GC MS Analysis of One Ayurvedic Preparation ‘Aswagandharishtam’

M. Kotteswari¹, M.R.K. Rao²*, Siva Kumar³, K. Prabhu⁴, R. Lakshmi Sundaram⁵ and Shruthi Dinakar⁶

¹Department of Anatomy, Madha Dental College, Chennai, India.
²Department of Industrial Biotechnology, Bharath Institute of Higher Education and Research, Chennai, India.
³Department of Oral Pathalogy, Madha Dental College, Chennai, India.
⁴Department of Anatomy, Sree Balaji Medical College and Hospital, Channai, India.
⁵Central Research facility, Sri Ramachandra Medical College and Research Institute, Porur, Chennai - 600116, India.
⁶Ayurvedic Practitioner, Kottakkal Arya Vaidya Sala, Chennai, India.
*Corresponding author E mail: mrkrao1455@gmail.com

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Aswagandharishtam is classical medicine for diseases pertaining to nervous system and digestive system prepared by a number of plants and plant parts. The present work is to know the types of biomolecules present in it by GC MS analysis. Aswagandharishtam was procured from standard Ayurvedic outlet and was subjected to Gas Chromatography Mass Spectrometry after due processing. The GC MS analysis of Aswagandharishtam has shown some promising molecules like Prostaglandin A2, Cholesterol, Piperine, Gentamicin a, d-Mannose, Eugenol, Pipradrol among others, which have activities similar to that of Aswagadharishtam. This is a preliminary report where some clue about the various types of biomolecules present in Aswagandharishtam was obtained. Further work is on to prove the efficacy of this medicine by other parameters.

Keywords: Aswagandharishtam, GC MS, Piperine, Eugenol, Cholesterol, d-Mannose.

Ashwagandharishta or Aswagandharishtam is a liquid Ayurveda medicine used in the treatment of feeling tired all the time, psychiatric conditions, dullness, loss of memory, sluggishness, epilepsy, stomach problems like low digestion power, emaciation, Piles and Vata imbalance diseases. This increases ojas, nourishes all dhatus. It is also used as a nervine tonic.
MS analysis of this medicine to throw some light on the type of molecules present in Ashwagandha and their medicinal role. This is a first step in the direction of understanding the medicinal efficacy of Aswagandharistam. This Arishtam is made of the following ingredients and the following paragraphs indicate the medicinal role of each of the ingredients briefly. The ingredients are divided into two sections: Kwatha dravyas and Prakshepa dravyas.

The coarse powder of Kwatha dravyas are added with water, boiled and reduced to 12.288 liters, filtered. It is added with honey and Prakshepa Dravyaa powders are added and kept in an air tight container for one month for fermentation. After a month time, it is filtered and preserved. The manufactures of this medicine are Baidyanath, Dabur, AVN, AVP, Vaidik Herbs and Kottakkal Arya Vaidya Sala.

Ashwagandharishtam ingredients:
• Ashwagandha (Withania somnifera) – Root – 2.4 kg
• Mushali (Chlorophytum tuberosum) – Root – 960 g
• Manjishta (Rubia cordifolia) – Root – 480 g
• Haritaki (Terminalia chebula) – Fruit – 480 g
• Nisha – Turmeric – (Curcuma longa) rhizome – 480 g
• Daruharidra (Berberis aristata) – Stem – 480 g
• Yashtimadhu – Licorice – (Glycrrhiza glabra) Root – 480 g
• Rasna (Pluchea lanceolata) – Root / leaf – 480 g
• Vidari (Pueraria tuberosa) – Root – 480 g
• Arjuna (Terminalia arjuna) – stem bark – 480 g
• Mustaka (Cyperus rotundus) – Rhizome – 480 g
• Trivrit (Ipomoea turpethum) – Root – 480 g
• Sariva (Indian sarsaparilla – Hemidesmus indicus) – Root – 384 g
• Krishna Sariva (Cryptolepis buchanani) – Root – 384 g
• Shweta Candana (Santalum album) – heart wood – 384 g
• Rakt Candana (Pterocarpus santalinus) – heart wood – 384 g
• Vacha (Acorus calamus) – Rhizome – 384 g
• Chitraka (Plumbago zeylanica) – Root – 384 g
• water for decoction – 98.304 liters
• Boiled and reduced to 12.288 liters.
• Madhu – Honey – 14.4 kg
• Prakshepa – Dravyas

