RESEARCH PAPER

Pharmaceutical and analytical evaluation of Bhalltaka Ghrita

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ABSTRACT

Introduction: *Bhallataka Ghrita* is a classical *Ayurvedic* medicated ghee preparation containing *Semecarpus anacardium* Linn. as the principal ingredient. It is traditionally indicated in disorders such as *Kushta* (skin diseases), *Arsha* (hemorrhoids), and as a *Rasayana.* Due to the toxic nature of raw *Bhallataka*, purification (*Shodhana*) and processing with *ghrita* are essential to ensure safety and therapeutic efficacy. The present study aimed to standardize the pharmaceutical preparation and analytically evaluate *Bhallataka Ghrita.*

Materials and Methods: *Bhallataka* fruits were purified using *Narikela jala* through the *Dola Yantra Swedana* method. *Murchita ghrita* was prepared using *Triphala, Musta, Haridra,* and *Matulunga swarasa*. *Bhallataka Ghrita* was then prepared following the classical *Sneha Paka* procedure. Organoleptic and physicochemical parameters were assessed for raw, intermediate, and final products. Advanced analytical techniques including Gas Chromatography–Mass Spectrometry (GC–MS) and High Performance Thin Layer Chromatography (HPTLC) were performed for phytochemical profiling.

Results: Physicochemical analysis indicated acceptable quality parameters with moisture content of 1.824% and negative rancidity. GC–MS analysis identified several bioactive compounds including palmitic acid, cis-vaccenic acid, stearic acid, and myristic acid, with 2,4,6-Trimethyl-2-(4-methyl-pent-3-enyl)-2H-pyran as the major component. HPTLC profiling revealed multiple phytoconstituents with prominent peaks at Rf values around 0.36–0.77.

Conclusion: The study established preliminary pharmaceutical and analytical standards for *Bhallataka Ghrita* and confirmed the presence of diverse lipid-soluble phytochemicals, supporting the scientific basis of this traditional *Ayurvedic* formulation.

Keywords: *Bhallataka Ghrita*, *Semecarpus anacardium*, *Sneha Kalpana*, GC–MS, HPTLC, lipid based herbal formulation.

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INTRODUCTION

Bhallataka Ghrita is a medicated ghee (*Sneha Kalpana*) formulation containing *Bhallataka* (*Semecarpus anacardium* Linn.) as the main ingredient, processed with *Murchita ghrita*. It is extensively used in *Ayurveda* for treating skin diseases (*Kushta*), hemorrhoids (*Arsha*), and as a *Rasayana* (rejuvenator).[01] Due to the toxic nature of raw *Bhallataka*, it undergoes purification (*Shodhana*) and *Sneha Paka* (processing in ghee) to enhance therapeutic efficacy and safety. The preparation typically involves *Shodhana* (purification) of *Bhallataka* using *Gomutra* (cow urine), *Godugdha* (cow milk), *Narikela Jala* and *Ishtikachurna* (brick powder) to reduce toxicity[02.] In this study *Narikela jala* was used as a liquid media for the *shodhana* of *Bhallataka. Bhallataka (Semecarpus anacardium* Linn, Family: Anacardiaceae) is found in tropical, central, and sub-Himalayan regions of India. It is commonly named as dhobhi nut or marking nut having vernacular names like *Bhallataka, bhilwa* etc. Its strong therapeutic efficacy can be seen in both traditional as well as folklore medical system. *Acharya Charaka* listed ten

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Bhallataka formulations particularly for *Rasayana* purposes.

Various chemical and phytochemicals tests of the nut

Ingredients	Quantity
Ashuddha Bhallataka After removing of thalamus After cut into two parts	1.279 kg 1.212 kg 1.200 kg
Narikela jala	12 ltrs

shows the presence of tannins, bhilwanols and bhilwanoids etc. according to the drug and cosmetic act 1940 it is classified under poisonous substances in schedule E1 medications. Therefore it should be used therapeutically only after proper *shodhana*[03].

In this study the purified fruit is processed with *Murchita ghrita. Murchana Samskara* is done using cow ghee treated with specific herbs such as *Triphala, Haridra* and *Musta*. This preparation enhances the shelf life, aroma, and therapeutic action of the ghee. The final product is typically a semi-solid, yellowish-brown, and has a characteristic odour[04].

