Research Article

The GC-MS Study of One Ayurvedic Preparation Katakakhadiradi Kashayam

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ABSTRACT

Katakakhadiradi Kashayam is an Ayurvedic formulation for the treatment of diabetes, skin and urinary tract ailments. This is made up of 12 types of plants. The present study deals with the GC Ms analysis of this Kashayam to know the presence of different bio molecuels present in it. It was observed that it contained molecules like Ethyl acetate, 3-Trifluoroacetoxytridecane, 3-Trifluoroacetoxypentadecane, Dodecane, 1,2-dibromo-, 4-Trifluoroacetoxytridecane, Trichloroacetic acid pentadecyl ester, Trichloroacetic acid hexadecyl ester, E-14-Hexadecenal, E-11,13-Tetradecadien-1-ol 6- and Tridecene, (Z)- which have various medicinal activities. Further work is in progress to evaluate these molecules and correlate their activities to Katakakhadiradi kashayam. This study will help in better understanding of the mechanism of action of this medicine.

Keywords: Katakhadiradi Kashayam, GC MS, Ayurvedic, Ethyl acetate, E-14-Hexadecenal.

INTRODUCTION

The Ayurvedic and Sidha systems of medicines have great many varieties of medicines for all types of diseases. Since the advent of modern medicine the traditional forms of medicine such as Ayurveda, Sidha and Unani have been neglected although majority of the population world over use some or the other form of traditional medicines for common ailments.

Scientific data like efficacy, molecular mechanism of action and statistics on the positive as well as negative role of such medicines is not documented well to prove the veracity of these systems.

Not much work is done on these aspects and only recently some reports are coming.[1-19]

The present study deals with the GC MS analysis of one Ayruvedic formulation Katakakhadiradi kashayam to know the presence of various bio molecules which could give a clue to the mechanism of action of this medicine as claimed by Ayurveda.

Katakakhadiradi Kashayam is supposed to control both Vata and Kapha related ailments.

This medicine is taken before food once or twice a day at a dose of 5 to 10 ml or as advised by medical practitioner. The medicine is also available in capsule form, which can be taken twice a day before food, two at a time. It is advised that sweets must be avoided and light exercise must be done regularly.

This medicine is taken along Niruryadi gulika, Swetha gunjadi gulika, Mehasahari gulika etc as adjuvant. The reference of this medicine is found in the Ayurvedic treatise Sahasrayoga, Kashaya Prakarana, Pramehahara Kashaya.

Katakakhadiradi Kashayam is an herbal decoction prepared from 10 grams each of the following ingredient plants.

Kataka - *Strychnos potatorum*

Khadira – *Acacia catechu*

Dhatri - Amla- *Embelica officinalis*

Darvi - Daruharidra (*Berberis aristata)*

Samanga - *Biophytum sensitivum*

Vidula - *Barringtonia actuangula*

Abda *(Cyperus rotundus)*

Vairi - *Salacia reticulata*

Rajani - Turmeric- *Curcuma longa*

Abhaya -*Terminalia chebula*

Chootabija - Mango seed- *Mangifera indica*

Pata - *Cyclea peltata*

The medicinal role of each constituent plant present in Katakakhadiradi Kashayam in mentioned below which could reflect in the medicinal role of this Kashayam.

Kataka (*Strychnos potatorum*)

In traditional system of medicine, the seeds are used in the treatment of gonorrhea, leucorrhea, gastropathy, bronchitis, chronic diarrhea, dysentery, renal and vesicle calculi, diabetes, conjunctivitis, sclerosis, ulcers, and other eye disease (Kavitha).[20] It has anti diabetic, anti-inflammatory, anti ulcero-genic, hepato-protective, antioxidant, anti arthritic, anti-nociceptive, anti pyretic, anti diarrheal and diuretic and antimicrobial activities.[21-28]

Khadira – *Acacia catechu*

The medicinal values of this plant were reviewed by Stohs and Bagchi, 2015.[29] This plant has medicinal roles such as antioxidant, anti-inflammatory and chemo protective properties.

