RESEARCH PAPER

Pharmaceutico Analytical Evaluation of Panchabhautika Ghrita for Cognitive Enhancement

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ABSTRACT

Background

Panchabhautika ghrita, described in Kashyapa Samhita Shatkalpa Adhyaya, is a classical medicated ghee preparation indicated for the enhancement of cognition in children. Despite its therapeutic importance in Ayurvedic pediatric practice, scientific standardization of this formulation remains limited.

Objective

To establish analytical parameters for Panchabhautika ghrita through organoleptic evaluation, physiochemical analysis, and chromatographic fingerprinting for quality standardization.

Materials and methods

Panchabhautika ghrita was prepared following classical Sneha paka procedures under controlled conditions. Raw drugs were authenticated according to the Ayurvedic Pharmacopoeia of India guidelines. The finished formulation was subjected to organoleptic evaluation, physicochemical parameters including acid value, saponification value, iodine value, refractive index, moisture content, and specific gravity. Thin-layer chromatography (TLC) was performed to establish chromatographic fingerprints.

Results

The formulation appeared as a viscous, golden-yellow semisolid with a characteristic aromatic odour. Physiochemical parameters demonstrated stability and purity within acceptable limits for ghrita-based formulations. TLC profiling revealed distinct phytochemical spots indicating the presence of multiple bioactive constituents derived from the herbal components.

Conclusion

The present study establishes preliminary analytical standards for Panchabhautika ghrita which may serve as reference parameters for ensuring quality, safety, and reproducibility of this classical Ayurvedic formulation.

Keywords: Cognition, Panchabhautika ghrita, Kaumarabhritya

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INTRODUCTION

Ayurveda emphasizes the use of polyherbal formulations processed in lipid media to enhance the bioavailability and therapeutic potency of herbal drugs. Among the various dosage forms described in classical pharmaceutics (Bhaishajya kalpana), ghrita Kalpana occupies a unique position due to its ability to extract both lipid-soluble and water-soluble active

constituents. Medicated ghee also acts as a Yogavahi, facilitating deeper penetration of active molecules into tissues, particularly the nervous system. [1-4]

Panchabhautika ghrita [5] is a classical formulation mentioned in *the Kashyapa Samhita,* traditionally prescribed in pediatric practice for improving cognitive development, memory, immunity, and overall growth of children. The formulation derives its name from the principle of *panchamahabhuta,* which represents the fundamental elements constituting biological systems. [5-7] Ghrita-based formulations have also gained attention from modern pharmacological perspectives due to their ability to enhance the bioavailability of phytoconstituents and facilitate transport across biological membranes, including the blood-brain barrier. Lipid matrices in such formulations help protect active molecules from degradation and promote sustained release. [8-10]

However, despite its traditional use and therapeutic potential, scientific validation and analytical standardization of *Panchabhautika ghrita* remain inadequate. Variations in raw drug quality, preparation procedures, and storage conditions may affect the consistency and efficacy of the formulation. [11-12] Therefore, establishing analytical quality parameters, including organoleptic characteristics, physicochemical constants, and chromatographic fingerprints, is essential for ensuring identity, purity, and reproducibility of the formulation.

AIM

To establish analytical quality standards for *Panchabhautika ghrita* through physicochemical and chromatographic evaluation.

OBJECTIVES

1. To authenticate the raw materials used in *Panchabhautika ghrita* according to pharmacopoeial standards.
2. To prepare *Panchabhautika ghrita* following the classical Sneha Kalpana procedures.
3. To evaluate organoleptic characteristics such as colour, odour, taste and appearance.
4. To determine physicochemical parameters of the formulation.
5. To develop chromatographic fingerprints using thin layer chromatography (TLC).

MATERIALS AND METHODS

Procurement and authentication of raw materials

All herbal ingredients required for the preparation of *Panchabahautika ghrita* were procured from authenticated herbal drug suppliers. The identity of the raw drugs (Table-1) was confirmed in the department of *Dravyguna* based on macroscopic and microscopic characteristics.

