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# GC - MS PROFILING OF MAHAMASHA TAILA AND ITS ROLE IN SENSORINEURAL HEARING LOSS

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## ABSTRACT
Mahamasha taila is an Ayurvedic oil preparation described in Bhaishajyaratnavali under Vatavyadhi Chikitsa prakarana.It is a preparation which gives excellent results in neurological cases. Traditionally it is also used as Nasya and Karnapurana for neurological and auditory disorders. The present study aimed to analyse the phytoconstituents of Mahamashataila using Gas Chromatography – Mass Spectometry (GC-MS) and to corelate its bioactive components with possible otoprotective and neuro regenerative effects which is helpful in managing Sensorineural hearing loss). The GC–MS analysis revealed 50 phytoconstituents, with major peaks corresponding to 9-Octadecenoic acid (Z)-, 2,3-dihydroxypropyl ester (55.66%), Heptadecanoic acid, 14-methyl-, methyl ester (6.12%), and Octadecanoic acid, 3-hydroxy-2-tetradecyl-, methyl ester (14.76%). These compounds are having anti-inflammatory, antioxidant and neuroprotective properties. These results provide a scientific basis for the therapeutic use of Mahamasha taila in the management of SNHL.

**KEYWORDS:** Mahamasha taila, Vatavyadhi, Vataja Badhirya, Karnapurana, Nasya, Sensorineural hearing loss.

## INTRODUCTION
Ayurveda is the science of life. From ancient time's itself, it has shown its effectiveness in managing degenerative and neurological disorders. As per Ayurveda neurological and degenerative disorders are generally grouped under Vatavyadi. Hearing loss or reduced hearing is one among the common problems faced by the older age group, also in the present era irrespective of the age many are being affected with the same. Once affected it will definitely decrease the quality of life. Among various types of hearing losses Sensorineural hearing loss results from damage to the hair cells within the ear, Vestibulocochlear nerve or central processing areas of brain (1). The signs and symptoms of sensorineural hearing loss can be compared with Vataja Badhirya one among the Vatika disorders of ear. The best Samana Oushadhi for aggravated Vata is the usage of Taila in various forms. For Vataja Badhirya Karnapurana, instillation of medicated oil directly to ear as drops, Nasya instillation of medicated drops into the nostrils, Shiropichu application of oil for a specific time over Sringataka Marma, Basti administration of medicated enema and Snehapana internal administration of medicated fat are few methods we can practise for pacifying Vata. Mahamasha taila is a classical Ayurvedic medicated oil that shows excellent results in Vatika disorders.It is mentioned in Brhatrayi and Lagutrayi in Vatavyadhi Rogadhikara prepared with Masha (Phaseolus mungo) as the main ingredient along with other herbs processed with Tila Taila as a base and fortified with various Dravyas, including Aja mamsa having Vata Shamaka and Brimhana properties (2).

## MATERIALS AND METHODS
Mahamasha Taila has been procured from Arya Vaidya Sala Kottakkal, Kerala.Gas chromatography- Mass spectrometry (GC-MS) analysis was carried out at Amrith Labs,Nisargram Pvt. Ltd, Shimoga, Karnstaka. 1 gm of the oil was extracted with 10ml of acetone to ensure maximum recovery of volatile and semivolatile compounds. The extract was filtered to remove impurities and 1 µL of the prepared solution was injected into the GC-MS system for analysis. The instrument used was Shimadzu GC-MS QP- 2010 SE model. High purity helium was used as the carrier gas. The compounds were identified by compairing their retention time and mass fragmentation patterns with the National Institute of Standards and technology (NIST) library fata base.Peak area normalization was employed for semi- quantitative analysis of the detected phytoconsstituents.