Dhatri- Amla- *Embelica officinalis*

Amla has multifarious medicinal properties such as antipyretic, analgesic, as skin care lotion, antioxidant and also used to treat Gonorrhea, nausea, vomiting, indigestion, nose bleeding etc.[30,31]

Daruharidra (*Berberis aistata*)

Berberis aristata is ethno botanically important herb that is used from time immemorial by mankind for the treatment of various ailments.

Sharma has reviewed this plant's therapeutic role such as hepato-protective, hypoglycemic, anticancer, antimicrobial, anti-inflammatory, antioxidant etc. among many other medicinal values.[32]

Samanga *(Biophytum sensitivum L.)*

This plant has important medicinal properties like anti-angiogenic, antibacterial and antiulcer, antifungal etc.[33-35]

Vidula (*Barringtonia acutangula*)

In Ayurveda its roots, leaves and fruits are used for the treatment of jaundice, liver disorders, stomach disorders, leprosy, spleen disorders etc. Kaur have reviewed the various scientific work carried out on this medicine.[36]

It has been reported to have properties like anti-tumour, antioxidant, hypoglycemic, CNS depressant, hepato-protective, antifungal, anti nociceptive and anti-inflammatory, anthelmmintic and Anti diarrheal activity etc.[37-45]

Abda *(Cyperus rotundus)*

Sivapalan, 2013 has given an exhaustive review of the various medicinal properties of *C. rotundus*.[46]

This plant has anti Inflammatory, antipyretic, analgesic, tranqulizing, anti-emetic, anticonvulsant, hepatoprotective, antiarthritic, antioxidant, anticancer, antidiabetic, hypolipidemic, antibacterial, antioxidant, cytotoxic and apoptotic activities.[47-58]

Vairi (Salacia Spp.)

This plant is also a source of wonder drug which is used for treating various human diseases.[59]

This plant has medicinal activities like anti diabetic, anti hypertriglyceridemic, antioxidant etc.[60-65]

Rajani – Turmeric - *Curcuma longa*

Turmeric is another important medicinal plant with its wide application as food, medicine and as preservative.

Many workers have worked on this plant on various aspects.

Turmeric is anti-inflammatory, antimicrobial, preservative, antifungal, anticancer, cardio protective, hypoglycemic and antidiabetic.[66,67]

Haritaki – Chebulic Myrobalan fruit rind – *Terminalia chebula*

One of the constituent of the common Triphala choornam, *T. chebula* bark, rind, galls etc. have been found to have activities like antioxidant, antimicrobial, anti diabetic, hepato protective, anti-inflammatory, anti arthritic, anti mutagenic, anti proliferative, radio-protective, cardio protective, hypo lipidemic, antispasmodic, Immuno-modulatory and antiviral.[68]

Mango (*Mangifera indica*) seeds

Mango has a special role in Ayurveda not only because of its taste and variety but also because of its multifarious medicinal values. Mango seed kernel is used as anti diarrheal as a homemade medicine.

The anti diarrheal, anti-inflammatory activity of mango seed kernel was reported by (Sairam).[69] Garrido have claimed the presence of poly phenols present in mango seeds for the anti-inflammatory activity.[70] The seeds are reported to act as antibacterial (Rajan).[71]

Pata (*Cyclea peltata*)

C. peltata has pharmacological activities such as diuretic, anticancer, anti oxidative, anti toxic, anti-inflammatory etc.[72]

RESULTS AND DISCUSSION

Figure 1 and Table 1 shows the GC MS analysis results.

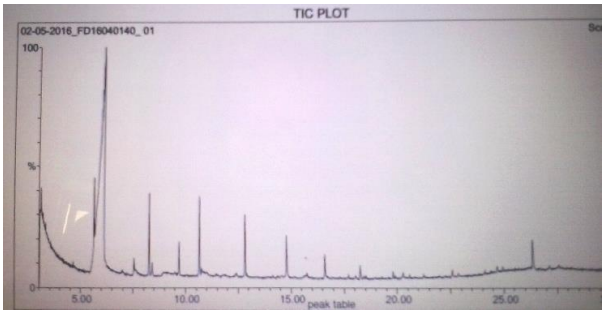

Figure 1: Shows the GC MS graph of Katakakhairadi Kashyama.