Advanced spectrometric and chromatography methods that is GCMS and HPTLC were used including retention time analysis and mass spectrometric detection. Spectral data were processed using several databases for precise annotation of compounds. Furthermore, important parameters include molecular weight, chemical structure, base peak intensity patterns were noted to aid in structural elucidation.[05]

MATERIALS AND METHODS

A standard operative procedures was followed for the preparation of the study drug *Bhallataka Ghrita* and study was carried out in the department of *Rasashastra and Bhaishajya Kalpana* KAHER's Shri BMK Ayurveda Mahavidyalaya, Belgavi.

1. **Procurement:** All the raw materials were collected from GMP certified KLE Ayurveda pharmacy Belgavi.
2. **Authentication and analysis of raw drugs:** The sample of all procured and collected drugs were authenticated and its analytical data was collected from approved drug testing laboratory for ASU drugs in KAHER's Shri. B.M.K Ayurveda Mahavidyalaya, Belagavi and other recognized drug testing laboratory.

PREPARATION OF STUDY DRUG:

Selection of *Bhallataka*[06]

Pakva phala was selected and was dipped in water, one which sinks, that *Bhallataka* was taken for shodhana.

Shodhana of *Bhallataka*[07]

The *Bhallataka* seed bases was cut and taken in a cloth. Then a *pottali* was tied and placed in *dola yantra* consisting of freshly collected tender coconut water as liquid media. The process of *swedana* was carried out for 3hrs. Later the *Bhallataka* was taken out, washed with warm water and preserved for further pharmaceutical procedure.

Temperature noted down every 30 mins.

Ph was noted before *shodhana*, in between and after *shodhana* process.

Table 01

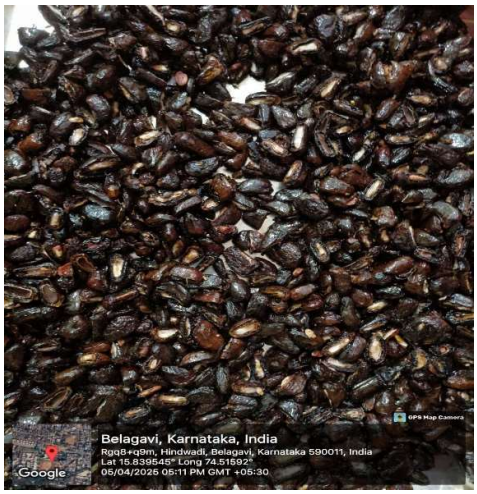


Image-1 Bhallataka after cut into two pieces

Image-2 shodhana in narikela jala

Table 02

pH of Narikela jala	Initial	Intermediate	End of the procedure
	5.31	5.25	5.23

Table 03

Preparation of *Murchita ghrita*[08]

Ingredients	Quantity
Haritaki	5o gms
Vibhitaki	50 gms
Amalaki	50 gms
Musta	50 gms
Haridra	50 gms
Matulunga swarasa	Quantity sufficient
Ghrita	1 ltr
Jala	4 ltr

- Fine powders of these drugs were added with *matulunga rasa* to prepare *kalka.*
- Measured quantity of *Ghrita* was heated over mild fire, prepared *kalka* was added to this and mixture will be boiled until *Sneha siddhi lakshana* appear and only the ghee part remains.

Image-3

Image-4

Preparation of *Bhallataka ghrita*[09]

Ingredients: 1. *Bhallataka kalka*- 1 part-125 gms

2. *Murchita ghrita*- 4 parts-500ml

3. *Bhallataka kwatha*- 16 parts-2000ml

It involves *Bhallataka kalka* and *Bhallataka kwatha* preparation.

Preparation of *Bhallataka kalka- Shodhita Bhallataka* was taken and pounded in *clean khalva yantra* and made in to paste form.

Preparation of *Bhallataka kwatha- Shodhita Bhallataka* was pounded in *khalva yantra* + 8 parts of potable water was added and left undisturbed overnight. On next day contents were boiled over mild fire and reduced to ¼, then it was filtered. Ratio of *Sneha, kalka*, *kwatha/drava dravya* will be 1:4:16[10]

When fumes start appearing in *Sneha, Bhallataka kwatha* was added followed by *Bhallataka kalka.* Boiling was continued until *Sneha siddhi lakshanas* appears. Prepared *Bhallataka ghrita was stored in air tight container*.