## RESULTS
GC-MS analysis of Mahamashataila identified 50 compounds. The major constituemt were
Other significant compounds include

Table 1 GC-MS compounds of Mahamasha Taila.

| Sl. No | Peak # | R time | Compound name | Area | Area % | Height | Cas# |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 5.113 | Hexanoic acid, methyl ester | 70771582 | 0.65 | 31082377 | 106-70-7 |
| 2 | 2 | 8.299 | Octanoic acid, methyl ester | 56063407 | 0.52 | 37046365 | 111-11-5 |
| 3 | 3 | 11.268 | 4-Decenoic acid, methyl ester, Z- | 12534313 | 0.12 | 4748887 | 7367-83-1 |
| 4 | 4 | 11.434 | Decanoic acid, methyl ester | 130045538 | 1.20 | 45460735 | 110-42-9 |
| 5 | 5 | 16.032 | Cyclopropanenonanoic acid, methyl ester | 4698658 | 0.04 | 2090933 | 10152-60-0 |
| 6 | 6 | 16.116 | Tetradecanoic acid, 12-methyl-, methyl ester | 203211562 | 1.87 | 84922021 | 5129-66-8 |
| 7 | 7 | 17.030 | Tridecanoic acid, methyl ester | 2426742 | 0.02 | 1296178 | 1731-88-0 |
| 8 | 8 | 17.493 | Methyl tetradecanoate | 5817169 | 0.05 | 2840199 | 124-10-7 |
| 9 | 9 | 18.212 | Methyl tetradecanoate | 12593990 | 0.12 | 7453116 | 124-10-7 |
| 10 | 10 | 18.348 | 5-Octadecenoic acid, methyl ester | 1328020 | 0.01 | 850010 | 56554-45-1 |
| 11 | 11 | 18.486 | Methyl myristoleate | 61937639 | 0.57 | 36080805 | 56219-6-8 |
| 12 | 12 | 18.608 | Octadecanoic acid, 3-hydroxy-2-tetradecyl-, m | 413871863 | 3.80 | 133036386 | 18951-36-5 |
| 13 | 13 | 19.072 | Pentacosanoic acid, 4-methyl-, methyl ester | 1337168 | 0.01 | 773797 | 55281-93-1 |
| 14 | 14 | 19.189 | Pentadecanoic acid, 14-methyl-, methyl ester | 23996803 | 0.22 | 14890889 | 5129-60-2 |
| 15 | 15 | 19.270 | Tetradecanoic acid, 12-methyl-, methyl ester, ( | 46303870 | 0.43 | 26693518 | 62691-5-8 |
| 16 | 16 | 19.387 | 6-Octadecenoic acid, methyl ester, (Z)- | 5146925 | 0.05 | 2689393 | 2777-58-4 |
| 17 | 17 | 19.516 | Tridecanoic acid, 12-methyl-, methyl ester | 83957850 | 0.77 | 51063569 | 5129-58-8 |
| 18 | 18 | 20.046 | Pentadecanoic acid, 14-methyl-, methyl ester | 25997355 | 0.24 | 14401036 | 5129-60-2 |
| 19 | 19 | 20.120 | 7,10-Hexadecadienoic acid, methyl ester | 2374620 | 0.02 | 1441767 | 16106-3-9 |
| 20 | 20 | 20.203 | 7-Hexadecenoic acid, methyl ester, (Z)- | 231537847 | 2.13 | 103483448 | 56875-67-3 |
| 21 | 21 | 20.408 | Octadecanoic acid, 3-hydroxy-2-tetradecyl-, m | 1606183603 | 14.76 | 132177948 | 18951-36-5 |
| 22 | 22 | 20.515 | 7,10-Hexadecadienoic acid, methyl ester | 2854331 | 0.03 | 1158159 | 16106-3-9 |
| 23 | 23 | 20.663 | Cyclopentanetridecanoic acid, methyl ester | 1095888 | 0.01 | 672345 | 24828-61-3 |
| 24 | 24 | 20.732 | Oxiraneundecanoic acid, 3-pentyl-, methyl est | 2083401 | 0.02 | 1164971 | 38520-30-8 |
| 25 | 25 | 20.816 | Pentadecanoic acid, 14-methyl-, methyl ester | 29231755 | 0.27 | 16283096 | 5129-60-2 |
| 26 | 26 | 20.888 | Heneicosanoic acid, methyl ester | 39036169 | 0.36 | 22175526 | 6064-90-0 |
| 27 | 27 | 20.943 | 9-Octadecenoic acid (Z)-, methyl ester | 44413610 | 0.41 | 23440353 | 112-62-9 |
| 28 | 28 | 21.084 | Heptadecanoic acid, methyl ester | 84030409 | 0.77 | 41021704 | 1731-92-6 |
| 29 | 29 | 21.370 | 9,12,15-Octadecatrienoic acid, methyl ester, (Z | 2585313 | 0.02 | 765106 | 301-0-8 |
| 30 | 30 | 21.744 | 9-Octadecenoic acid (Z)-, 2,3-dihydroxypropy | 6056465739 | 55.66 | 667794808 | 111-3-5 |
| 31 | 31 | 21.832 | Heptadecanoic acid, 14-methyl-, methyl ester | 665356396 | 6.12 | 331493324 | 2490-23-5 |
| 32 | 32 | 21.936 | 9,11-Octadecadienoic acid, methyl ester, (E,E) | 58398076 | 0.54 | 31465021 | 13038-47-6 |
| 33 | 33 | 22.110 | 12,15-Octadecadienoic acid, methyl ester | 5861834 | 0.05 | 2609461 | 57156-97-5 |
| 34 | 34 | 22.186 | 9,11-Octadecadienoic acid, methyl ester, (E,E) | 41373312 | 0.38 | 26400482 | 13038-47-6 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 35 | 35 | 22.278 | 9-Octadecenoic acid (Z)-, methyl ester | 11012930 | 0.10 | 6400790 | 112-62-9 |
| 36 | 36 | 22.413 | Pentadecanoic acid, 14-methyl-, methyl ester | 8209529 | 0.08 | 5397709 | 5129-60-2 |
| 37 | 37 | 22.590 | 8,11,14-Eicosatrienoic acid, (Z,Z,Z)- | 2436736 | 0.02 | 567577 | 1783-84-2 |
| 38 | 38 | 22.721 | Arachidonic acid | 5715335 | 0.05 | 2897328 | 506-32-1 |
| 39 | 39 | 22.817 | Cyclopropaneoctanoic acid, 2-[[2-[(2-ethylcyc | 24104218 | 0.22 | 7145075 | 10152-71-3 |
| 40 | 40 | 22.938 | 9-Octadecenoic acid (Z)-, methyl ester | 187016032 | 1.72 | 61823523 | 112-62-9 |
| 41 | 41 | 23.090 | Tetradecanoic acid, 12-methyl-, methyl ester | 199982540 | 1.84 | 102075434 | 5129-66-8 |
| 42 | 42 | 23.863 | Heneicosanoic acid, methyl ester | 4268069 | 0.04 | 2044519 | 6064-90-0 |
| 43 | 43 | 24.389 | 9,12-Octadecadienoyl chloride, (Z,Z)- | 169273133 | 1.56 | 57728476 | 7459-33-8 |
| 44 | 44 | 24.475 | Pinolenic acid | 4833566 | 0.04 | 1720753 | 16833-54-8 |
| 45 | 45 | 24.589 | 13-Docosenoic acid, methyl ester, (Z)- | 46762138 | 0.43 | 15103849 | 1120-34-9 |
| 46 | 46 | 24.791 | Docosanoic acid, methyl ester | 71527776 | 0.66 | 26279948 | 929-77-1 |
| 47 | 47 | 25.913 | Docosanoic acid, methyl ester | 9713430 | 0.09 | 2979880 | 929-77-1 |
| 48 | 48 | 27.000 | 9-Octadecenoic acid (Z)-, methyl ester | 9442825 | 0.09 | 2422279 | 112-62-9 |
| 49 | 49 | 27.290 | Tetracosanoic acid, methyl ester | 77717320 | 0.71 | 19720667 | 2442-49-1 |
| 50 | 50 | 31.101 | Hexacosanoic acid, methyl ester | 13486470 | 0.12 | 2452212 | 5802-82-4 |

