy- ethyl-cinnamate (6.14%), trans-p-methoxy-ethyl-cinnamate (59.24%), and ethyl-cinnamate (5.27%). The variation may be due to geographical difference in the climate and soil. Variation in the oil chemical composition was also reported in different galangalsin other studies also (Indrayan *et al*, 2007). A finding similar to has been reported in other studies where the major component was either ethyl cinnamate or their trans isomers like ethyl trans-cinnamate, ethyl trans-p-methoxycinnamate and methyl cinnamate.(Tewtrakul*et al*, 2005).

The present study endorses that the essential oil derived from *Kaempferia galanga* rhizome contains a diverse array of volatile compounds, each with its own pharmacological activities. These compounds have shown promise in various therapeutic applications, including anti-inflammatory, antioxidant, analgesic, anticancer and antimicrobial activities. Understanding the pharmacological properties of the volatile compounds in *Kaempferia galanga* essential oil, opens up exciting possibilities for the development of novel drugs and natural remedies. As the interest in natural and plant-based medicines continues to grow, *Kaempferia galanga* and its essential oil may play a significant role in future healthcare and wellness practices. However, further in depth future research is required to explore the full potential and to develop pharmaceutical and cosmetic products harnessing the benefits of these volatile compounds.

CONCLUSION

From the results, it is evident that *Kaempferia galanga* contains various phytocomponents and is recommended as a plant of phyto pharmaceutical importance with drug potential in future.

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