Quantity of final product obtained was about 480 ml

Image-5 *Bhallataka ghrita*

Analytical evaluation of raw, intermediate and final product

To ensure quality, safety and effectiveness of raw, processed and final product must be analytically evaluated. According to traditional and contemporary analytical guidelines the unprocessed *Bhallataka*, purified *Bhallataka, Murchita ghrita* and *Bhallataka ghrita* were all subjected to systemic analysis in this current study and the assessment comprised organoleptic parameters, physicochemical and for the final product high end analysis that is HPTLC and GCMS were carried out.

RESULTS

Organoleptic characters of *Ashodhita Bhallataka*

Description Macroscopic

Table 04

Test	Limit	Result
Part	Fruit	Fruit
Colour	Dark brown	Dark brown
Taste	NA	NA
Odour	NA	Characterstic

Table 05

Physico chemical standards of *Ashodhita Bhallataka*

Test	Limits	Results
Foreign Matter	Not more than 1%	Nil
Ash Value	Not more than 4%	2.0057%
Acid insoluble Ash	Not more than 0.5%	0.286%
Water soluble extractive	Not less than 5%	10.717%
Alcohol soluble extractive	Not less than 11%	37.868%

Table 06

Organoleptic characters of *shodhita Bhallataka*

Description Macroscopic

Test	Limits	Results
Part	Fruit	Fruit
Colour	Dark brown	Dark brown
Taste	NA	Characterstic
Odour	NA	Characterstic

Table 07

Physico chemical standards of *shodhita Bhallataka*

Test	Limits	Results
Foreign Matter	Not more than 1%	Nil
Ash Value	Not more than 4%	1.092%
Acid insoluble Ash	Not more than 0.5%	0.434%
Water soluble extractive	Not less than 5%	7.460%
Alcohol soluble extractive	Not less than 11%	15.365%

Table 08

Organoleptic characters of *Murchita ghrita*

Test	Results
Form	Ghrita
Colour	Dark yellow
Odour	Characterstic

Table 09

Physico chemical stanadards of *Murchita ghrita*

Test	Results
Moisture content	0.520 %
Specific gravity	0.921 %
Saponification Value	195.178 %
Iodine Value	39.046 %
Acid value	1.677 %
Refractive index	1472 %

Table 10

Organoleptic characters of *Bhallataka ghrita*

Test	Results
Form	Ghrita
Colour	Dark Brown
Odour	Aromatic

Table 11

Physico chemical standards of Bhallataka ghrita

Test	Result
Moisture content	1.824 %
Specific gravity	0.918

Saponification Value	117.012
Iodine Value	56.820
Acid value	6.700
Refractive index	1476
Rancidity	Negative
Weight/ml	1.0265 gm

Results of GC-MS

Integrates two methods:

1. GC, or gas chromatography
separates volatile chemical substances by to their polarity and boiling point.

2. MS, or mass spectrometry
compares isolated chemicals with spectrum libraries (often the NIST library) and identifies them based on their mass-to-charge ratio (m/z).

As a result, each chemical is recognized by:

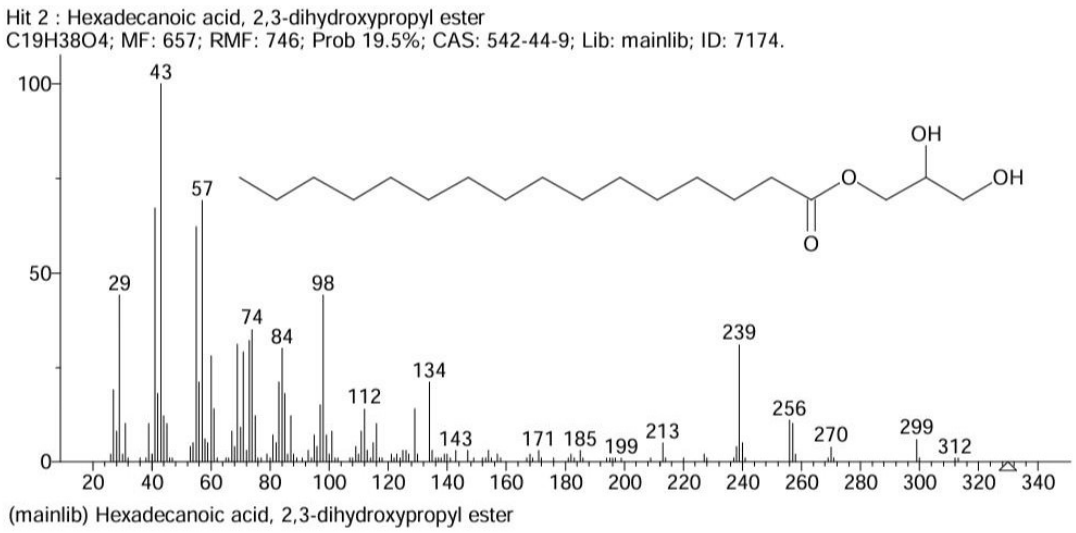
Retention Time (RT) is the amount of time a compound takes to move through the column.
Matching the mass spectrum with standard libraries

