

Pharmacognostical and Pharmaceutical Analysis of Amalaka Rasayana Churna: A Polyherbal Ayurveda Formulation

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ABSTRACT

Background: *Amalaka Rasayana Churna* (ARC) is a polyherbal Ayurvedic formulation consisting of *Amalaki* (*Embolica officinalis* Gaertn.), *Pippali* (*Piper longum* L.), *Ghrita* (ghee), *Madhu* (honey), and *Sarkara* (sugar) traditionally used for rejuvenation, longevity, and overall health enhancement.

Objectives: This study aims to evaluate the phytochemical composition, nutritional profile, and antioxidant activity of ARC through modern pharmaceutical-analytical methods to validate traditional claims. **Materials and Methods:** The raw ingredients for ARC were sourced from a GMP-Certified Ayurveda Pharmacy and authenticated at an AYUSH-certified Central Research Facility. Various analytical methods, including preliminary phytochemical screening and Thin Layer Chromatography (TLC) were conducted at the KLE Shri B. M. K. Ayurveda Mahavidyalaya. Antioxidant activity, High Performance Thin Layer Chromatography (HPTLC) and nutritional analysis was performed at CARE Keralam Ltd., to assess the energy content, macronutrients, and bioactive compounds present in the formulation. **Results:** The pharmaceutical-analytical evaluation showed that ARC has a semi-solid, blackish appearance, with a sour taste and an acidic pH of 2.43. The formulation exhibited a high water-soluble extractive value (86.596%) and significant antioxidant activity with an IC₅₀ value of 29.72 mg/kg. Phytochemical analysis revealed the presence of carbohydrates, reducing sugars, flavonoids, tannins, steroids, alkaloids, and glycosides. The HPTLC analysis at 254 nm revealed nine distinct peaks, indicating the presence of multiple bioactive compounds. Nutritional analysis showed high carbohydrate content (90.9%) and significant sugar (45.77%), with minimal fat (0.35%) and protein (0.64%).

Conclusion: The pharmaceutical and analytical evaluation of *Amalaka Rasayana Churna* (ARC) confirms its rich phytochemical composition, and potent antioxidant activity. The formulation supports longevity, immunity, and overall rejuvenation. Analytical assessments validate its traditional Ayurvedic claims, highlighting its potential as a therapeutic drug. ARC's antioxidant and immunomodulatory properties make it a promising natural supplement for managing oxidative stress, promoting well-being and longevity.

Keywords: Antioxidant, Ayurveda, Pharmaceutical, *Rasayana*, Traditional Medicine.

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INTRODUCTION

Ayurveda is the most ancient medical system in the Indian subcontinent, dating back to the 12th century BC. Its goal is to achieve overall well-being, physically, mentally, socially, and spiritually by embracing a preventive, health-enhancing, and

holistic approach to life (Patwardhan *et al.*, 2005). *Rasayana* is a fundamental concept in Ayurveda that refers to rejuvenation and longevity-promoting therapies. It is derived from the Sanskrit words "*Rasa*" (plasma or vital fluid) and "*Ayana*" (pathway), *Rasayana* encompasses a range of herbal formulations and lifestyle practices aimed at enhancing overall health, delaying ageing, and improving immunity. These therapies work at a deep cellular level, nourishing tissues, boosting vitality, and promoting mental well-being (Brahma & Debnath, 2003). *Rasayana*, involves the specialized use of herbs, herbo-mineral formulations, food items, lifestyle, self-discipline, and social etiquette to achieve the optimal state of the body's tissues and systems and minimize the impact of etiological factors on the body. To put it another way,



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Rasayana is a means of achieving homeostasis, which delays the ageing process and helps avoid illness. When in good health, *rasayana* can be seen as a nutritional dynamic for mental and physical renewal (Goyal, 2018).