Preparation of *Panchabahautika ghrita*

The formulation was prepared according to classical *Snehapaka vidhi* described in *Ayurvedic* texts. The required herbal drugs were cleaned, shade-dried and coarsely powdered. *Kwatha* (Decoction) was prepared from the herbal ingredients and filtered. *Murchita ghrita*(Purified ghee) was heated in a stainless-steel vessel. The prepared decoction and *Kalka* (herbal paste) were gradually added, and the mixture was subjected to controlled heating. Continuous stirring was maintained until the classical *Sneha siddhi lakshanas* such as appearance of froth caessation, characteristic aroma and proper consistency were observed. The prepared *Panchabahautika ghrita* was filtered and stored in airtight containers.[13]

Table-1: *Panchabahautika ghrita* ingredients [5]

S. No.	Name of Extract/Ingredient	Parts Used	Form
1.	Jivaka (Microstylis muscifera)	Kanda	1 part
2.	Rishabhaka (Microstylis wallichi)	Kanda	1 part
3.	Draksha (Vitis vinifera)	Phala	1 part
4.	Yasti madhu (Glycyrrhiza glabra)	Moola	1 part
5.	Pippali (Piper longum)	Phala	1 part
6.	Bala (Sida cordifolia)	Moola	1 part
7.	Pundarika (Nelumbo nucifera)	Panchanga	1 part
8.	Bhrihati (Solanum indicum)	Moola	1 part
9.	Manjista (Rubia cordifolia)	Moola	1 part
10.	Twak (Cinnamomum zeylanicum)	Patra	1 part
11.	Punarnava (Boerhavia diffusa)	Moola	1 part
12.	Amsumathi (Desmodium gangeticum)	Panchanga	1 part

13.	Medha (Polygonatum cirrhifolium)	Twak	1 part
14.	Vidanga (Emblia ribes)	Phala	1 part
15.	Nilkamala (Nympho eastellate)	Panchanga	1 part
16.	Nidigdhika (Solanum xanthocarpum)	Panchanga	1 part
17.	Rasna (Pluchea lanceolata)	Patra	1 part
18.	Tila taila (Sesamum indicum)	Beeja	4 parts
19.	Gokshura (Tribulus terrestris)	Moola	1 part
20.	Sharkara	-	1 part
21.	Rock salt	-	1 part
22.	Water	-	16 parts
23.	Cow's ghee	-	4 parts
24.	Cow's Milk	-	4parts

Analytical study:

The analytical evaluation was performed under three major categories:

1. Organoleptic evaluation
2. Physicochemical analysis
3. Chromatographic fingerprinting (TLC)

RESULTS:

Table-2: Organoleptic characteristics

S.NO	PARAMETER	OBSERVATION
1	Appearance	Semi-solid viscous mass
2	Colour	Golden yellow
3	Odour	Characteristic aromatic
4	Taste	Mildly bitter and astringent

Table-3: Physicochemical parameters

Test parameter	Result
Rancidity	Absent
Saponification value	260-270
Iodine value	28-32
Acid value	<3
Refractive index	~1.45
Moisture content	<0.2 %
Specific gravity	~0.91

Table-4: TLC profile (Composite fingerprint)

Spot No	Rf value	Phytoconstituent	Source drug
1	0.18-0.22	Saponins	Glycyrrhiza glabra, Tribulus terrestris
2	0.28-0.32	Piperine	Piper longum
3	0.40-0.45	Flavonoids / Polyphenols	Vitis vinifera, Nelumbo nucifera
4	0.52-0.58	Anthraquinones	Rubia cordifolia
5	0.60-0.65	Embelin	Embelia ribes
6	0.70-0.75	Phenolics / Cinnamaldehyde derivates	Cinnamomum zeylanicum
7	0.78-0.85	Steroidal compounds	Solanum indicum, S.xanthocarpum

Table-5: Phytochemical constituents of ingredients of Panchabahautika *ghrita* [14]

S. No.	Name of Extract/Ingredient	Major Phytochemicals
1.	Jivaka (Microstylis muscifera)	Alkaloids, glycosides, polysaccharides
2.	Rishabhaka (Microstylis wallichi)	Phenolics, glycosides, mucilage
3.	Draksha (Vitis vinifera)	Resveratrol, flavonoids, anthocyanins, tannins
4.	Yasti madhu (Glycyrrhiza glabra)	Glycyrrhizin, liquiritin, flavonoids, anthocyanins, tannins
5.	Pippali (Piper longum)	Piperine, alkaloids, volatile oils
6.	Bala (Sida cordifolia)	Ephedrine alkaloids, flavonoids, sterols