Table 2 shows the indicated important compounds present in the GC MS and their medicinal roles.

Table 1: The GC MS analysis results of Katakakhadiradi Kashayam indicating the Retention time, name of the possible compounds, molecular weight and molecular formula.

S. No.	Retention Time	Compounds	M.W.	Formula
1	3.093	CH3C(O)CH2CH2OH	88.00	C4H8O2
2	4.178	Ethyl Acetate	88.00	C4H8O2
3	4.645	CH3C(O)CH2CH2OH	88.00	C4H8O2
		Arsonous dichloride, methyl-	160	CH3AsCl2
4.	4.884	CH3C(O)CH2CH2OH	88.00	C4H8O2
		Propanoic acid, 2-oxo-	88.00	C3H4O3
5.	5.222	Acetic acid, (acetyloxy)-	118.0	C4H6O4
		Acetyl chloride	78.00	C2H3ClO
		Propanoic acid, 2-oxo-	88.00	C3H4O3
6.	5.643	3-Trifluoroacetoxytridecane	296.0	C15H27F3O2
7	6.121	Benzoic acid	122.0	C7H6O2
8	6.372	Dammar-22-en-3-ol, 20,24-epoxy-24-methyl-, acetate, (3á,24S)	498.0	C33H54O3
		N-(p-Methoxyphenyl)-p-chloro-benzenesulfinylamide	281.0	C13H12ClNO2S
9	6.553	N-(p-Methoxyphenyl)-p-chloro-benzenesulfinylamide	281.0	C13H12ClNO2S
10	6.740	N-(p-Methoxyphenyl)-p-chloro-benzenesulfinylamide	281.0	C13H12ClNO2S
		Hexanediamide, N,N'-di-benzoyloxy-	384.0	C20H20N2O6
		D-Glucose, O-(phenylmethyl)oxime, 2,3,4,5,6-pentabenzoate	805.0	C48H39NO11
11	6.996	4-Pyridinecarboxaldehyde, O-acetyloxime, (E)-	164.0	C8H8N2O2
		N-(1,3,4-Thiadiazol-2-yl)benzamide	205.0	C9H7N3OS
		Acetamide, N-[2-(4-chlorophenoxy)ethyl)-	213.0	C10H12ClNO2
12	7.551	Ethanone, 1-(2,4-dichlorophenyl)-	188.0	C8H6Cl2O
		2,6-Dichloroacetophenone	188.0	C8H6Cl2O
		Benzoic acid, 2,4-dichloro-, 4-acetylphenyl ester	308.0	C15H10Cl2O3
13	7.773	Methyl 3-[1-(2,6-dichlorobenzoyl)-5-formylpyrrol-2-yl]prop-2-enoate	351.0	C16H11Cl2NO4
		Ethyl 3-[1-(2,6-dichlorobenzoyl)-5-formylpyrrol-2-yl]prop-2-Enoate	365.0	C17H13Cl2NO4
		Cholest-7-en-3á,5à-diol-6à-benzoate	522.0	C34H50O4
14	8.280	E-11,13-Tetradecadien-1-ol	210.0	C14H26O
		6-Tridecene, (Z)-	182.0	C13H26
		4-Trifluoroacetoxytridecane	296.0	C15H27F3O2
15	8.998	Dimethylmuconic acid	170.0	C8H10O4
		2-Chloroethanol	80.00	C2H5ClO
		1,2-Benzenediol, 4-[2-(methylamino)ethyl]-	167.0	C9H13NO2
16	9.313	2-Chloroethanol]	80.00	C2H5ClO
		4-Pyridinecarboxaldehyde, O-acetyloxime, (E)-	164.0	C8H8N2O2
		Norpseudoephedrine	151.0	C9H13NO
17	9.494	4-Pyridinecarboxaldehyde, O-acetyloxime, (E)-	164.0	C8H8N2O2
		N-(1,3,4-Thiadiazol-2-yl)benzamide	205.0	C9H7N3OS
		4-Benzoyloxy-1-morpholinocyclohexene	287.0	C17H21NO3
18	9.698	Phenol, 2,4-bis(1,1-dimethylethyl)-	206,00	C14H22O