In the Ayurveda Classical textbook *Charaka Samhita*, Acharya Charaka enumerates a diverse range of *rasayanas*, which are believed to play a pivotal role in disease prevention, immune enhancement, and the restoration of overall health (Trikamaji et al., 2002). *Amalaka Rasayana Churna* (ARC) is a widely used Ayurveda polyherbal formulation that contains *Amalaki* (*Embllica officinalis* Gaertn.), *Pippali* (*Piper longum* L.), *Sarkara* (Sugar), *Madhu* (honey) and *Ghritha* (ghee). The consumption of ARC promotes a disease-free life, longevity without the typical signs of ageing, enhanced mental clarity and calmness, improved cognitive function, strength, and nourishment. It also boosts disease resistance, increases sexual vitality in women, supports reproductive health for conception, ensures well-developed progeny, strengthens the sense organs, improves voice clarity and stability, and fosters overall rejuvenation health (Trikamaji et al., 2002). However, while these benefits are traditionally recognized, this study seeks to investigate and verify these claims using modern scientific parameters. Although it is a commonly used formulation in the Ayurveda System of Medicine for preventative, promotional, and curative reasons, there is a dearth of information about the phytoconstituents, nutritional value and antioxidant activity of ARC. So, a pharmaceutical analytical study was planned to determine the phytoconstituents, antioxidant activity and nutritional assessment of the formulation.

MATERIALS AND METHODS

Collection and Authentication of Raw Ingredients

The raw materials used for preparing *Amalaka Rasayana Churna* (Table 1) were sourced from the GMP-certified KLE Ayurveda Pharmacy, Khasbag, Belagavi, Karnataka. These ingredients were authenticated at the AYUSH-Certified Central Research

Facility of KLE Shri B.M.K. Ayurveda Mahavidyalaya, Belagavi, Karnataka. ARC was prepared at the GMP-Certified KLE Ayurveda Pharmacy, Belagavi.

Methods

A preliminary phytochemical screening, macroscopic description and Thin-Layer Chromatography (TLC) of the formulation were conducted at the AYUSH-Certified Central Research Facility of KLE Shri B.M.K. Ayurveda Mahavidyalaya, Belagavi, Karnataka. The antioxidant activity, High Performance Thin Layer Chromatography (HPTLC) and nutritional analysis were performed at the Confederation for Ayurvedic Renaissance-Keralam Limited (CARE KERALAM Ltd), Koratty, Thrissur, Kerala, India.

Preparation of Amalaka Rasayana Churna

The preparation involves impregnating *Amalaki* (*Embllica officinalis* Gaertn.) fruit powder (2 kg 560 g) with fresh *Amalaki* fruit juice for a duration of 21 days in wet grinder. This mixture is then blended with honey and ghee (2 kg 560 g each) and further combined with *Pippali* (*Piper longum* L.) in one-eighth proportion and fine sugar in one-fourth proportion. The ingredients and composition of *Amalaka Rasayana Churna* is mentioned in Table 1.

RESULTS

The pharmaceutical-analytical evaluation of *Amalaka Rasayana Churna* (ARC) provided critical insights into its composition, physicochemical properties, and potential health benefits. The Preliminary Phytochemical Analysis (Table 2), Description Macroscopic and Physico- Chemical Standards Tests (Table 3), The Thin Layer Chromatography (Table 4), Nutritional Analysis and Antioxidant Activity (Table 5) and HPTLC (Table 6, Figures 1 and 2) of *Amalaka Rasayana Churna* are summarized in the given tables.