• Dhatriki - Woodfordia fruticosa – Flower – 768 g
• Shunti – Ginger – (Zingiber officinalis) Rhizome – 96 g
• Maricha – Pepper – (Piper nigrum) fruit – 96 g
• Pippali – Long pepper – (Piper longum) - 96 g
• Twak – Cinnamon – (Cinnamomum zeylanicum) - 192 g
• Ela – Cardmom – (Elettaria cardamomum) - 192 g
• Patra (Cinnamomum tamala) – leaves – 192 g
• Priyangu (Callicarpa macrophylla) – Flower – 192 g
• Nagakeshara (Mesua ferrea) – Stamen – 96 g

The medicinal properties of the ingredients are mentioned here under briefly.

**Ashwagandha – Winter cherry/ Indian Ginseng (root) – Withania somnifera (L.) Dunal**

This plant has medicinal values such as immuno-modulator, aphrodisiac, antitumor, anti-inflammatory, anti stress, antioxidant, sleep inducing, effective in memory related conditions, and cardiopulmonary systems (Uddin et al, 2012) (1). The phyto-constituents present in this plant like Withanoside IV or VI produced dendritic outgrowth in normal cortical neurons of isolated rat cells, whereas axonal outgrowth was observed in the treatment with withanolide A in normal cortical neurons (2). The crude extract of the plant containing the steroidal substances sitoinodosides VII–X and withaferin A augmented learning acquisition and memory in both young and old rats (3).

**Mushali (Chlorophytum tuberosum Baker)**

The tuberous roots are medicinally important and are known commonly as safed musali. Safed musali is used as an aphrodisiac and galactogogue as well as for its nutritive, health promoting properties and immune-enhancing, hepatoprotective and antioxidants activities (4-6). The tubers are also used in fever and leucorrhoea.

**Bhandi (Rubia cordifolia)**

This plant is reported to have medicinal properties like anti-acne, anti-inflammatory, antibacterial and antioxidant (7-12).

**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, antidiabetic, hepato
protective, anti-inflammatory and anti arthritic, anti mutagenic, anti proliferative, radio protective, cardio protective, hypo lipidemic, antispasmodic, Immuno-modulatory and antiviral activities (13).

**Nisha – 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 anti diabetic (14, 15).

**Daruharidra (Berberis aristata)**

*Berberis aristata* is ethno botanically important herb that is used from time immemorial by mankind for the treatment of various ailments. Sharma *et al*, 2011 has reviewed this plant’s therapeutic role such as hepato-protective, hypoglycemic, anticancer, antimicrobial, anti-inflammatory, antioxidant etc. among many other medicinal values (16).

**Yashti – Licorice – Glycrrhiza glabra**

*Glycrrhiza glabra* is known for its medicinal properties such as anti-tussive & expectorant, antioxidant and antibacterial, anti-inflammatory, antiviral, memory enhancer, antifungal, antibacterial, anti-hyperglycemic, immune-stimulatory, hepato-protective, anticancer and anticoagulant (17).

**Rasna (Pluchea lanceolata)**

This plant is used as antiarthritic, antiarhritic and as anti-inflammatory (18).

**Vidari (Pueraria tuberosa)**

Various *in vitro* experimental models earlier have established its anti-oxidant and anti-inflammatory property (19, 21). Some of its other documented biological properties are anti-hyperglycemic, anti-hyperlipidemic, anti-fertility in male rats, and hepatoprotective (22-25). The tubers are rich in isoflavonoids and terpenes with daidzein, puerarin, puertubersoanol, and tuberosin as bioactive phytochemicals (26).

