Research Article

Gas chromatography–mass spectrometry analysis of one Ayurvedic medicine, Drakshadi Kashayam

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ABSTARCT

Introduction: The present work deals with the gas chromatography (GC)–mass spectrometry (MS) analysis of Drakshadi Kashayam, which is used in the treatment of Panduroga (anemia), jaundice, and diseases caused due to imbalance in Pitta (bile) consistency. **Methods:** Drakshadi Kashayam was bought from a standard Ayurvedic vendor at Chennai and subjected to GC–MS analysis by standard procedures. The medicinal roles of the biomolecules indicated in the GC–MS profile were screened for their various medicinal roles using Dr. Duke's phytochemical and ethnobotanical data and other data. **Results:** GC–MS profile of Drakshadi Kashayam indicated the presence of important biomolecules such as carbonic acid, pentyl phenyl ester, bisphenol C, histamine, N-benzoyl-2-cyano-, o-Methoxy-.alpha.-phenethylamine, benzenethanamine, 3,4-dimethoxy-.alpha.-methyl-, cis-Z-.alpha.-Bisabolene epoxide, and 1,3-Dimethoxy-5-(1-methyl-heptyl)-benzene which have medicinal roles supporting the efficacy of Drakshadi Kashayam as a liver tonic. **Conclusions:** It is concluded that Drakshadi Kashayam, which is an important Ayurvedic medicine, does contain some very important molecules showing its efficacy. Further research is required for a better understanding of the medicinal roles of this medicine.

KEY WORDS: 3,4-dimethoxy-.alpha.-methyl-, Benzenethanamine, Bisphenol C, Carbonic acid, Drakshadi Kashayam, Gas chromatography–mass spectrometry, Histamine, N-benzoyl-2-cyano-, o-Methoxy-.alpha.-phenethylamine, Pentyl phenyl ester

INTRODUCTION

Authentication of Ayurvedic and other forms of alternative and complementary medicines in the light of modern pharmacological and clinical methods will help in establishing the age-old forms of medicines back to the forefront of medical science. This is all the more important since majority of the world population still depends on these forms of medicine for their primary health needs without knowing its positive as well as negative effects on health. Of late, this problem is being taken up at various levels and some reports are pouring, but lot more is needed in this regard.[1-31] The present work deals with the gas chromatography (GC)–mass spectrometry (MS) analysis of one Ayurvedic medicine, Drakshadi Kashayam, which is a time tested formulation for Panduroga (anemia), jaundice, and diseases caused due to imbalance in Pitta (bile) consistency. This is a liver tonic and relieves tiredness. It is also used to treat nasal bleeding, burning sensation, excessive thirst, and schizophrenia. This Kashayam is taken at a dose of 12–24 ml along with equal quantity of water and little honey, before food or as per prescription.

One part each of the following herbs is powdered and boiled with eight parts of water till the volume become one-fourth. It is filtered and stored to be used as medicine.

Vitis vinifera, Madhuca longifolia, Glycyrrhiza glabra, Symplocos racemosa, Gmelina arborea, Hemidesmus indicus, Cyperus rotundus, Embelica officinalis, Coleus zeylanicus, Nelumbium speciosum, Prunus cerasoides, Vetiveria zizanioides, Phoenix famifera, Santalum album, and *Jasminum sambac*. This medicine finds its reference in the Ayurvedic treatise, Ashtanga Hridaya

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Chikitsa Sthana 1/55–58, and Sahasrayoga-Vata-Pitta Jwarahara Kashayam. This Kashayam is also found in tablet form. It is manufactured by Arya Vaidyasala, Kottakkal, AVN, AVP, etc.

METHODS

Drakshadi Kashayam was obtained from standard Ayurvedic vendor at Chennai and was subjected to GC–MS analysis by standard procedure.

Instrument: GC (Agilent: GC: [G3440A] 7890A. MS/MS: 7000 Triple Quad GC–MS) was equipped with MS detector.