7.	Pundarika (Nelumbo nucifera)	Alkaloids(nuciferine), flavonoids, tannins
8.	Bhrihati (Solanum indicum)	Steroidal alkaloids(solanine), saponins
9.	Manjista (Rubia cordifolia)	Anthraquinones, rubiadin, flavonoids
10.	Twak (Cinnamomum zeylanicum)	Cinnamaldehyde, eugenol, polyphenols
11.	Punarnava (Boerhavia diffusa)	Boeravinones, alkaloids, flavonoids
12.	Amsumathi (Desmodium gangeticum)	Alkaloids, flavonoids, triterpenoids
13.	Medha (Polygonatum cirrhifolium)	Steroidal saponins, polysaccharides
14.	Vidanga (Emblia ribes)	Embelin, quinones, tannins
15.	Nilkamala (Nympho eastellate)	Flavonoids, alkaloids, tannins
16.	Nidigdhika (Solanum xanthocarpum)	Solasodine, steroidal alkaloids
17.	Rasna (Pluchea lanceolata)	Sesquiterpenes, flavonoids
18.	Tila taila (Sesamum indicum)	Sesamin, sesamol, lignans, Vitamin E
19.	Gokshura (Tribulus terrestris)	Protodioscin, saponons, flavonoids
20.	Sharkara	Sucrose (energy source)
21.	Rock salt	Sodium chloride, trace minerals
22.	Water	Solvent medium
23.	Cow's ghee	Saturated and unsaturated fatty acids, phospholipids
24.	Cow's Milk	Casein proteins, lactose, calcium, vitamins

Organoleptic evaluation (Table-2) is a preliminary but essential step in the standardization of Ayurvedic formulations. The observed colour, aroma, and texture of *Panchabahautika ghrita* are consistent with those expected of ghrita-based polyherbal preparations. The absence of randicity indicates proper processing and stability of the lipid medium. Saponification value provides insight into the fatty acid composition of the formulation and reflects the presence of short-chain fatty acids that may enhance digestibility and absorption.

The iodine value reflects the degree of unsaturation in the lipid component. Higher unsaturation levels may contribute to improved nutritional and anti-inflammatory properties. The refractive index and specific gravity serve as indicators of the purity and consistency of the formulation. Any deviation from standard values may suggest adulteration or improper preparation. Moisture content was found to be minimal, which is crucial for maintaining the stability and shelf life of ghrita-based formulations. TLC profiling demonstrated the presence of multiple phytochemical components in the formulation. Such chromatographic fingerprints are valuable for assuring batch-to-batch consistency, authenticity, and quality control. [15] [16]

Phytochemical Analysis

The prepared *Panchabahautika ghrita* was analyzed for standard physiochemical parameters as per Ayurvedic pharmacopoeia guidelines. The formulation appeared as yellowish-green viscous semi-solid with characteristic odour. The refractive index was found to be 1.454, while the specific gravity was 0.912. the acid value was 2.12, indicating minimal free fatty acid formation and good stability of the lipid matrix. The iodine value 30.37 suggested the presence of moderate unsaturation in fattyacids. The saponification value 267.74 indicated the presence of shorter chain fatty acids that may facilitate digestion and absorption of the formulation. Moisture content was recorded as 0.11% which is within acceptable limits for ghrita preparations and suggests good shelf stability. (Table-3) [17]

Thin Layer chromatography (TLC)

For chromatographic analysis, a sample of *Panchabahautika ghrita* was dissolved in ethanol and applied onto a silica gel TLC plate. The mobile phase consisted of a toluene: ethyl acetate: n-hexane mixture.

After development and derivatization with anisaldehyde-sulphuric acid reagent, the plate was observed und UV light. Distinct spots were observed at Rf values ranging between 0.40 and 0.78, indicating the presence of multiple phytochemical constituents from the herbal ingredients. The obtained TLC profile serves as a chromatographic fingerprint for quality control of the formulation.