19	10.673	E-14-Hexadecenal	238.0	C16H30O
20	11.035	Ursane-3,16-diol, (3á,16á,18à,19à,20á)-	444.0	C30H52O2’
		Cholest-7-en-3á,5à-diol-6à-benzoate	522.0	C34H50O4
21	11.443	Pyridine-3-carboxamide, 1,2-dihydro-4,6-dimethyl-2-thioxo-	182.0	C8H10N2OS
		2-Methyl-2-phenyl-5-(1,4-dihydropyridin-4-ylidene)-1,3-dioxan-4,6-dione	283.0	C16H13NO4
		Benzoxazol, 2,3-dihydro-2-thioxo-3-diallylaminomethyl-	260.0	C14H16N2OS
22	11.770	Benzoxazol, 2,3-dihydro-2-thioxo-3-diallylaminomethyl-	260.0	C14H16N2OS
		1-(4-Acetamidoanilino)-3,7-dimethylbenzo[4,5]imidazo[1,2-a]pyridine-4-carbonitrile	369.0	C22H19N5O
		Benzeneethanamine, 2,5-difluoro-á,3,4-trihydroxy-N-methyl-	219	C9H11F2NO3
	12.417	Ethaneperoxoic acid, cyanodiphenylmethyl ester	267	C16H13NO3
		5-Nitro-3-cyano-2(1H)-pyridone	165	C6H3N3O3
		Pyridine-3-carboxamide, 1,2-dihydro-4,6-dimethyl-2-thioxo-	182	C8H10N2OS
23	12.843	Trichloroacetic acid, hexadecyl ester	386	C18H33Cl3O2
		Trichloroacetic acid, pentadecyl ester	372	C17H31Cl3O2
		E-14-Hexadecenal	238	C16H30O
24	14.162	2-Cyclopropylcarbonyloxytridecane	268	C17H32O2
		4-Cyclopropylcarbonyloxytridecane	268	C17H32O2
		3-Cyclopropylcarbonyloxytridecane	268	C17H32O2
25	14.553	Benzoxazol, 2,3-dihydro-2-thioxo-3-diallylaminomethyl-	260.0	C14H16N2OS
		Pyridine-3-carboxamide, 1,2-dihydro-4,6-dimethyl-2-thioxo-	182.0	C8H10N2OS
		Butanoic acid, 2,3-dichloro-	156.0	C4H6Cl2O2
26	14.816	Trichloroacetic acid, hexadecyl ester	386.0	C18H33Cl3O2
		Trichloroacetic acid, pentadecyl ester	372.0	C17H31Cl3O2
		E-14-Hexadecenal	238.0	C16H30O
27	15.773	2-Cyclopropylcarbonyloxytridecane	268.0	C17H32O2
		4-Cyclopropylcarbonyloxytridecane	268.0	C17H32O2
		5-Cyclopropylcarbonyloxypentadecane	296.0	C19H36O2
28	16.625	Trichloroacetic acid, hexadecyl ester	386.0	C18H33Cl3O2
		Trichloroacetic acid, pentadecyl ester	372.0	C17H31C l3O2
		4-Trifluoroacetoxytridecane	296.0	C15H27F3O2
29	17.722	2-Cyclopropylcarbonyloxytridecane	268.0	C17H32O2
		5-Cyclopropylcarbonyloxypentadecane	296.0	C19H36O2
		4-Cyclopropylcarbonyloxytridecane	268.0	C17H32O2
30	18.066	2-Cyclopropylcarbonyloxytridecane	268.0	C17H32O2
		5-Cyclopropylcarbonyloxypentadecane	296.0	C19H36O2
		4-Cyclopropylcarbonyloxytridecane	268.0	C17H32O2
31	18.282	4-Trifluoroacetoxytetradecane	310.0	C16H29F3O2
		4-Trifluoroacetoxytridecane	296.0	C15H27F3O2
		2-Trifluoroacetoxytridecane	296.0	C15H27F3O2
32	19.823	2-Trifluoroacetoxytridecane	296.0	C15H27F3O2
		3-Trifluoroacetoxypentadecane	324.0	C17H31F3O2
		4-Trifluoroacetoxypentadecane	324.0	C17H31F3O2