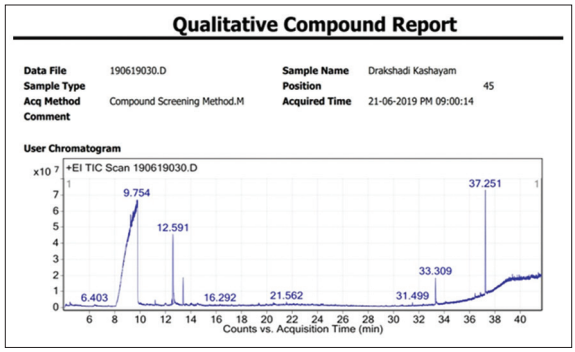

Figure 1: The gas chromatography–mass spectrometry graph with various important peaks of Drakshadi Kashayam

Sample Preparation

One hundred microliter sample dissolved in 1 ml of suitable solvents. The solution stirred vigorously using vortex stirrer for 10 s. The clear extract was determined using GC for analysis.

GC–MS Protocol

The details of GC MS column: Column DB5 MS (30 mm × 0.25 mm ID × 0.25 µm, composed of 5% phenyl 95% methyl poly siloxane), Electron impact mode at 70 eV; helium (99.999%) was used as carrier gas at a constant flow of 1 ml/min injector temperature 280°C; axillary temperature: 290°C; and ion source temperature 280°C.

The oven temperature was programmed from 50°C (isothermal for 1.0 min), with an increase of 40°C/min, to 170°C (isothermal for 4.0 min), then 10°C/min to 310°C (isothermal for 10 min) fragments from 45 to 450 Da. Total GC running time is 32.02 min. The compounds are identified by GC–MS Library (National Institute of Standards and Technology and Wiley).

RESULTS AND DISCUSSION

Table 1 indicates the details of GC–MS profile of Drakshadi Kashayam. Figure 1 indicates the GC–MS graph representing the various peaks corresponding to each molecule present in Drakshadi Kashayam.

Table 1: The GC–MS profile of Drakshadi Kashayam showing retention time, name of the compound, peak area, peak height, and molecular mass

Retention time	Name of molecule	Area	Height	Mass
4.16	Glycerin	1,715,778	792,920	92
4.48	Carbonic acid, pentyl phenyl ester	7,261,739	2,059,418	208.1
6.40	Ethanone, 1-(1-cyclohexen-1-yl)-	2,101,909	685,853	124.1
9.25	Cyclobutane-1,1-dicarboxamide, N, N'-di-benzoyloxy-	6,151,668	7,231,618	382.1
10.03	Heptanediamide, N, N'-di-benzoyloxy-	1,957,287	743,449	398.1
11.19	Ethanone, 1-(2-hydroxy-5-methylphenyl)-	8,186,881	3,209,201	150.1
12.50	Hydrocoumarin	7,132,088	3,385,004	148.1
12.59	1,2,3-Benzenetriol	165,348,358	4,331,2160	126
13.40	Bisphenol C	39,337,100	16,978,003	256.1
13.60	Histamine, N-benzoyl-2-cyano-	2,558,507	821,922	240.1
13.97	o-Methoxy-.alpha.-phenethylamine	2,679,068	882,523	151.1
14.05	Benzenethanamine, 3,4-dimethoxy-.alpha.-methyl-	4,688,159	1,292,039	195.1
14.38	Bicyclo[2.2.2]oct-2-ene-1-carboxamide	1,681,395	928,805	151.1
16.29	6,7-Dihydro-3-nitro-5H-cyclopenta[b] pyridin-2 (1H)-one	1,707,364	655,996	180.1
19.37	Benzeneethanamine, 2,5-dimethoxy-.alpha.-methyl-	3,754,638	1,509,220	195.1
19.94	Pterin-6-carboxylic acid	2,088,206	872,835	207
20.52	Cis-Z-.alpha.-Bisabolene epoxide	2,959,200	1,171,756	220.2
21.30	5,6,6-Trimethyl-5-(3-oxobut-1-enyl)-1-oxaspiro[2.5] octan-4-one	1,680,602	512,179	236.1
21.56	4,4,8-Trimethyltricyclo[6.3.1.0 (1,5)]dodecane-2,9-diol	3,886,342	1,577,523	238.1
30.71	4-Aminobutyramide, N-methyl-N-[4-(1-pyrrolidinyl)-2-butynyl]-N', N'-bis (trifluoroacetyl)-	1,683,974	686,228	429.1
31.50	Bis (2-ethylhexyl) phthalate	3,802,966	1,958,751	390.3
32.35	Heptasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11,13,13-tetradecamethyl-	1,872,259	851,243	504.2
33.31	4',5-Dihydroxy-7-methoxyflavanone	33,154,229	16,321,549	286.1
36.87	Octasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-hexadecamethyl-	2,316,253	1,757,559	578.2
37.25	1,3-Dimethoxy-5-(1-methyl-heptyl)-benzene	114,092,573	64,121,795	250.2