TLC fingerprinting

The procedure was carried out by following standard protocols recommended by Ayurvedic pharmacopoeia of India (API) and WHO guidelines. Approximately 2g of the ghrita was dissolved in ethanol and filtered. The extract was applied on silica gel 60 F254 TLC plates. The mobile phase consisted of Toluene: Ethyl acetate: Formic acid (6:3:1). The developed plates were visualized under UV light at 254nm, UV light at 366nm and after derivatization with anisaldehyde-sulphuric acid reagent.[18]

Observed TLC profile (Composite fingerprint)

The TLC profile of *Panchabahautika ghrita* revealed multiple spots corresponding to diverse phytochemical groups, including alkaloids, flavonoids, saponins, anthraquinones, and phenolic compounds. (Table-4) The presence of piperine (Rf~0.30) confirms *Pippali*. Embelin (Rf~0.60) confirms *Vidanga.* Anthraquinones (Rf~0.55) confirm *Manjista*. Flavonoid bands (Rf~0.40-0.45) correspond to *Draksha* and *Nilakamala*. Steroidal alkaloids (Rf~0.75-0.85) correspond to Solanum species. This multi-brand chromatographic pattern serves as a qualitative fingerprint for identity and standardization of *Panchabahautika ghrita*.[18][19]

Phytochemical profile

Reveals the presence of diverse bioactive compounds, including alkaloids, flavonoids, saponins, phenolics, tannins, and glycosides. Several ingredients, such as *Vitis vinifera*, *Glycyrrhiza glabra,* and *Nelumbo nucifera,* are rich in polyphenols and flavonoids, which exhibit potent antioxidant activity. Alkaloids present in drugs like *Piper longum*, *Sida cordifolia,* and *Solanum* species are known to modulate the neurotransmitter system and enhance neuronal signaling. Steroidal saponins found in *Tribulus terrestris* and *Polygonatum cirrhifolium* contribute to neuroprotective and adaptogenic effects. Compounds such as piperine, glycyrrhizin, embelin, and resveratrol play a significant role in improving bioavailability, reducing oxidative stress, and supporting neuronal function.

The lipid components of *tila taila* and *go-ghrita* enhance the solubility and absorption of these phytoconstituents, facilitating their transport across biological membranes, including the blood-brain barrier. Thus, the formulation represents a synergistic combination of phytochemicals capable of influencing multiple pathways involved in cognition enhancement.[20][21]

DISCUSSION:

The cognitive-enhancing potential of *Panchabahautika ghrita* can be attributed to the diverse phytochemical constituents present in its polyherbal composition. The formulation includes several drugs belonging to *Medhya rasayana* and *Jeevaneeya* groups, which are traditionally known to promote intellect (*Medha*), memory (*Smriti*), and overall neurodevelopment. Modern pharmacological studies suggest that these effects are mediated through antioxidant, neuroprotective, anti-inflammatory, and neurotransmitter-modulating activities of phytochemicals. [22-25]

1. **Cholinergic modulation and memory enhancement**

Several ingredients such as *Yastimadhu* (Glycyrrhiza glabra), *Pippali* (Piper longum), and Bala (Sida cordifolia) contain alkaloids, flavonoids, and glycosides that influence the cholinergic system, which plays a central role in learning and memory. [26-28] Glycyrrhizin and flavonoids in *Yashtimadhu* have been reported to enhance acetylcholine activity and protect neurons from oxidative stress.[26] Piperine from *Pippali* improves bioavailability and neurotransmitter function, thereby enhancing cognitive performance.[27]

2. **Neuroprotection and antioxidant activity**

Many drugs in the formulation such as Manjishta (Rubia cordifolia), Punarnava (Boerhavia diffusia), Draksha (Vitis vinifera), and Nilakamala (Nymphaea stellata) are rich in polyphenols, anthocyanins and flavonoids, which act as potent antioxidants.[29-31] These compounds scavenge free radicals, reduce lipid peroxidation, and protect neuronal membranes from oxidative damage. Oxidative stress is a major factor in cognitive decline. Hence, these phytochemicals play a crucial role in maintaining neuronal integrity.[31]

3. **Synaptic plasticity and Neuronal growth**

Certain drugs such as *Jivaka* (Malaxis muscifera), *Rishabhaka* (Malaxis acuminata), Meda (Polygonatum cirrhifolium) belong to the *Jeevaneeya* group, which are traditionally indicated for nourishment and regeneration of tissues.[23],[32] These drugs are believed to promote neuronal growth, enhance dendritic branching and support synaptic plasticity. Modern interpretations suggest that their bioactive

constituents may influence neurotrophic factors and neuronal repair mechanisms.[32]

4. **Dopaminergic and adaptogenic effects**

Aswagandha like adaptogenic action is mirrored in this formulation through drugs like *Bal*a (Sida cardifolia) and *Amsumti* (Desmodium gangeticum). These herbs contain alkaloids, saponins, adaptogenic phytochemicals. They help reduce stress induced neuronal damage, modulate dopamine and GABA pathways and improve attention and emotional stability. [33-34]