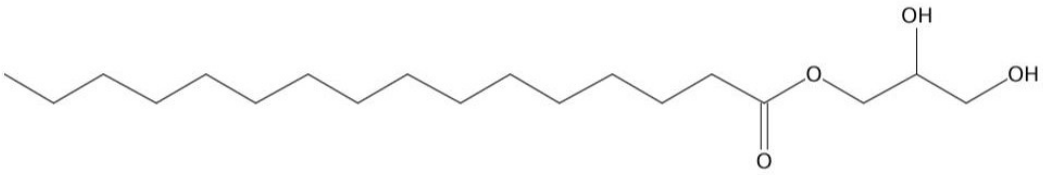
Table 12

The GCMS data is as follows:

SL NO	RETENTION TIME	MOLECULE	AREA %
1	11.18	Caproic acid	0.33%
2	12.31	Tetrahydro-2-furancarbinol	0.27%
3	17.14	n-Capric acid	0.53%
4	22.46	1.7-(Methoxymethyl)-2,7-dimethyl-1,3,5-cycloheptatriene	0.13%
5	22.62	Tetradecanal	0.15%
6	23.87	Ar-tumerone	1.64%
7	23.91	Tumerone	0.22%
8	24.16	Decanoic acid, decyl ester	0.24%
9	24.58	Curlone	0.61%
10	25.96	Myristic acid	2.41%
11	28.65	Palmitic acid	8.50%
12	29.71	α-Monomyristin	0.91%
13	30.51	cis-Vaccenic acid	7.80%
14	30.69	Stearic acid	2.07%
15	31.71	Palmitic acid β-monoglyceride	1.26%
16	33.48	Icosapent	3.57%
17	34.32	Myristic acid β-monoglyceride	3.67%
18	35.19	2,4,6-Trimethyl-2-(4-methyl-pent-3-enyl)-2H-pyran	37.77%
19	35.44	Terephthalic acid, di(2-ethylhexyl) ester	0.84%
20	35.78	Hexadecanoic acid, 2,3-dihydroxypropyl ester	13.97%
21	37.09	9-Octadecenoic acid (Z)-, 2-hydroxy-1-(hydroxymethyl)ethyl ester	6.33%
22	38.76	17-(1,5-Dimethylhexyl)-10,13-dimethyl-2,3,4,7,8,9,10,11,12,13,14,15,16,17-tetradecahydro-1H-cyclopenta [a]phenanthren-3-ol	3.69%
23	38.94	Octadecanoic acid, 2,3-bis[(1-oxotetradecyl)oxy]propyl ester	3.11%

This shows that 2,4,6-Trimethyl-2-(4-methyl-pent-3-enyl)-2H-pyran was 37.77% in concentration, while 9-Octadecenoic acid (Z)-, 2-hydroxy-1-(hydroxymethyl)ethyl ester constituted 13.97%. These were the two highest quantity of molecules in the Bhallataka Ghrita





HPTLC Method summary:

Phase of stationarity
HPTLC plate with silica gel 60 F254

Phase of movement:
Hexane: Ethyl acetate: Toluene (6: 3: 1)

Solvent sample:
Methanol

Applied sample:
5 µL

Chamber of development:
chamber with two troughs

Reagent for derivatization:
Sulfuric acid and anisaldehyde

Wavelengths of detection

254 nm and 366 nm
White light (after derivatization)

HPTLC interpretation of *Bhallataka ghrita*

Number of constituent

Around 8 main components at 254 nm

- Up to 10 components in Track 3 → minor variation: Indicates rich phytochemical diversity
- Major Peaks (area percentage) Dominant peaks at 254 nm :

Table 13

Rf value	Area % range	Interpretation
~0.77	25–27%	Major constituent
~0.40	21–22%	Second major compound
~0.58–0.64	9–11%	Moderate compounds
~0.93	11– 12%	Non polar compound

Good repeatability and technique reliability are confirmed by similar Rf value across tracks.