Table 2 Major components with pharmacological action

| Sl.no | Peak No. | Compound | Area % | Pharmacological activity | Ayurvedic interpretation |
|---|---|---|---|---|---|
| 1 | 30 | 9-Octadecenoic acid(Z)-,2,3-dihydroxypropyl ester | 55.66 | Antioxidant (3) Neuroprotective (4) Membranestabilizer (5,6) | Vata-shamana, Majja dhatu poshana |
| 2 | 21 | Octadecanoic acid, 3-hydroxy-2-tetradecyl-,methyl ester,(2R,3R) | 14.76 | Neuro protective, anti-inflammatory (7) | Supports Shrotra indriya,Prevents Srotorodha |
| 3 | 31 | Heptadecanoic acid, 14-methyl-,methyl ester | 6.12 | Anti-inflammatory, Metabolic support (8) | Balances Vata, improves meda and majja dhatu |
| 4 | 27/40/48 | 9-Octadecenoic acid (z)-,methyl ester | 3.0 | Antioxidant, Anti-inflammatory (9,10) | Enhances snigdha guna, Reduces Vata aggravation |
| 5 | 50 | Hexacosanoic acid, methyl ester | 0.12 | Myelinstabilizer, Neuroproctive (11,12) | Supports majja dhatu. Protects Shrotrendriya |
| 6 | 38 | Arachidonic acid | 0.05 | Inflammatory mediator, Precursor of eicosanoids (13,14) | Modulates Shotha and dosha avarana |