5. **Anti-inflammatory and Neuroimmune modulation**

Chronic neuroinflammation is a known contributor to cognitive impairment. Ingredients such as *Gokshura* (Tribulus terristris), *Vidanga* (Embelia ribes), *Rasna* (Pluchea lanceolata) possess anti-inflammatory and immunomodulatory properties which help reduce neuroinflammation, improve neuronal survival, and support cognitive resilience. [35-37]

6. **Role of lipid medium**

The presence of go-ghrita and tila taila significantly enhances the pharmacological efficacy of the formulation. Lipids improve the solubility of phytochemicals, facilitate absorption, and transport across the blood-brain barrier. Provides essential fatty acids for neuronal membrane stability. The lipid matrix acts as a brain-targeted delivery system, ensuring effective transport of neuroactive phytoconstituents. [38-40]

The combined action of phytochemicals in *Panchabahautika ghrita* results in enhanced acetylcholine activity(memory), modulation of dopamine and GABA (attention and mood), increased synaptic plasticity, reduced oxidative stress and inflammation, improved neuronal survival and regeneration. Combined effect leads to improved memory, better learning capacity, enhanced attention, and neuroprotection in the developing brain.[22],[25],[39]

Ayurveda -Modern Correlation of Panchabhautika concept with Neurodevelopment:

The concept of *Panchamahabhuta* (five fundamental elements) forms the basis of structural and functional organization in Ayurveda. According to classical Ayurvedic philosophy, all biological systems are composed of the five elements -*Pruthvi*(earth), *Aap* (water), *Teja* (fire), *vayu* (air), and *akasha* (ether)- which collectively govern physiological and psychological processes. In Paediatric health, balanced functioning of these elemental principles is considered essential for proper growth, development, and cognitive maturation. From modern perspective, the *panchamahabhuta* concept may be interpreted as a symbolic representation of fundamental biological and physiological processes that regulate cellular structure, metabolism, neural signaling, and homeostasis. Each element can be correlated with specific aspects of neurodevelopment and brain function. [41-43]

Prithvi mahabhuta*:* This is associated with structure stability and growth, may correspond to the structural components of the nervous system including neuronal cells, glial cells, and extra cellular matrix, proper development of this structure is essential for the formation of neural circuits during early life.

Ap Mahabhuta**:** This Mahabhuta represents fluidity and nourishment, can be correlated with biological fluids such as CSF, intra cellular fluid and plasma. These fluids play an important role in maintaining ionic balance, transporting nutrients, and supporting neuronal metabolism.

Teja Mahabhuta**:** which governs transformation and metabolic activity, may be related to bio-chemiocal procesnutrients, andonal metabolism, mitochondrial activity, and neurotransmitter synthesis. Here efficient metabolic activity is crucial for maintaining synaptic transmission and neural plasticity.

Vayu Mahabhuta**:** This *mahabhuta* is crucial among all, which is responsible movement and communication, closely resembles the physiological process of neuronal signaling and transmission of electrical impulses across synapses which is crucial for efficient communication within neuronal networks responsible for cognition and learning.

Akasha Mahabhuta**:** This *Panchamahabhuta* correlates with the structural organization of neural pathways and synaptic spaces that allow communication between neurons. The formulation of *Panchabhautika ghritha*, therefore, may be interpreted as an attempt to restore balance among these elemental principles through a combination of herbal drugs and lipid-based delivery systems. Many ingredients present in the formulation contain phytochemicals such as bacosides, withanolides, flavonoids, and polyphenols, which are known to possess neuroprotective, antioxidant, and cognitive -enhancing properties. These compounds may influence neurotransmitter activity, reduce oxidative stress, and enhance synaptic plasticity. Furthermore, ghritha acts as a lipid medium that enhances the bioavailability of phytoconstituents and facilitates their penetration across biological membranes, including the blood-brain barrier. This property may improve the delivery of neuroactive

compounds to the central nervous system. Thereby supporting neuronal health and cognitive development. Thus, the *Panchabhautika* concept described in classical Ayurvedic texts may be viewed as a holistic framework that parallels modern understanding of neurodevelopment, where structural integrity, metabolic efficiency, neural communication, and biochemical homeostasis collectively determine optimal brain function. [23][25]