**Arjuna- Terminalia arjuna**

*Terminalia arjuna* is one of the most versatile medicinal plants having a wide spectrum of biological activity. The Hypcholesterolaemic effects of *Terminalia arjuna* tree bark was reported by Ram *et al*, 1997, in rabbits (27). Antioxidant and hypocholesterolaemic effects of *Terminalia arjuna* tree bark powder was reported by Gupta *et al*, 2001 (28). The bark of *T. arjuna* is anti-dysenteric, antipyretic, astringent, cardiotonic, litho-triptic, anticoagulant, hypolipidemic, antimicrobial and antiuremic agent (29-31). Many useful phytoconstituents have been isolated from *T. arjuna* which included triterpenoids for cardiovascular properties, tannins and flavonoids for its anticancer, antimicrobial properties and so on (32). In studies on mice, its leaves have been shown to have analgesic and anti-inflammatory properties (33).

**Mushtaka - Cyperus rotundus**

According to the Ayurveda, *C. rotundus* rhizomes are considered astringent, diaphoretic, diuretic, analgesic, antispasmodic, aromatic, carminative, antitussive, emmenagogue, litholytic, sedative, stimulant, stomachic, vermifuge, tonic and antibacterial. It is also useful for dietary management of psychotic diseases and metabolic disorders (Sivapalan, 2013) (34) They are used in treatment of nausea and vomiting, dyspepsia, colic, flatulence, diarrhoea, dysentery, intestinal parasites, fever, malaria, cough, bronchitis, renal and vesical calculi, urinary tenesmus, skin diseases, wounds, amenorrhoea, dysmenorrhoea, deficient lactation, loss of memory, insect bites, food poisoning, indigestion, nausea, dysuria, bronchitis, infertility, cervical cancer and menstrual disorders, and the aromatic oils are made of perfumes and splash (35, 36).

**Trivrit – Operculina turpethum**

Kohli *et al*, 2010 have given an exhaustive review on the medicinal importance of *Operculina turpethum* (37).This plant has activities such as antisecretory, ulcer protective and anti-inflammatory, hepatoprotective, antibacterial activity, antioxidant and cytotoxic (38-41).

**Shweta and Krishnasariva – Indian Sarsaparila – Hemidesmus indicus**

This plant is a very rich medicinal resource having activities like antiarthritic, anticancerous, antimicrobial, anti-diarrhoeal, anti-inflammatory, antioxidant, hepatoprotective, nootropic and antileprotic (41).
Chandana - *Santalum album*

Sandal is an age old medicinal plant and it is used for many diseases. It has curative roles such as anti hyperglycemic and anti hyperlipidemic, cardio protective, as a brain tonic and anti ulcerogenic (44, 45).

**Rakta Chandana (Pterocarpus santalinus)**

This plant is one of the oldest medicinals having properties like hepato protective, gastro protective, anticancer, antioxidant, anti diabetic and apoptotic (46).

**Vacha - Acorus calamus**

The medicinal properties of *A. calamus* were reported by Kumar and Vandana, 2012 (47). This plant has activities like antiulcer and cyto - protective, analgesic, anti spasmodic, anti-inflammatory, anti convulsant and antibacterial.

**Chitraka - Plumbago zeylanica**

This plant has medicinal roles such as antimicrobial, anti ulcer, anti obesity, anti-inflammatory, hypo cholesterolemic, hepato protective, wound healing, cytotoxic, anticancer and antiproliferative (48).

**Dhataki - Woodfordia fruticosa**

It was reported by Dubey et al, 2014 that the presence of therapeutically potent antimicrobial compounds against MDR bacteria in *Woodfordia fruticosa* and the crude leaf extract had no host toxicity on human lymphocytes (49). n-butanol fraction of the extract was the most suitable bioactive fraction. The terpenes isolated were, phenol, 5-methyl-2-(1-methylethyl)-, phenol, 2-methoxy-4-(2-propenyl)-, 2, 6-octadien-1-ol, 3, 7-dimethyl-(E)-, 2, 6-octadienial, 3, 7-dimethyl-, cyclohexanol, and 2-methylene-5-(1-methylethenyl). The leaves have sedative properties and the juice of its fresh flowers, when applied on the head, supposed to reduce headache. The curative properties of *Woodfordia* are due to the presence of secondary metabolites like alkaloids, flavonoids, glycosides, phenols, saponins, sterols etc. Grover and Patni, 2013 have identified 21 compounds in the GC MS analysis of *Woodfordia* leaf extracts with important medicinal properties (50).