Major peaks were observed within the range of 0.4~0.7, indicating the presence of phytochemicals that are largely non polar as expected in *ghrita* extracts lipophilic chemicals from *Bhallataka.*

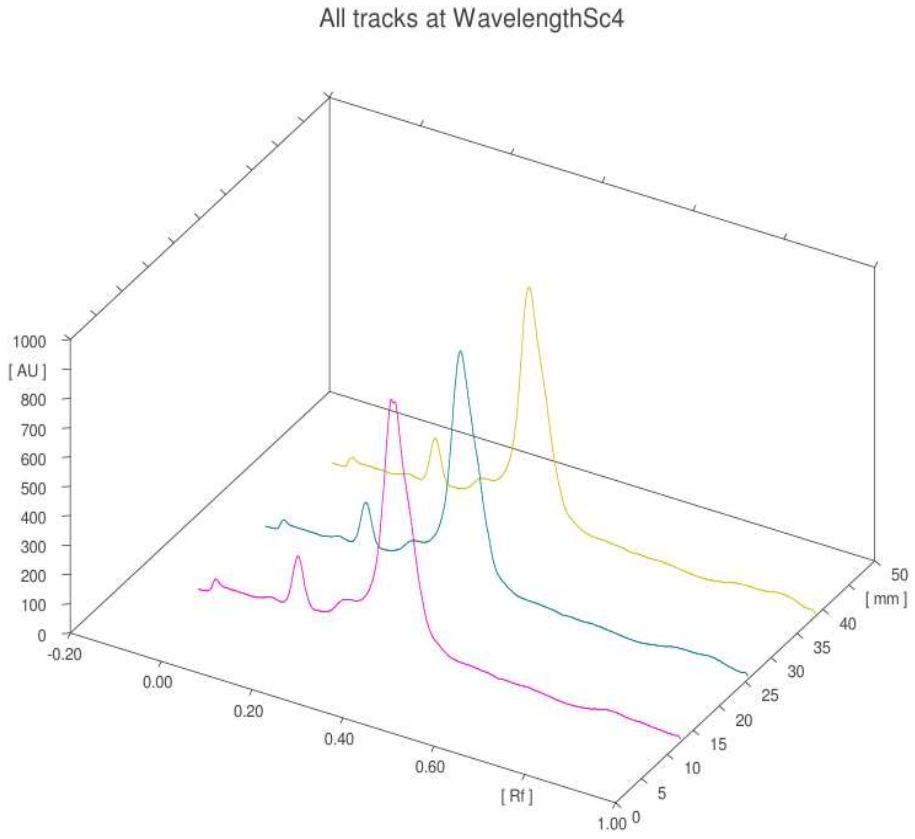
Major peaks at 366 nm

Dominant peak observed around **Rf ≈ 0.36–0.37**

Table 14

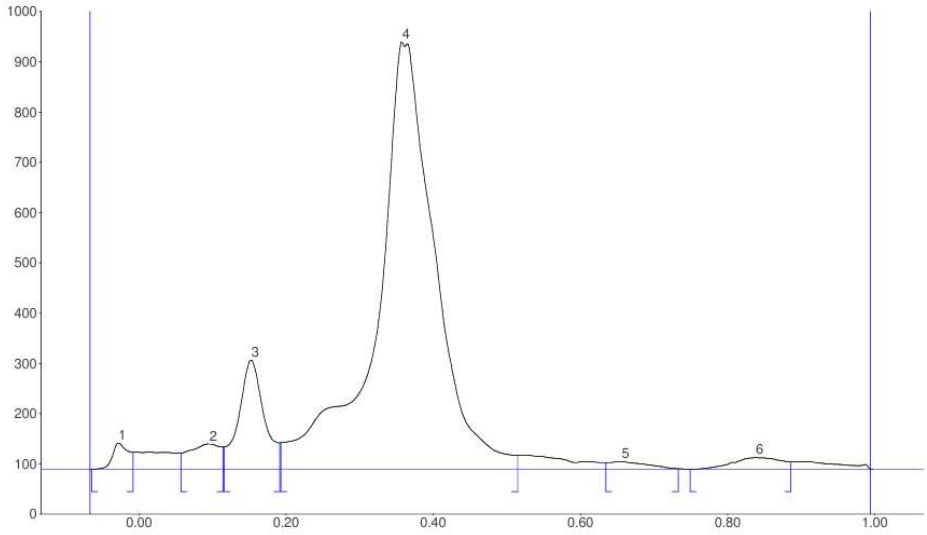
Track	Rf	Area %
1	0.36	83.72
2	0.36	82.64
3	0.37	79.35

The presence of a significant phytochemical group in *Bhallataka Ghrita*-possibly **phenolic or flavonoid** chemicals, which are known to contribute to **antioxidant activity**-is indicated by this prominent fluorescence peak.