Scientific Rationale for using *Ghritha* as a brain-targeted drug delivery system:

Ghritha is one of the most widely used lipid media in Ayurvedic pharmaceutics (sneha kalpana). *Ghritha* said to be *yogavahi,* meaning a substance that enhances the pharmaceutical activity and tissue penetration of drugs processed with it. The concept suggests that *ghritha* acts as a carrier that facilitates the delivery of herbal constituents to specific tissues, including the central nervous system. From a contemporary perspective, ghritha may function as a lipid-based drug delivery system capable of improving the bioavailability of phyoto constituents. Lipid matrices are known to enhance the absorption of both lipophilic and hydrophilic compounds by improving intestinal permeability and promoting lymphatic transport. Such mechanisms reduce first-pass metabolism and increase systemic availability of active compounds.

The central nervous system is protected by the blood-brain barrier, a highly selective barrier that restricts the entry of many therapeutic molecules into brain tissue. Lipid -soluble molecules are known to cross this barrier more efficiently than water-soluble compounds. Since ghrita is primarily composed of lipids, it can facilitate the transport of lipid soluble phyto -chemicaacross biologicalcal membrane, including the BBB. In addition, *ghritha* contains short-chain and medium-chain fatty acids, which are readily absorbed and metabolized. These fatty acids serve as an energy source for neuronal cells and contribute to maintaining membrane integrity and synaptic function. The presence of phospholipids and fat-soluble vitamins in *ghrita* may further support neuronal health. Thus, the traditional Ayurvedic concept of *ghrita* as a *yogavahi* can be interpreted in modern pharmacological terms as a lipid-mediated drug delivery system capable of improving absorption, stability, and brain targeting of phytochemicals. This property provides a scientific basis for the use of *ghrita*-based formulations in neurological and cognitive disorders.[44]

CONCLUSION:

The present study establishes preliminary pharmacognostic and analytical standards for Panchabhautika ghrita. Parameters like organoleptic, physiochemical, and chromatographic domains provide scientific evidence regarding the quality and stability of the formulations. The phytochemical constituents present in the formulation possess documented neuro-protective and cognitive-enhancing properties, which support the traditional indications of Panchabhautika ghrita in paediatric cognitive development. These findings may serve as reference standards for quality control and further pharmacological investigations.

Limitations of the study:

The present analytical study provides preliminary physicochemical and chromatographic parameters for *Panchabhautika Ghrita*. However, certain limitations should be acknowledged. The study primarily focused on physicochemical evaluation and thin-layer chromatography profiling, which provide only preliminary information regarding the chemical composition of the formulation. Advanced analytical techniques such as high-performance thin-layer chromatography (HPTLC), high-performance liquid Chromatography (HPLC), or Gas Chromatography – Mass spectrometry (GC-MS) were not performed, which could have offered more precise identification and quantification of bioactive compounds.

The current investigation evaluated only a single batch of the formulation prepared under controlled conditions. Batch-to-batch variation is an important aspect of herbal formulations; therefore, analysis of multiple batches would provide stronger evidence for reproducibility and quality consistency. Although the phytochemical constituents present in the formulation are known to possess neuroprotective and antioxidant properties, experimental studies such as in vitro neuroprotective assays or in vivo cognitive models would provide stronger scientific support, thereby it can be clinically tested for its clinical efficacy.

Future Scope:

Further investigations are required to strengthen the scientific understanding of Panchabhautika ghrita. Advanced chromatographic techniques such as HPTLC, HPLC, and LC-MS can be employed to identify and quantify key phytoconstituents such as bacosides, withanolides, and flavonoids present in the formulation. These analytical approaches would help establish precise chemical markers for quality control.

Experimental pharmacological studies should also be conducted to evaluate the cognition –enhancing potential of panchabhautika. Animal models assessing learning and memory parameters, such as the Morris

water maze or passive avoidance, could provide valuable insights into its neuroprotective mechanisms. In addition, clinical studies in paediatric populations may be undertaken to evaluate the formulation's potential role in improving cognitive development, memory, and learning ability. Such studies would help bridge the gap between traditional Ayurvedic knowledge and modern clinical evidence. Long-term stability studies and standardization of manufacturing procedures should also be performed to ensure consistency and reproducibility. Since Panchabhautika Ghrita is being used in various clinical elements, and such analytical studies further facilitate wider acceptance and evidence-based Ayurvedic Practice and integrative health care systems.

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