**Sunthi - Zingiber officinalis**

Ginger is also one of the household medicines used against common cold, cough and indigestion. Its medicinal values are well documented. Adel and Prakash, 2014, have reported its antioxidant properties. Ginger controls vomiting and nausea during pregnancy. It controls blood pressure by blocking calcium channels (51).

**Magadhi - Piper longum**

Kumar et al, 2011 have reviewed the various health benefits of *Piper longum*, with many important medicinal values such as anticancer, antioxidant, hepato protective, anti-inflammatory, immunomodulatory, antimicrobial, antihyperlipidemic, analgesic, antidepressant, antiamoebic, vasodialtory, bioavailability enhancer due the presence of piperine in it, anti obesity activity, radio protective, cardioprotective and antifungal activities (52).

**Pepper - Piper nigrum**

Pepper plays a great role in digestions, useful for low appetite, sluggish digestion, abdominal pain, toxins and borborygmus (53). Its anthelmentic qualities help remove worms. The drug stimulates the thermal receptors and increases secretion of salvia and gastric mucous. It has antimicrobial effect. It influences liver and metabolic function, and has insecticidal effect. It has other pharmacological activities like antioxidant, anticonvulsant, sedative, muscle relaxant, antipyretic, anti-inflammatory, antifungal, hepatoprotective, antimicrobial, antulcer and lipolytic (54, 55). Meghwal and Goswami, 2012 have reviewed the chemical and physiological aspects of pepper (56). The dried or fried seeds are used for various culinary and medicinal use. In Ayurveda it is known as Kapha virodhini (works against Phlegm). The decoction of Pepper is used for treating cough.

**Twak – Cinnamon – Cinnamomum zeylanicum**

Almost every part of the cinnamon tree has some medicinal or culinary use. Ranasinghe et al 2013 and Jayaprakasha et al, 2011, have reviewed the medicinal properties of Cinnamon (57, 58).

**Ela - Cardamom - Elettaria cardamomum**

Cardamom is another important culinary ingredient used for its characteristic aroma. Apart from the aroma it has medicinal value. Verma et al, 2009, have reported blood pressure lowering, fibrinolysis enhancing and antioxidant activities of Cardamom (59). Khan et al, 2011 have shown the pharmacological basis of cardamom as medicine for asthma (60).

**Patra - Cinnamomum tamala (Buch.-Ham.)**

Its leaf and bark is used widely as
flavouring agent in various culinary preparations. This tree is valued for its antioxidant, antimicrobial, antibacterial and antidiabetic activities (61).

**Priyangu - Callicarpa macrophylla**

The Ayurvedic Pharmacopeia of India describes the fruits of *Callicarpa macrophylla Vahl* as an essential component of several ayurvedic formulations (62, 63). The plant has been reported to have various medicinal properties. The bark is used to heal cuts and wounds. Seeds and roots are used for digestion and leaves are used for rheumatism. The fruits are used for blisters and boils. The antimicrobial and anti-inflammatory activities of this plant have already proved (64). As many as 20 species from *Callicarpa* have reported ethnomedical uses, and several members among these are well known in the traditional medical systems of China and South Asia. Ethnomedical reports indicate their use in the treatment disorders like hepatitis, rheumatism, fever, headache, indigestion, and other ailments (65). The plant is already reported to have antibacterial, antidiabetic, analgesic and antipyretic, antifungal, anti-inflammatory and anti-arthritic activity (66).