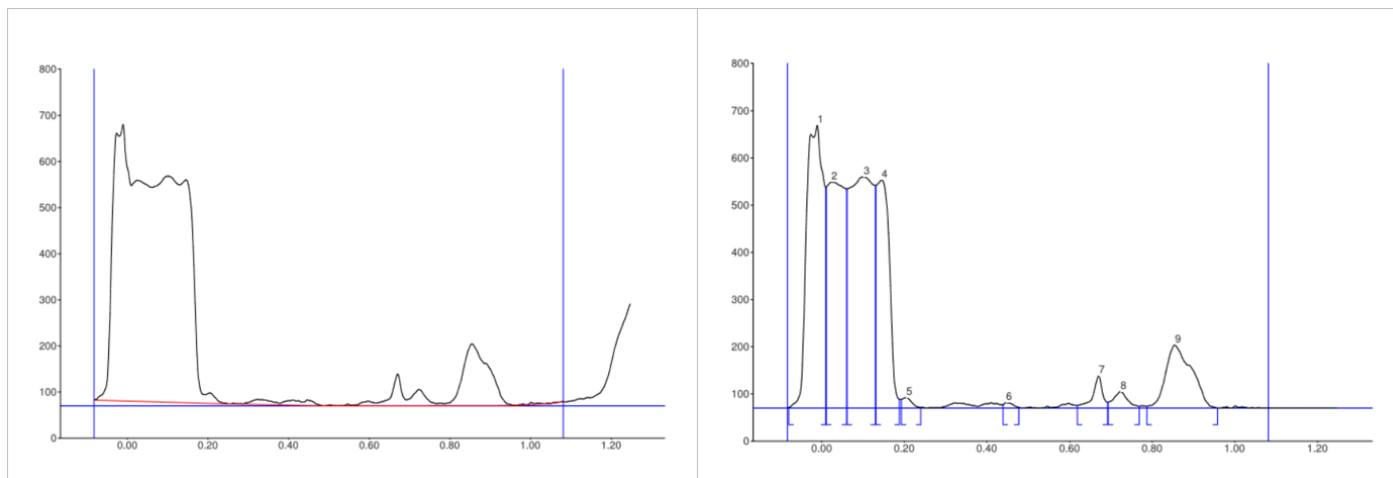


Figure 1: *Amalaka Rasayana Churna*: HPTLC (254nm).

Table 1: Ingredients and composition of Amalaka Rasayana Churna.

Sl. No.	Ingredients	Latin Name	Part Used	Composition	Source
1.	Amalaki	<i>Emblica officinalis</i> Gaertn.	Fruit	1 part	GMP Certified KLE Ayurveda Pharmacy
2.	Pippali	<i>Piper longum</i> L.	Fruit	1/8 part	
3.	Ghrita	Ghee	-	1 part	
4.	Madhu	Honey	-	1 part	
5.	Sarkara	Sugar	-	1/4 part	

Table 2: Preliminary Phytochemical Analysis of Amalaka Rasayana Churna.

Tests	Water	Alcohol
Carbohydrates	+	+
Reducing Sugar	+	+
Monosaccharides	+	+
Pentose Sugar	+	+
Non reducing sugar	-	-
Hexose sugar	-	-
Proteins	-	-
Amino Acids	-	-
Steroids	+	+
Flavonoids	+	+
Alkaloids	-	+
Tannins	+	+
Test for glycosides		
Cardiac Glycosides	+	+
Anthraquinone Glycosides	+	-
Saponin Glycosides	+	+

DISCUSSION

Preliminary Phytochemical Analysis

The water and alcohol extracts of *Amalaka Rasayana Churna* revealed the presence of carbohydrates, reducing sugars, monosaccharides, and pentose sugars. The formulation also contained steroids, flavonoids, tannins, and alkaloids. Additionally, cardiac glycosides, anthraquinone glycosides, and saponin glycosides were detected.

The phytochemical screening confirms the presence of various bioactive compounds. Carbohydrates were detected in both water and alcohol extracts, indicating energy-yielding potential. The presence of reducing sugars and monosaccharides indicates easily digestible simple sugars, which may support rapid energy availability in nutrition. The detection of pentose sugars, along with the absence of hexose sugars and non-reducing sugars, suggests a selective sugar composition that could influence glycemic response and metabolic outcomes in patients (Zhu *et al.*, 2022). Proteins and amino acids were absent in both extracts, suggesting