33	20.295	2,4,4,6,6,8,8-Heptamethyl-2-nonene	224.0	C16H32
		3-Trifluoroacetoxypentadecane	324.0	C17H31F3O2
		4-Cyclopropylcarbonyloxytridecane	268.0	C17H32O2
34	20.593	2-Cyclopropylcarbonyloxytridecane	268.0	C17H32O2
		4-Cyclopropylcarbonyloxytridecane	268.0	C17H32O2
		2-Cyclopropylcarbonyloxytetradecane	282.0	C18H34O2
35	21.982	5-Cyclopropylcarbonyloxypentadecane	296.0	C19H36O2
		3-Trifluoroacetoxypentadecane	324.0	C17H31F3O2
		4-Cyclopropylcarbonyloxytridecane	268.0	C17H32O2
36	22.256	Pterin-6-carboxylic acid	207.0	C7H5N5O3
		3-Trifluoroacetoxydodecane	282.0	C14H25F3O2
		5-Cyclopropylcarbonyloxypentadecane	296.0	C19H36O2
37	22.600	3-Trifluoroacetoxypentadecane	324.0	C17H31F3O2
		3-Trifluoroacetoxydodecane	282.0	C14H25F3O2
		2-Trifluoroacetoxytridecane	296.0	C15H27F3O2
38	22.886	3-Trifluoroacetoxydodecane	282.0	C14H25F3O2
		2-Cyclopropylcarbonyloxytridecane	268.0	C17H32O2
		3-Trifluoroacetoxypentadecane	324.0	C17H31F3O2
39	24.129	3-Trifluoroacetoxydodecane	324.0	C17H31F3O2
		9-Octadecenoic acid (Z)-,	282.0	C14H25F3O2
		phenylmethyl ester	372.0	C25H40O2
40	24.701	3-Trifluoroacetoxypentadecane	324.0	C17H31F3O2
		3-Trifluoroacetoxydodecane	282.0	C14H25F3O2
41	24.958	9-Octadecenoic acid (Z)-, phenylmethyl ester	372.0	C25H40O2
		3-Trifluoroacetoxypentadecane	324.0	C17H31F3O2
		Pterin-6-carboxylic acid	207.0	C7H5N5O3
42	25.162	9-Octadecenoic acid (Z)-, phenylmethyl ester	372.0	C25H40O2
		Pterin-6-carboxylic acid	207.0	C7H5N5O3
		3-Trifluoroacetoxypentadecane	324.0	C17H31F3O2
43	25.331)	Pterin-6-carboxylic acid	207.0	C7H5N5O3
		9-Octadecenoic acid (Z)-, phenylmethyl ester	372.0	C25H40O2
		4-Aminobutyramide, N-methyl-N-[4-(1-pyrrolidinyl)-2-butynyl]-N',N'-bis(trifluoroacetyl)-	429.0	C17H21F6N3O3
44	25.529	9,12,15-Octadecatrienoic acid, 2-[(trimethylsilyl)oxy]-1-[[(trimethylsilyl)oxy]methyl]ethyl ester, (Z,Z,Z)-	496.0	C27H52O4Si2
		9-Octadecenoic acid (Z)-, phenylmethyl ester	372.0	C25H40O2
		4-Aminobutyramide, N-methyl-N-[4-(1-pyrrolidinyl)-2-butynyl]-N',N'-bis(trifluoroacetyl)-	429.0	C17H21F6N3O3
45	25.728	Pterin-6-carboxylic acid	207.0	C7H5N5O3
		4-Cyclopropylcarbonyloxytridecane	268.0	C17H32O2
		3-Trifluoroacetoxypentadecane	304.0	C17H31F3O2
46	26.166	3-Trifluoroacetoxypentadecane	304.0	C17H31F3O2
		Pterin-6-carboxylic acid	207.0	C7H5N5O3
		-Trifluoroacetoxydodecane	282.0	C14H25F3O2
47	26.387	9,12,15-Octadecatrienoic acid, 2-[(trimethylsilyl)oxy]-1-	496.0	C27H52O4Si2
		[[(trimethylsilyl)oxy]methyl]ethyl ester, (Z,Z,Z)-	326.0	C12H24Br2