**Nagakesara - Mesua ferrea L.**

This medicinal role of this plant was reviewed by Chahar *et al.*, 2013 (67). It has medicinal activities like antioxidant and hepatoprotective, analgesic, antispasmodic, anti-venom, cancer chemotherapeutic, Immuno-modulatory, anti-neoplastic, anti-convulsant, anti-inflammatory, anti-ulcer and anti-microbial (68-79).

**MATERIAL AND METHODS**

The medicine which is available in liquid form was subjected to GC MS analysis after necessary procedure.

The metabolites in the samples were identified using a P2010 gas chromatography with thermal desorption system T20 coupled with mass spectroscopy (Shimadzu). The ionization voltage 70ev and GC was conducted in the temperature programming mode with a Restek column (0.25mm, 60m, XTI-5). The temperature in the initial column was 80°C for 1 min, and then increased linearly to 70°C to 220°C held for 3 min followed by linear increased temperature 100° C up to 290°C and held for 10min. The injection port temperature was 290° C and the GC/MS interface was maintained at 29°C, the samples were introduced via an all glass injector working in the split mode with helium carrier gas low rate with 1.2 ml per minute. The identification of metabolites was accomplished by comparison of retention time and fragmentation pattern with mass spectra in the NIST spectral library stored in the computer software (version 1.10 beta, Shimadzu) of the GC-MS. The relative percentage of each extract constituent was expressed with peak area normalization.

**RESULTS AND DISCUSSION**

The GC MS analysis graph is presented in Figure 1. Table 1 represents the retention time, percentage peak values, molecular formulae, molecular weights of possible types of compounds present in the GC MS analysis.

The possible medicinal roles of each of the compounds represented in the GC MS are mentioned below referring Dr.Duke’s Phytochemical and Ethnobotanical Data base and others.