that ARC's effects are primarily due to secondary metabolites rather than protein-based nutrition (Kumar *et al.*, 2023). The presence of steroids in both extracts suggest anti-inflammatory and hormonal activity (Rhen & Cidlowski, 2005). Plant-derived steroids, such as phytosterols, have been studied for their potential benefits in human health. While phytosterols are primarily recognized for their cholesterol-lowering properties, some research suggests they may also influence hormonal activity due to their structural similarity to human steroid hormones (Devi *et al.*, 2023). The sexual vigour is also well maintained with the help of steroids (Jain *et al.*, 2009). The healthy reproductive organs will be giving the best of the progenies which is also mentioned in the benefits of using ARC (Chapin *et al.*, 2004). *Amalaki* (*Emblica officinalis* Gaertn.) is also well studied in terms of reproductive health and have given significant results clinically (Kumari & Saxena, 2023). Flavonoids, known for their antioxidant and anti-inflammatory properties, further support ARC's traditional role in combating oxidative stress and inflammation-related disorders such as cancer and further promotes longevity (Romagnolo & Selmin, 2012; Ysrafil *et al.*, 2023). Alkaloids were detected only in the alcohol extract, indicating their solubility in organic solvents and their potential antimicrobial and analgesic properties (Pereira *et al.*, 2023). The presence of tannins in both extracts suggests astringent, antimicrobial, and antioxidant activities, reinforcing its traditional use in gastrointestinal health and wound healing (Khanbabaee & van Ree, 2001). The presence of alkaloids and tannins can combat infections as it possesses antimicrobial action and anti-inflammatory properties (Ti *et al.*, 2021). The formulation also contains glycosides, including cardiac glycosides with potential cardiotoxic properties which is beneficial for cardiac health and promotes vitality, anthraquinone glycosides which have laxative effects, and saponin glycosides which is having expectorant and immunomodulatory effects (Patel, 2016). The saponin glycosides helps in the respiratory health as it is having potent expectorant action and can combat respiratory tract infections (Tatli Cankaya & Somuncuoglu, 2021).

Macroscopic and Physicochemical Analysis

The formulation of *Amalaka Rasayana Churna* was observed to be semi-solid, blackish in colour, with a mild characteristic odour and a sour taste. The pH value was recorded as 2.43, indicating its acidic nature. The low pH value also indicates to the presence

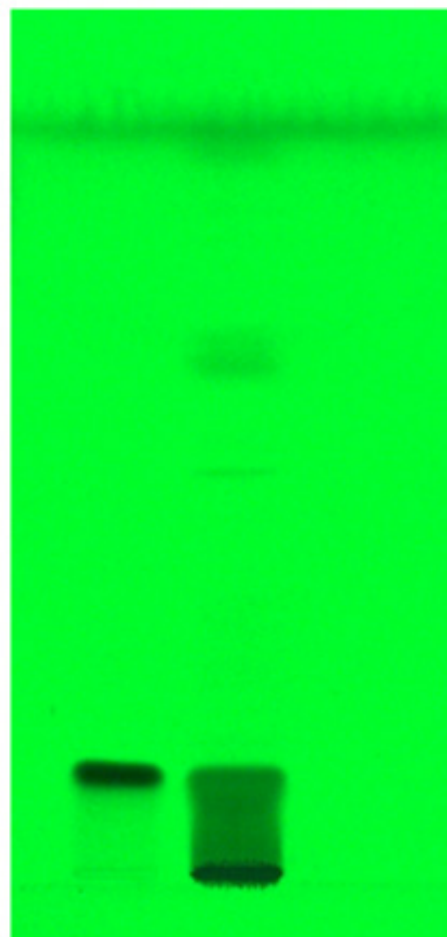
Table 3: Description Macroscopic and Physico Chemical Standards Tests of Amalaka Rasayana Churna.