GC: Gas chromatography, MS: Mass spectrometry

Table 2: The possible medicinal values of each compound observe in the GC–MS profile of Drakshadi Kashayam

Name of the molecule	Possible medicinal roles
Glycerin	Provides smoothness to skin
Carbonic acid, pentyl phenyl ester	Carbonic anhydrase inhibitor, acidifier, acidulant, arachidonic acid inhibitor, increase aromatic amino acid decarboxylase activity, inhibit production of uric acid
Ethanone, 1-(1-cyclohexen-1-yl)-	Not known
Cyclobutane-1,1-dicarboxamide, N, N'-di-benzoyloxy-	Antitumor, anticancer, GABAnergic, increase NK cell activity, inhibit TNF activity, myoneurostimulant, decrease norepinephrine production
Heptanediamide, N, N'-di-benzoyloxy-	Antitumor, anticancer, GABAnergic, increase NK cell activity, inhibit TNF activity, myoneurostimulant, decrease norepinephrine production
Ethanone, 1-(2-hydroxy-5-methylphenyl)-	Not known
Hydrocoumarin	Not known
1,2,3-Benzenetriol	Not known
Bisphenol C	Acetyl choline antagonist, Acetyl CoA carboxylase inhibitor, anticancer, antitumor, and bisphenols A (BPA) and S (BPS) have been shown to be endocrine disruptors.[2,3] Due to its high production volumes, BPA has been characterized as a "pseudo-persistent" chemical,[4] leading to its spreading and potential accumulation in a variety of environmental matrices, even though it has a fairly short half-life.[5]
Histamine, N-benzoyl-2-cyano-	Histamine inhibitor, inhibit TNF, 5-alpha reductase inhibitor, NADH oxidase inhibitor, Myoneurostimulant, increase NK cell activity, GABAnergic, decrease norepinephrine production
o-Methoxy-.alpha.-phenethylamine	Inhibit TNF, 5-alpha reductase inhibitor, NADH oxidase inhibitor, alpha agonist, alpha-amylase inhibitor, HIF 1-alpha inhibitor, increase alpha-mannosidase activity, TNF-alpha inhibitor, antidote, catechol-O-methyltransferase inhibitor, methyl donor
Benzenethanamine, 3,4-dimethoxy-.alpha.-methyl-	Inhibit TNF, 5-alpha reductase inhibitor, NADH oxidase inhibitor, alpha agonist, alpha-amylase inhibitor, HIF 1-alpha inhibitor, increase alpha-mannosidase activity, TNF-alpha inhibitor, antidote, catechol-O-methyltransferase inhibitor, methyl donor
Bicyclo[2.2.2]oct-2-ene-1-carboxamide	Not known
6,7-Dihydro-3-nitro-5H-cyclopenta[b] pyridin-2 (1H)-one	Not known
Benzeneethanamine, 2,5-dimethoxy-.alpha.-methyl-	Inhibit TNF, 5-alpha reductase inhibitor, NADH oxidase inhibitor, alpha agonist, alpha-amylase inhibitor, HIF 1-alpha inhibitor, Increase alpha-mannosidase activity, TNF-alpha inhibitor, antidote, catechol-O-methyltransferase inhibitor, methyl donor
Pterin-6-carboxylic acid	Acidifier, acidulant, arachidonic acid inhibitor, increase aromatic amino acid decarboxylase activity, inhibit production of uric acid
cis-Z-.alpha.-Bisabolene epoxide	Increase zinc bioavailability, inhibit TNF, 5-alpha reductase inhibitor, NADH oxidase inhibitor, alpha agonist, alpha-amylase inhibitor, HIF 1-alpha inhibitor, increase alpha-mannosidase activity, TNF-alpha inhibitor, antidote, catechol-O-methyltransferase inhibitor, methyl donor
5,6,6-Trimethyl-5-(3-oxobut-1-enyl)-1-oxaspiro[2.5] octan-4-one	Not known
4,4,8-Trimethyltricyclo[6.3.1.0 (1,5)]dodecane-2,9-diol	Not known
4-Aminobutyramide, N-methyl-N-[4-(1-pyrrolidinyl)-2-butynyl]-N', N'-bis (trifluoroacetyl)-	Not known
Bis (2-ethylhexyl) phthalate	Not known
Heptasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11,13,13-tetradecamethyl-	Not known
4',5-Dihydroxy-7-methoxyflavanone	Not known
Octasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-hexadecamethyl-	Not known
1,3-Dimethoxy-5-(1-methyl-heptyl)-benzene	Catechol-O-methyltransferase inhibitor, methyl donor, methyl donor