		Dodecane, 1,2-dibromo-3-Trifluoroacetoxypentadecane	324.0	C17H31F3O2
48	27.140	3-Trifluoroacetoxypentadecane	324.0	C17H31F3O2
		3-Trifluoroacetoxydodecane	282.0	C14H25F3O2
		9-Octadecenoic acid (Z)-, phenylmethyl ester	372.0	C25H40O2
49	27.601	9-Octadecenoic acid (Z)-, phenylmethyl ester	372.0	C25H40O2
		3-Trifluoroacetoxypentadecane	324.0	C17H31F3O2
		3-Trifluoroacetoxydodecane	282.0	C14H25F3O2

Table 2: Indicates the possible medicinal role of some of the compounds which were found in large quantities in the GC MS analysis.

S. No.	Retention time	% Peak value	Compound	M. W	Medicinal Value
1	4.178	3.217	Ethyl acetate	88.0	Wound Healing
2	4.645	1.606	CH3C(O)CH2CH2OH	88.0	
3	5.643	3.043	3-Trifluoroacetoxytridecane	296.0	Antimicrobial
4	6.121	31.991	Benzoic Acid	122.0	Antibacterial
5	8.280	1.606	E-11,13-Tetradecadien-1-ol	210.0	Activity not known
			6-Tridecene, (Z)-	182.0	Flavouring agent
			4-Trifluoroacetoxytridecane	296	Antimicrobial
6.	10.673	1.606	E-14-Hexadecenal	238	Antibacterial
7.	11.770		Benzoxazol, 2,3-dihydro-2-thioxo-3-diallylaminomethyl-	260	
			1-(4-Acetamidoanilino)-3,7-dimethylbenzo[4,5] imidazo[1,2-a]pyridine-4-carbonitrile	369	Anticancer
			Benzeneethanamine, 2,5-difluoro-á,3,4-trihydroxy-N-methyl-	219	Antiseptic
8.	12.843	1.348	Trichloroacetic acid, hexadecyl ester	386	Cosmetics
			Trichloroacetic acid, pentadecyl ester	372	Cosmetics
			E-14-Hexadecenal	238	Antibacterial
9	14.816	1.091	Trichloroacetic acid, hexadecyl ester	386	Cosmetics
			Trichloroacetic acid, pentadecyl ester	372	Cosmetics
			E-14-Hexadecenal	238	Antibacterial
10	16.625	1.666	Trichloroacetic acid, hexadecyl ester	386	Cosmetics
			Trichloroacetic acid, pentadecyl ester	372	Cosmetics
			4-Trifluoroacetoxytridecane	296	Antibacterial
11	26.387	1.666	9,12,15-Octadecatrienoic acid, 2-[(trimethylsilyl)oxy]-1-	496	No report
			[[(trimethylsilyl)oxy]methyl]ethyl ester, (Z,Z,Z)-	326	No report
			Dodecane, 1,2-dibromo-3-Trifluoroacetoxypentadecane	324	Antioxidant

Among the bio molecules present a few have known medicinal activities. Ethyl acetate, 3-Trifluoroacetoxytridecane, 3-Trifluoroacetoxypentadecane, Dodecane, 1,2-dibromo-, 4-Trifluoroacetoxytridecane, Trichloroacetic acid, pentadecyl ester, Trichloroacetic acid hexadecyl ester, E-14-Hexadecenal, E-11,13-Tetradecadien-1-ol 6- and Tridecene, (Z)- which have various medicinal activities.

There are some other compounds which are in small quantities but still could have some major or minor medicinal role.

Further work is in progress to evaluate these molecules and correlate their activities to Katakakhadiradi Kashayam to understand the mechanism of action of this medicine along with other pharmacological parameters.

CONCLUSION

The GC MS analysis of Katakakhadiradi Kashaym indicates its role as a good medicine as shown by the presence of some important bio molecules. Further work to establish its medicinal value in continuing.

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