**DISCUSSION**

The GC-MS profile of Mahamasha taila reveals that it contains various types of bioactive compounds, including fatty acid esters, long -chain hydrocarbons and other lipid -soluble molecules. Each compounds have a specific role in managing Badhirya.

Vata-shamana and Snigdha Guna

Oleic, Stearic and palmitic derivatives are fatty acid esters, they are naturally unctuous, that is Snigdha as per Ayurveda (15). Snigdha guna helps in pacifying aggravated Vata dosa (16). snigdha and Mardava Guna helps in restoring neuromuscular balance where Vata Dosha has the major role (17). Various studies revel that lipid-based substances which are rich in essential fatty acids helps in maintaining neuronal stability, myelin repair and regulating inflammatory action. (18).

Majja Dhatu poshana and Myelin protection

Long chain fatty acid derivatives such as Hexacosanoic acid methyl ester and docosanoic acid methyl ester enhances neuronal myelin stability and protect it (19-21). Maintenance of membrane stability accounts with Ayurvedic concept of Majja Dhatu Poshana. In SNHL that is Vatja Badhirya degeneration of nervous tissue and depletion of neural strength and unctuousness can be attributed to Vata Prakopa and Majjadathu Kshaya (22). In Samhitas it is clearly mentioned that usage of Sneha will definetly help in restoring Dhatu Kshaya and maintain neural steadiness (23). Thus, the neuroprotective role of these compounds can be explained.

Shrotrendriya Brmhana (Auditory Sensory Support)

Cochlear degeneration is one among the cause for SNHL, it can be due to the free radical injury to cochlear hair cells (24-25). Studie's reveals that anti-oxidants can reverse the oxidative stress and protects cochlear structure. Here Mahamashataila is rich in antioxidants, including essential fatty acids as oleic, linoleic and arachidonic acid derivatives (26).

Thus, it can be interpreted how an Ayurvedic treatment procedures like Karnapurana with oil does local regeneration and maintains a healthy ear (27-28). In classics there are references regarding Vata Samana and Majja dhatu poshana helps in proper functioning of shrothrendriya, which reflects the relation between lipid- based neuro protection and classical therapis (29).

Roga marga Avarana and Inflammatory control

Srotorodha results in Avarana which causes Shotha. If there is Srothorodha in ear or in its pathway it leads to Avarana and causes inflammatory changes in auditory pathway.Mahamasha taila contains Heptadecanoic acid, Linoleic acid and arachidonic acid derivatives they are having anti- inflammatory properties (30-32). These fatty acids modulate''s the inflammatory pathways and maintain proper cochlear and auditory nerve function, which can be compaired to Srothorodha Nivarana.

Avarana plays a major role in developing Vataja Badhirya in such conditions anti inflammatory type of management to be adopted in ordere to restore hearing (33-34). The presence of anti- inflammatory derivatives in Mahamashataila thus justifies the concept of Karnapurana and Nasya with the same for Badhirya.

**Local otoprotective role.**

Nasya and Karnapurana are two treatment modalities adopted in Badhirya. Nasa paves the way to Shiras, so through Nasya procedure medicine will be entering to the higher centers of brain via olfactory pathway (35-36). Lipids can cross the blood brain barrier, so the lipids with neuroprotective properties if carefully administered through the nostrils in the form of Nasya cross the cribriform plate and provide the desired effects (37). Like wise, Karnapurana also guaranteed the otoprotective and nourishing actions by delivering the drugs through external auditory canal and its absorption from there (38).

Analysis of Mahamasha taila through GC-MS profiling revels various components processing anti -inflammatory, anti-oxidant and neuro protective effects. These results validate the use of Mahamashataila in Vatavyadhi especially in Sensorineural hearing loss in the form of Nasya and Karnapurana.

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