Tests	Results
Description Macroscopic Tests	
Form	Semi Solid
Taste	Sour
Odour	Mild Characteristic
Colour	Blackish
Physico Chemical Standards Tests	
Loss on drying	2.745%
Ash value	2.135%
Water Soluble Extractive	86.596%
Alcohol Soluble Extractive	44.471%
pH Value	2.43

of organic acids like ascorbic acid, which contributes to its preservative nature, antiaging, absorptive, and digestive benefits (Maniya *et al.*, 2024). The acidic nature of drugs significantly influences their pharmacokinetic properties, including Absorption, Distribution, Metabolism, Excretion, and Toxicity (ADMET). A key parameter in understanding this influence is the acid dissociation constant, or pKa, which indicates the pH at which a drug exists equally in its ionized and non-ionized forms. The ionization state of a drug affects its solubility and permeability across biological membranes, thereby impacting its absorption and distribution within the body (Dar & Khatoun, 1997).

The loss on drying was 2.745%, demonstrating its stability in terms of moisture retention. The ash value was 2.135%, reflecting the presence of inorganic content. The water-soluble extractive was significantly high at 86.596%, highlighting the solubility of bioactive compounds in aqueous mediums. Additionally, the alcohol-soluble extractive was 44.471%, suggesting a considerable presence of alcohol-soluble phytoconstituents. These parameters ensure that the formulation is stable, bioavailable, and free from contaminants, which is essential for maintaining therapeutic efficacy and safety in clinical applications.

The macroscopic characteristics of ARC provide insights into its composition and quality. The semi-solid consistency suggests the presence of moisture or extractives contributing to its texture, which is typical for herbal formulations prepared using liquid media (Kshirsagar *et al.*, 2011). The sour taste indicates the presence of organic acids, such as ascorbic acid, which is abundant in *Amalaki* (*Embllica officinalis* Gaertn.) and aligns with its traditional use as a digestive and rejuvenating tonic (Gaire *et al.*, 2014). The mild characteristic odour suggests minimal volatile components, which is desirable for maintaining stability and acceptability in herbal formulations (Singh *et al.*, 2011). The blackish appearance may result from processing and drying methods, as well as the presence of tannins, polyphenols,

**Figure 2:** HPTLC image formation of Amalaki Rasayana Churna at 254 nm.

and other phytochemicals contributing to the dark colouration (Panda & Kar, 1998).

The physicochemical parameters of ARC further establish its stability and efficacy. The low loss on drying (2.745%) indicates minimal moisture content, which is beneficial for shelf stability and preventing microbial growth, suggesting good processing and storage conditions (Rege *et al.*, 1999). The ash value (2.135%) represents the total mineral and inorganic matter, and its low percentage suggests purity and absence of excessive contaminants (Joshi & Parle, 2006). The high water-soluble extractive content (86.596%) indicates the presence of hydrophilic compounds such as tannins, flavonoids, and glycosides, making ARC effective in aqueous preparations (Kurapati *et al.*, 2014). The alcohol-soluble extractive (44.471%) highlights bioactive constituents like alkaloids, flavonoids, and steroids, which dissolve better in organic solvents and enhance therapeutic potential (Kulkarni & Dhir, 2008).

Chromatographic Analysis

The TLC (Thin Layer Chromatography) analysis of the alcohol extract exhibited R_f values of 0.65 (short wave) and 0.16, 0.29,

0.54, and 0.72 (long wave). The HPTLC analysis at 254 nm revealed nine distinct peaks, indicating the presence of multiple bioactive compounds.

Nutritional Profile and Antioxidant Activity

The total iron content was measured at 267.97 ppm. The formulation contained 0.095% Vitamin C. The energy value was recorded as 369.31 kcal, primarily contributed by its high carbohydrate content (90.9%). The amounts of total fat (0.35%) and protein (0.64%) were minimal. The crude fibre content was 1.33%, and the total sugar content was 45.77%, derived mainly from honey and sugar. The moisture content was 7.37%, ensuring the formulation's stability. The antioxidant activity (IC₅₀ value) was 29.72 mg/kg, confirming its free radical scavenging ability.