GC: Gas chromatography, MS: Mass spectrometry, TNF: Tumor necrosis factor, NADH: Nicotinamide adenine dinucleotide phosphate, HIF: Hypoxia-inducible factor, GABA: Gamma-aminobutyric acid

Table 2 indicates the possible medicinal values of each compound observe in the GC–MS profile.

The quality standardization of Drakshadi Kashayam was reported by Pillai and Pandita, 2016.[32] Samantaray and Saran, 2019, have reported the pharmaceutical evaluation of Draksharishtam.[33] In the present work, the molecules shown in the GC–MS profile indicate various pharmacological roles conforming toward the role of Drakshadi Kashayam as a liver tonic formulation. Molecules such as carbonic acid, pentyl phenyl ester, bisphenol C, histamine, N-benzoyl-2-cyano-, o-Methoxy-.alpha.-phenethylamine, benzenethanamine, 3,4-dimethoxy-.alpha.-methyl-, cis-Z-.alpha.-Bisabolene epoxide, and 1,3-Dimethoxy-5-(1-methyl-heptyl)-benzene have medicinal roles indicated in Table 2. Among these roles, carbonic anhydrase inhibitor is used as medicine for diseases such as gastric and duodenal ulcers, neurological disorders, and osteoporosis. Acetyl-CoA carboxylase inhibition results in inhibition of fatty acid synthesis and stimulation of fatty acid oxidation, thus reducing the chance of fatty liver and metabolic risks of cardiovascular disease.[34,35]

Histamine inhibitors act as anti-allergic. A tumor necrosis factor (TNF) inhibitor suppresses the physiologic response to TNF, thus reducing the inflammatory responses in the body due to autoimmune and immune-medicated disorders. A catechol-*O*-methyltransferase inhibitor facilitates the availability of L-Dopa which is crucial in neurotransmission. This role could be helpful indirectly toward the function of Drakshadi Kashayam. 5α-Reductase inhibitors help in reduced production of hormones such as epinephrine and norepinephrine, thus slowing down metabolism. The inhibition of alpha-amylase enzyme reduces the glucose peaks after food intake, thus slowing down glucose metabolism and, in turn, helps the liver function. The nicotinamide adenine dinucleotide phosphate oxidase inhibition reduces the chances of superoxide radical formation, thus reducing oxidative stress and reactive oxygen species reactions in the body, thus helping less stress to liver. Thus, all the molecules with so many roles could help in the medicinal roles claimed for Drakshadi Kashayam.

CONCLUSIONS

It is interesting that the molecules shown in the GC–MS profile of Drakshadi Kashayam augur well with its medicinal roles.

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