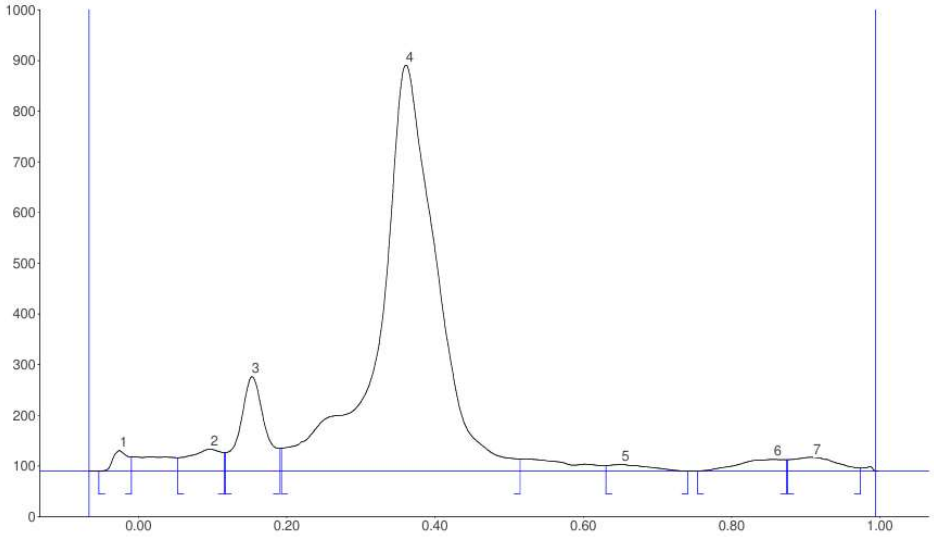


Sc4-sample code

Track 1, ID: Bhallataka Ghrita



Track 2, ID: Bhallataka Ghrita



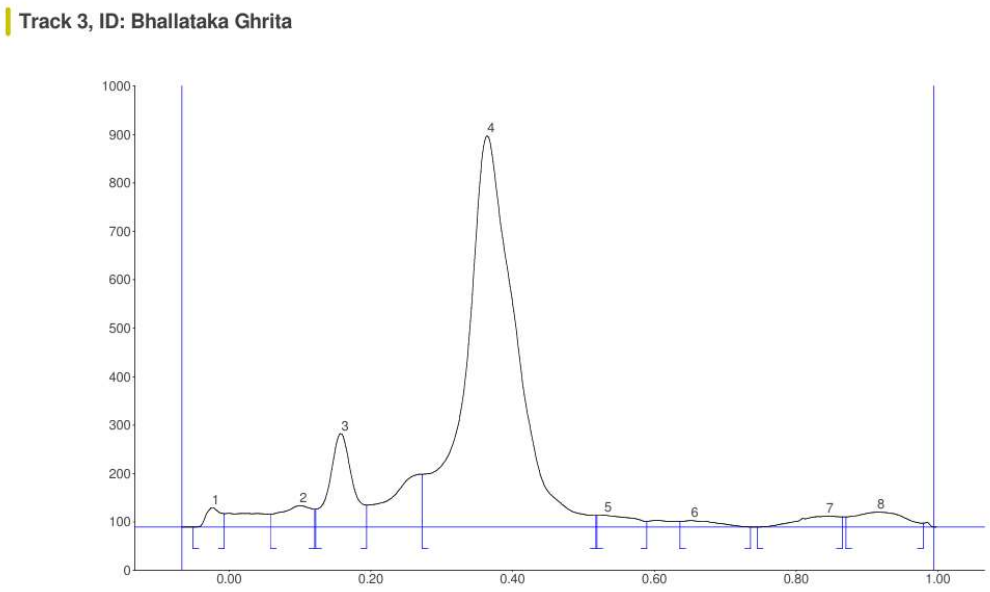


Image-7 HPTLC chromatogram of Bhallataka Ghrita observed under **UV 254 nm** showing multiple dark bands corresponding to different phytoconstituents

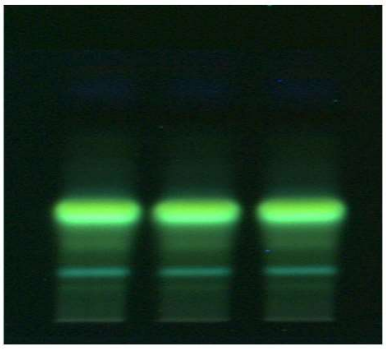


Image-6 HPTLC chromatogram of Bhallataka Ghrita observed under **UV 366 nm** showing fluorescent bands of phytoconstituents.