The nutritional profile of ARC highlights its potential as a functional food. The total iron content (267.97 ppm) suggests a role in improving haemoglobin levels and preventing anaemia (Malhotra *et al.*, 1965). Although the Vitamin C content (0.095%) is relatively low, it still contributes to antioxidant activity, immune function, and collagen synthesis (Dubey *et al.*, 2021). The energy value (369.31 kcal) indicates its role as an energy-boosting supplement. The high carbohydrate content (90.9%) makes it a rich energy source (Tiwari *et al.*, 2014). The low fat (0.35%) and protein (0.64%) contents suggest that ARC primarily provides carbohydrates and phytochemicals rather than macronutrient balance. ARC contains *Ghritha* (Cow ghee), which gives nourishment to the body and also acts as an anti-oxidant (Patil *et al.*, 2009). The crude fibre content (1.33%) supports digestive health, while the significant total sugar content (45.77%) enhances palatability and provides quick energy (Balasubramani *et al.*, 2020). The moderate moisture content (7.37%) contributes to stability while preventing microbial growth (Tapia *et al.*, 2020;

Sannapaneni & Latha, 2019). The fibre content in the formulation along with the anthraquinone glycosides supports the gut health which directly is contributing to the mental wellbeing (Verma & Kumar, 2021).

The antioxidant activity of ARC further supports its traditional use in rejuvenation. The IC₅₀ value of 29.72 mg/kg indicates high antioxidant potential. The presence of flavonoids, tannins, and vitamin C contributes to this activity, reinforcing ARC's role in reducing oxidative stress and inflammation (Durg *et al.*, 2015). Additionally, the rich antioxidant content of ARC helps slow down telomere length shortening, promoting cellular longevity and overall health (Gannon *et al.*, 2021).

Madhu (Honey), an animal-derived compound, is well studied in previous research works and has anti-inflammatory, antioxidant, immunomodulatory, antimicrobial, and wound-healing properties, along with a high calorific value of approximately 304 kcal per 100g, making it a valuable natural therapeutic and energy-providing agent (Pandey *et al.*, 2022).

The *Amalaki* (*Emblica officinalis* Gaertn.) is proven drug in enhancing vision and delaying disease progression in eye disorders (Kulkarni *et al.*, 1991). In recent studies *Amalaki* (*Emblica officinalis* Gaertn.) is proven to be a best antioxidant rich drug with free radical scavenging properties (Auddy *et al.*, 2008). *Amalaki* (*Emblica officinalis* Gaertn.) is also found to have an action in enhancing cardiorespiratory endurance (Chandran *et al.*, 2023). A clinical study was conducted using a formulation with *Amalaki* (*Emblica officinalis* Gaertn.) as the primary ingredient, demonstrating significant anti-aging effects in patients (Ahmad *et al.*, 2010).

Pippali (*Piper longum* L.) contains a diverse range of secondary metabolites, including alkaloids, flavonoids, steroids, essential oils, cardiac glycosides, anthraquinones, arbutin, and anthraglycosides, among others. The most abundant alkaloid present is piperine, which constitutes 4-5% of its composition and is responsible for its distinctive pungent taste. Previous studies highlight the pharmacological properties of *Pippali* (*Piper longum*

Table 4: Thin Layer Chromatography (Alcohol extract) of Amalaka Rasayana Churna.

R _f values of Short Wave	0.65
R _f values of Long Wave	0.16, 0.29, 0.54, 0.72

Table 5: Nutritional Analysis and Antioxidant Activity of Amalaka Rasayana Churna.

Parameter	Unit	Result	Test Method
Total Iron	ppm	267.97	CKL/ANL/AY-008
Vitamin C	%	0.095	CKL/ANL/HPLC/014
Energy Value	Kcal	369.31	CKL/ANL/FP-042
Carbohydrate	%	90.9	CKL/ANL/FP-041
Total Fat	%w/w	0.35	AOAC 21 st Edition 2019
Total Protein	%w/w	0.64	IS:7219-1973(RA 2020)
Crude Fibre	%w/w	1.33	IS:1155-2022
Total Sugar	%w/w	45.77	API Part I, Vol VI
Moisture	%w/w	7.37	API Part I, Vol I
Antioxidant activity IC ₅₀ value	mg/kg	29.72	CKL/ANL/UV-004

Table 6: Amalaka Rasayana Churna: HPTLC R_f Values of at 254 nm.