<table>
<thead>
<tr>
<th>Compound</th>
<th>Medicinal Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 1'- (Methyl-1, 2-ethanediyldiene) bis(cyanoacetoxydrazide):</td>
<td>Catechol-O-methyl-Transferase – Inhibitor and Methyl donor.</td>
</tr>
<tr>
<td>2. Propanenitrile, 3-chloro:</td>
<td>Not Known.</td>
</tr>
<tr>
<td>3. Dichloroacetic acid, allyl ester:</td>
<td>Acidifier, Arachidonic acid inhibitor, Increase aromatic amino acid decarboxylase activity, inhibit uric acid production</td>
</tr>
<tr>
<td>4. Pyridine, 2,3,4,5-tetrahydro-</td>
<td>Not Known.</td>
</tr>
<tr>
<td>5. E-2-Octadecaden-1-ol:</td>
<td>Oligosaccharide provider, anticancer, antidote, Cytochrome-P450 2E1-Inhibitor, Decrease Epinephrine Production.</td>
</tr>
<tr>
<td>7. Tramadol:</td>
<td>It is opioid pain medicine used for moderate to severe pain.</td>
</tr>
<tr>
<td>9. Cyclopropanecarboxylic acid, isobornyl ester:</td>
<td>Acidifier, Arachidonic acid inhibitor, Increase aromatic amino acid decarboxylase activity, inhibits uric acid production</td>
</tr>
<tr>
<td>10. R-lavandulyl acetate:</td>
<td>anti-inflammatory</td>
</tr>
<tr>
<td>11. Geranyl vinyl ether:</td>
<td>anti-microbial, anticancer</td>
</tr>
</tbody>
</table>
and antimalarial
12. 4-Amino-1, 5-pentandioic acid: Acidifier, Arachidonic acid inhibitor, Increase aromatic amino acid decarboxylase activity, inhibit uric acid production
14. Dichloroacetic acid, allyl ester: Acidifier, Arachidonic acid inhibitor, Increase aromatic amino acid decarboxylase activity, inhibit uric acid production,
15. 1-(3-Acetamidophenyl)-3-(2,2,2-trichloro-1-isovaleramidoethyl)-2-thiourea : Not known
16. 3-Methyl-2-butenolic acid, propyl ester: Acidifier, Arachidonic acid inhibitor, Increase aromatic amino acid decarboxylase activity, inhibit uric acid production
17. 3-Phenylpropionaldehyde: Antibacterial
19. Pipradrol: Psychotic activity, anticonvulsant
20. Formyl glutamine: Amino acid derivative
21. Eugenol or Phenol, 2-methoxy-3-(2-propenyl): Synthetic Eugenol has been reported to have many important medicinal properties as is described by many reporters. It has medicinal roles such as antifungal, antioxidant, anticonvulsant and local anaesthetic, antistress and bactericidal, bactericidal, Anticarcinogenic, deresses activity of central nervous depressant, anti radiation, antiviral, induces apoptosis in melanoma cells and HL-60 leukemia cells (80-86).
22. d-Mannose: 17-beta- hydroxysteroid dehydrogenase inhibitor, Anticancer (Duodenum), Circulatory depressant, CNS- Depressant, Coronary dilator, Cyclin-D1-Inhibitor, Decongestant, Decrease endothelial Platelet adhesion
23. Desulphosinigrin: Not known
24. L-Glucose: Glucose-6-Phosphate Inhibitor, Anti LDL, Decrease lactate, 12-Lipoxygenase-Inhibitor
25. Asarone: is a known antifungal (87).
26. Folic Acid: Acidifier, Arachidonic acid inhibitor, Increase aromatic amino acid decarboxylase activity, inhibit uric acid production
27. Pyrroline-1, 7-dione-6-carboxylic acid, methyl(ester): Acidifier, Arachidonic acid inhibitor, Increase aromatic amino acid decarboxylase activity, inhibit uric acid production
28. Gentamicin a: 5-Alpha Reductase inhibitor, Acetylene cholin antagonist, AChE Inhibitor, Adaptogen
29. Tricyclo[4.4.0.0(2,7)]dec-8-ene-3-methanol, a,a,6,8-tetramethyl-, stereoisomer
30. (-)-Spathulenol Antioxidant and anti-inflammatory activities
31. 1H-Cycloprop[a]cyclopenta-7,10-dien-1,7,17-trimethyl-4-methylenec-, [1ar-(1a,4a,7a,7a,7b)]- Antiobesity
32. ethyl- methyl ester; Catechol-O-Methyl Transferase Inhibitor, Methyl Donor, Methyl Guanidine inhibitor
33. Methyl 9-methyltetradecanoate: Catechol-O-Methyl-Transferase Inhibitor, Methyl-Donor.
35. Hexadecanoic acid, 14-methyl-, methyl ester: Catechol-O-Methyl-Transferase Inhibitor, Methyl-Donor.

Fig. 1. The GC MS profile of Aswagandharishtam.
Table 1. Represents the retention time, percentage peak values, molecular formula, molecular weights of possible types of compounds present in the GC MS analysis