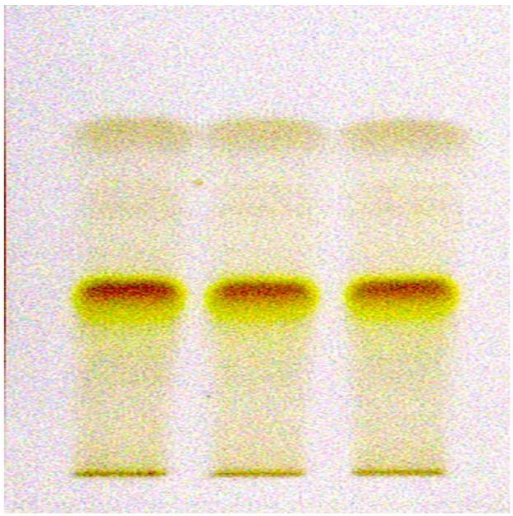
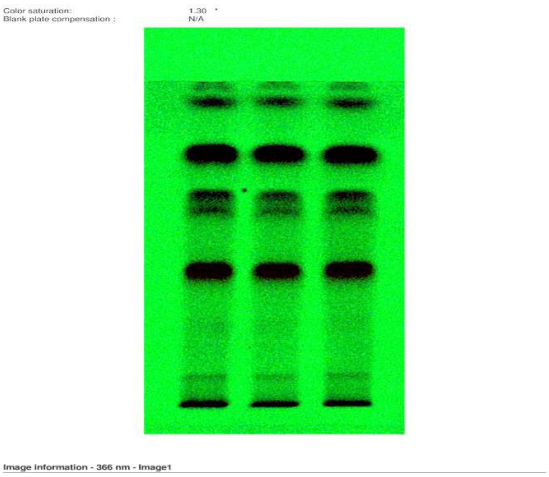


Image-8 HPTLC chromatogram of Bhallataka Ghrita after derivatization with anisaldehyde–sulphuric acid reagent observed under white light showing multiple colored bands corresponding to different phytoconstituents.



DISCUSSION

Bhallataka ghrita is a classical medicated ghee formulation mentioned in *Ayuredic* classical texts, indicated in *Kushta, Arsha* as well as *Rasayana* and prepared through the process of *sneha kalpana*.[11] Which uses lipid medium to help extract and stabilize lipophilic phytoconstuents. The present study attempted to standardize the pharamaceutical preparation and evaluate the analytical characterstics of *Bhallataka ghrita* using

both traditional parameters and high end analytical techniques.

Selection of *Bhallataka phala* using *jala nimajjana pareeeksha* by taking mature and *pakva phala* ensured the use of potent fruits[12]. Choosing the right raw materials is very much crucial to achieve high therapeutic efficacy.

Since the *Bhallataka* is classified as a poisonous drug under schedule E1 of the Drugs and Cosmetics Act (1940), purification (s*hodhana*) is a necessary pharmacological step prior to therapeutic usage. *Dola yantra swedana* method was adopted by taking *Narikela jala* as liquid media.[13] The slight reduction in the pH of *Narikela jala* that is 5.31-5.23 indicated the percolation of irritant phenolic compounds from *Bhallataka* pericarp in to liquid media.[14]And also there is decrease in physicochemical parameters like ash value and extractive values after *shodhana* which further supports the removal of unwanted impurities and toxic principles. Thus *shodhana* not only detoxify the *Bhallataka* but also improves its pharamaceutical suitability.[15]

Herbal components like *Haritaki, Vibhitaki, Amalaki, Musta, and Haridra* were used in the *Murchana* process of *Ghrita* in addition *to Matulunga Swarasa[16]*. *Murchana* is typically used to improve *ghrita's* stability, shelf life, and therapeutic qualities.[17] Proper processing was indicated by the dark yellow colour and distinctive smell of the prepared *Murchita ghrita*. Moisture content (0.520%), saponification value (195.178), iodine value (39.046), and acid value (1.677) were all within acceptable values for medicated ghee, indicating that the base lipid medium was stable and of good quality.