Peak	Start R _f	Start Height	Max R _f	Max Height	Max %	End R _f	End Height	Area	Area %	Assigned substance
1.	-0.08	1.8	-0.01	599.4	25.78	0.01	467.3	17239.9	24.43	unknown*
2.	0.01	468.4	0.02	479.1	20.61	0.06	464.6	14191.9	20.11	unknown*
3.	0.06	464.8	0.1	490.1	21.08	0.13	472.1	20090.3	28.47	unknown*
4.	0.13	472.2	0.14	483.2	20.78	0.19	19.2	10611.4	15.04	unknown*
5.	0.19	18.9	0.2	22.7	0.97	0.24	1.3	372.5	0.53	unknown*
6.	0.44	7.4	0.45	12.5	0.54	0.48	1.9	186.9	0.26	unknown*
7.	0.62	6.0	0.67	69.1	2.97	0.69	12.9	1129.9	1.6	unknown*
8.	0.69	13.1	0.73	35.3	1.52	0.77	4.4	854.1	1.21	unknown*
9.	0.79	4.4	0.86	133.7	5.75	0.96	0.1	5894.6	8.35	unknown*

L.), demonstrating its antitumor, immunomodulatory, antifungal, antimicrobial, anti-inflammatory, anti-obesity, cardioprotective, antioxidant, hepatoprotective, antidepressant, and antiamebic effects, among several other therapeutic benefits (Kanchan & Bhalerao, 2020).

Ghritha (Cow ghee) is nutritionally superior to other oils and fats due to its high content of Medium-Chain Fatty Acids (MCFAs), which are directly absorbed by the liver and used as an energy source (Tandon & Yadav, 2020). *Ghritha* (Cow ghee) is highly beneficial for mental well-being and is commonly used in treating various mental health disorders (Sharma *et al.*, 2022). As a lipid, it has the unique ability to cross the blood-brain barrier, supporting cognitive function and neurological health (Karandikar *et al.*, 2016). The above findings also suggest that the consumption of ARC may contribute to a disease-free state and promote longevity with delayed signs of ageing, potentially through mechanisms such as telomere length preservation, antioxidant activity, and immunomodulatory effects. These actions may also underlie the observed enhancements in mental clarity, cognitive functions, physical strength, and overall nourishment (WHO *et al.*, 2013).

CONCLUSION

The pharmaceutical and analytical evaluation of *Amalaka Rasayana Churna* (ARC) confirms its rich phytochemical composition, and significant nutritional and antioxidant potential. The findings support its efficacy in promoting longevity, enhancing immunity, and rejuvenating bodily tissues. The combination of *Amalaki* (*Embolia officinalis* Gaertn.), *Pippali* (*Piper longum* L.), ghee, honey, and sugar create a well-balanced formulation that nourishes the body while offering protection against degenerative processes. ARC's potent antioxidant properties, along with its immunomodulatory and rejuvenating effects, reinforce its role as a valuable Ayurvedic formulation. Analytical assessments validate traditional Ayurvedic claims, highlighting its potential for modern therapeutic applications. Given its rich pharmacological profile, ARC holds promise as a

natural supplement for supporting immune function, managing oxidative stress, and improving overall well-being.

Future clinical studies are crucial for validating its effectiveness across diverse therapeutic and physiological domains. Integrating ARC into modern healthcare as an adjuvant therapy could enhance its applications in addressing oxidative stress-related disorders, anaemia, and immune deficiencies, reaffirming Ayurveda's relevance in contemporary medicine.

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ABBREVIATIONS

ARC: *Amalaka Rasayana Churna*.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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