<table>
<thead>
<tr>
<th>S.No</th>
<th>Retention Time</th>
<th>% Peak Value</th>
<th>Name</th>
<th>Formula</th>
<th>Mol. Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4.327</td>
<td>0.564</td>
<td>Chloromethanesulfonyl chloride</td>
<td>CH₂Cl₂SO₂</td>
<td>143</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1,1’-[[1-Methyl-1,2-ethanediylidenebis(cyanoacetohydrazide) Propanenitrile, 3-chloro-]</td>
<td>CH₉H₁₀N₆</td>
<td>234</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>E-2-Octadecadecan-1-ol</td>
<td>C₁₈H₃₆O₂</td>
<td>268</td>
</tr>
<tr>
<td>2</td>
<td>4.695</td>
<td>4.181</td>
<td>Phenyethyl Alcohol</td>
<td>C₈H₁₀O</td>
<td>122</td>
</tr>
<tr>
<td>3</td>
<td>4.575</td>
<td>0.506</td>
<td>Dichloroacetic acid, allyl ester</td>
<td>C₅H₈Cl₂O₂</td>
<td>163</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pyridine, 2,3,4,5-tetrahydro-</td>
<td>C₅H₇N</td>
<td>83</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>E-2-Octadecadecan-1-ol</td>
<td>C₁₈H₃₆O₂</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>5.249</td>
<td>0.416</td>
<td>Pyrrolidine, 1-[3-chloro-4,4,4-trifluoro-2-phenyl-2-butenyl]-Tramadol</td>
<td>C₁₄H₁₅ClF₃N</td>
<td>289</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Acetamide, H-[2-cyano-4,5-dimethoxyphenyl]-2-[pyrrolidin-1-y]-</td>
<td>C₁₅H₁₉N₂O₂</td>
<td>263</td>
</tr>
<tr>
<td>5</td>
<td>5.743</td>
<td>0.012</td>
<td>Cyclopropeneboronic acid, isobornyl ether</td>
<td>C₁₄H₁₂O₂</td>
<td>222</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>n-levandulyl acetate</td>
<td>C₁₂H₂₀O₂</td>
<td>196</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Geranyl vinyl ether</td>
<td>C₁₂H₂₀O</td>
<td>180</td>
</tr>
<tr>
<td>6</td>
<td>6.084</td>
<td>0.571</td>
<td>4-Amino-1,5-pentandiol acid</td>
<td>C₇H₁₃N₄</td>
<td>175</td>
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<td></td>
<td></td>
<td></td>
<td>Ethyl hydrogen succinate</td>
<td>C₅H₁₀O₄</td>
<td>146</td>
</tr>
<tr>
<td>7</td>
<td>6.130</td>
<td>0.597</td>
<td>Dichloroacetic acid, allyl ester</td>
<td>C₅H₈Cl₂O₂</td>
<td>168</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1-[4-Acetamidophenyl]-[2,2-dichloro-1-isovalerimidoyl]-2-ethyl</td>
<td>C₁₅H₁₃Cl₂N₂O₂</td>
<td>483</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3-Methyl-2-butenic acid, propyl ester</td>
<td>C₈H₁₀O₂</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>6.311</td>
<td>2.757</td>
<td>3-Phenylpropanol</td>
<td>C₅H₁₀O₂</td>
<td>136</td>
</tr>
<tr>
<td>9</td>
<td>6.877</td>
<td>0.423</td>
<td>Furin-2-one, 3,4-dihydroxy-5-[1-hydroxy-2-fluoroethyl]-</td>
<td>C₁₃H₂₁N₁O</td>
<td>267</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pipradrol</td>
<td>C₁₃H₁₉O₅</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Formylglutamine</td>
<td>C₁₃H₁₁O₇</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>7.846</td>
<td>1.118</td>
<td>Phenol, 2-methoxy-3-[2-propenyl]-Eugenol</td>
<td>C₁₀H₁₂O₂</td>
<td>164</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Desulphosinigrin</td>
<td>C₁₀H₁₇N₁O₅</td>
<td>180</td>
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<td>L-Glucose</td>
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<td>12</td>
<td>10.939</td>
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<td>Folic Acid</td>
<td>C₁₃H₁₈N₇O₅</td>
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<td>Gentamicin a</td>
<td>C₁₃H₁₈N₆O₄</td>
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<td>13</td>
<td>11.779</td>
<td>0.494</td>
<td>Pyrroclin-1, 7-dione-6-carboxylacid, methyl(ester)</td>
<td>C₁₃H₁₇N₆O₁₀</td>
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<td>14</td>
<td>13.979</td>
<td>1.579</td>
<td>Tricyclo[4,4,0.0(7,7)]dec-8-ene-3-methan, â₈,â₈,â₈-tetrahexyl-, stearosanol</td>
<td>C₁₅H₂₄O</td>
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<td>(1S)-Isomaronol</td>
<td>C₁₅H₂₄O</td>
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<td>1H-Cycloprop[e]azulen-7-ol, decahydro-1,1,7-trimethyl-4- methylene-</td>
<td>C₁₅H₂₄O</td>
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<td></td>
<td>1a,1a,â,â,â,7a,7a,7a,7a,7a)-</td>
<td>C₁₅H₂₄O</td>
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<td>15</td>
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<td>0.524</td>
<td>Cyclopropenebunroanic acid, z-[[2-[2-(2-pyryldiethyl</td>
<td>methyl]cyclopropyl]methyl]cyclopropyl</td>
<td>methyl ester</td>
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<td>Methyl 9-methyltetradecanoate</td>
<td>C₁₆H₃₂O₂</td>
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<td>Hexadecanoic acid, 14-methyl-, methyl(ester)</td>
<td>C₁₆H₃₂O₂</td>
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<td>16</td>
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<td>7.380</td>
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<td>17</td>
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<td>trans-13-Octadeconoic acid</td>
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<td>Squalene</td>
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<td>17'-[1,5-Dimethoxyhexyl]-10,10-dimethyl-2,2,4,7,8,9,10,11,12,13,14,15,16,17-tetradecahydro-1-Hcyclopenta[</td>
<td>C₂₇H₄₆O</td>
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<td>azaphenanthren-2-ol</td>
<td>C₂₂H₃₄O₂</td>
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<tr>
<td>22</td>
<td>25.356</td>
<td>0.426</td>
<td>Prostaglandin A2</td>
<td>C₂₀H₃₀O₄</td>
<td>334</td>
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<td>7,9-Oh-l-eryth-buty-1-oxaspiro(4,5)dec-a-9-diene-2,8-dione</td>
<td>C₁₇H₂₄O₃</td>
<td>275</td>
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<td>Prostaglandin A2</td>
<td>C₂₁H₂₄O₂</td>
<td>316</td>
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</table>
36. Hexadecanoic acid: Hexadecanoic acid is reported to have activities like antioxidant, hypocholesterolemic, nematicide, antiandrogenic, as flavoring agents, hemolytic, antibacterial and cytotoxic and as 5-alpha reductase inhibitor (88, 89).