Following the traditional *Sneha paka* method, *Murchita ghrita, Bhallataka kalka*, and *Bhallataka kwatha* were used to create *Bhallataka Ghrita.* The transfer of phytoconstituents from *Bhallataka* into the lipid medium during the heating process may be responsible for the finished product's dark brown colour and fragrant smell. A moisture content of 1.824%, a specific gravity of 0.918, and a negative rancidity test were found by physicochemical examination, suggesting high stability and the lack of oxidative degradation. The addition of unsaturated fatty acids and phytoconstituents from *Bhallataka* is suggested by the higher iodine value as compared to *Murchita ghrita.*

Bhallataka Ghrita was found to contain a number of bioactive substances, including fatty acids, esters, and aromatic molecules, according to GC-MS analysis. Palmitic acid, cis-vaccenic acid, stearic acid, and myristic acid—known lipid components that support the nutritional and structural qualities of medicinal ghee—were among the main chemicals found[18]. 2,4,6-Trimethyl-2-(4-methyl-pent-3-enyl)-2H-pyran was found to be the most prevalent chemical (37.77%), followed by esters related to oleic acid and derivatives of hexadecanoic acid (13.97%). The medicinal efficacy of Bhallataka Ghrita may be enhanced by the antioxidant, anti-inflammatory, and antibacterial qualities of fatty acids such palmitic acid and vaccenic acid[19].

The presence of several phytoconstituents in the formulation was further verified by HPTLC analysis. Eight significant components were found at 254 nm, with dominant peaks at Rf values of 0.77 and 0.40, suggesting the formulation's main chemical components. Moderately concentrated chemicals are represented by peaks between Rf 0.58 and 0.64, whereas strongly non-polar contents are represented by peaks close to Rf 0.93. These results are in line with ghrita's ability to extract non-polar phytochemicals from herbal medications in a lipid-soluble manner[20].

All tracks showed a prominent fluorescence peak at 366 nm around Rf 0.36–0.37 with a high area percentage (around 80–83%), indicating the existence of a significant phytochemical group in Bhallataka Ghrita. Because of their potential as antioxidants, phenolic or flavonoid chemicals are frequently linked to such fluorescence under UV radiation[21]. The analytical method's repeatability and dependability are demonstrated by the Rf values' consistency across many tracks.

The existence of various phytochemical classes, including terpenoids, phenolics, and fatty acid derivatives, was confirmed by the chromatograms obtained under white light following derivatization with anisaldehyde–sulphuric acid reagent[22]. The idea that Sneha Kalpana functions as an effective carrier system for lipid-soluble bioactive chemicals is supported by this phytochemical variety.

Overall, the analytical analysis showed that *Bhallataka Ghrita* has several bioactive components that are obtained from the Bhallataka medication as well as the ghrita base. Potential antioxidant and medicinal qualities are suggested by the presence of fatty acids, aromatic chemicals, and phenolic derivatives. The combined findings from GC-MS, HPTLC, and physicochemical investigation provide standardized standards for Bhallataka Ghrita and offer scientific support for the conventional *Ayurvedic* formulation.

CONCLUSION

The current study used purified *Bhallataka* and *Murchita ghrita* in accordance with traditional *Sneha Kalpana* processes to standardize the preparation and analytical evaluation of *Bhallataka Ghrita*. The quality and stability of the intermediate and finished products were verified by organoleptic and physicochemical examination. The observed alterations in physicochemical characteristics following *Shodhana* demonstrated how well purification improved *Bhallataka's* safety and potential for therapeutic application.

The formulation was further confirmed using sophisticated analytical methods. While HPTLC profiling showed various phytoconstituents with distinctive Rf values indicating phytochemical variety, GC–MS analysis confirmed the existence of several bioactive chemicals, including fatty acids, esters, and aromatic molecules. Significant lipid-soluble phytochemicals that could enhance the formulation's pharmacological potential are suggested by the appearance of major peaks in chromatographic examination.

Overall, the study validates the scientific foundation of this traditional Ayurvedic composition made from Semecarpus anacardium and offers preliminary standardization

parameters for *Bhallataka Ghrita*. To confirm its therapeutic efficacy, more pharmacological and clinical research is needed.

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