37. cis-Vaccenic acid: Acidifier, Arachidonic acid inhibitor, Increase aromatic amino acid decarboxylase activity, inhibit uric acid production

38. Oleic Acid: Antiinflamatory, Antiandrogenic, cancer preventive, hypercholesterolemic, 5-alpha reductase inhibitor (90).

39. trans-13-Octadecenoic acid: Acidifier, Arachidonic acid inhibitor, Increase aromatic amino acid decarboxylase activity, inhibit uric acid production

40. Octadecanoic acid: Octadecanoic acid esters are reported to be antiviral, antibacterial and antioxidant activities (91).


42. Piperine: Piperine has diverse biological and supportive therapeutic activities like radioprotective, immunomodulatory and anti tumor activities, antidepressant, anticonvulsant, antinociceptive, and anti-arithmetic. It helps in the absorption of selenium, vitamin B and Beta carotene as well as other nutrients. Among the various properties of piperine, the most important is that it facilitates the bioavailability of medicines by depressing the activity of drug metabolizing enzymes (93).

43. Cholesterol: Cholesterol is precursor for steroid synthesis and is a very important biomolecule.

44. Prostaglandin A2: Prostaglandin-Synthetase-Inhibitor, Prostaglandin Secretor, Inhibit AA-series- Prostaglandin synthesis


46. 7,9-Di-tert-butyl-1-oxaspiro(4,5)dec-6,9-diene-2,8-dione: Decalcifier, Decarboxylase inhibitor, DOPA decarboxylase inhibitor, Histidine decarboxylase inhibitor, Coronary dialator

47. Pregn-4-en-3-one, 20-hydroxy-, (20R) - Antibiotic.

CONCLUSIONS

The GC MS analysis of Aswagandharishtam has shown some promising molecules like prostaglandin A2, Cholesterol, Piperine, Gentamicin a, d-Mannose, Eugenol, Pipradrol etc. which have a activities similar to that of Aswagadharishtam. This is a preliminary report and further work is on to prove the efficacy of this medicine by other parameters.

ACKNOWLEDGEMENTS

The authors are indebted to all who have directly or indirectly helped in this work.

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