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Development and Phytochemical Evaluation through HPTLC of Ayurvedic Vrikshamla–Eranda Taila Suppository for Children with Functional Constipation

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KEYWORDS
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Abstract

Background: Functional constipation is a common childhood problem in which quality of life is markedly impaired and conventional therapies are largely unsatisfactory. **Objective:** The present study was conducted to prepare and standardize a novel paediatric herbal suppository using Vṛkṣamla (*Garcinia indica* Roxb.) and Eranda Taila (castor oil) based on references in classic Ayurvedic texts, including Vaidya Tārakam, a Kerala regional treatise. **Materials and Methods:** The Vṛkṣamla extract was prepared by the maceration method and subjected to classical Taila Pāka with Eranda Taila. Subsequently, it was incorporated with cocoa butter and beeswax as lipoids to form paediatric suppositories. Standardization was accomplished using High-Performance Thin Layer Chromatography (HPTLC) to establish a reproducible phytochemical fingerprint. **Results:** HPTLC analysis revealed characteristic R_f peaks at 0.23–0.31 and 0.70–0.82, representing both phenolic and lipophilic constituents, confirming the stability and reproducibility of the formulation. **Conclusion:** The Vṛkṣamla–Eranda Taila suppository is an evidence-based Ayurvedic formulation that offers a safe, effective, and natural therapeutic option for paediatric functional constipation, integrating classical intervention practices with contemporary analytical validation.

Introduction

Functional constipation is a chronic bowel disorder characterised by infrequent defecation, hard stools, straining, and a persistent sense of incomplete evacuation. Unlike secondary constipation caused by metabolic or structural disease, functional constipation is diagnosed using assessment-based criteria such as the Rome IV criteria, which emphasise the clinical course rather than laboratory abnormalities (Rao, S.S., 2021). Prevalence tends to be higher among women, older adults, and individuals with low fibre intake or limited mobility. In many Western populations, rates frequently reach 14–29% (Chu, H., Zhong, 2020). Children also experience the same disease load, with approximately 10% developing chronic functional constipation every year (Tabbers, M.M., 2013). First-line therapy generally includes dietary fibre optimisation, increased fluid consumption, and physical activity. For persistent symptoms, commonly used medications include osmotic and stimulant laxatives, stool softeners, and motility-enhancing agents. Polyethylene glycol remains the best-supported pharmacologic option and consistently improves stool frequency and ease of passage. Yet, a notable proportion of patients continue to report incomplete relief (Bharucha, 2015). Preliminary evidence suggests these rectal formulations may improve stool consistency and assist evacuation through localised soothing or mild stimulant effects, with fewer systemic adverse reactions than some oral agents (Zhu, L., 2020).

Traditional medicine continues to play a crucial role in healthcare across many regions, particularly where access to conventional pharmacological treatments is limited or where cultural reliance on herbal therapies remains strong. The World Health Organisation (WHO) estimates that up to 80% of the population in some Asian and African countries relies on traditional medicine for primary healthcare needs (World Health Organisation, 2019). Global herbal medicine markets are projected to grow steadily, with constipation-related botanical preparations representing a significant share of this growth (Parasuraman, S., 2014). Early clinical findings suggest that herbal rectal preparations may help reduce mucosal irritation, ease stool passage, and support natural bowel function, making them attractive to both patients and integrative practitioners (Rahimi, R., 2012).

Ayurvedic literature contains extensive descriptions of herbal and herbo-mineral preparations that have been used for centuries in regional and folklore medical practices. Kerala, in particular, has a rich heritage of localised Ayurvedic

treatments documented in classical texts as well as regional compendia such as *Vaidya Tārakam*, a respected traditional reference widely used by Kerala physicians. Among the diverse therapeutic modalities described, the use of Vṛkṣamla (*Garcinia indica* Roxb.) and Eranda Taila (castor oil) for bowel regulation is well established in local practice, especially for paediatric constipation. Ayurveda offers a rich repository of therapeutic formulations, many preserved in classical pharmaceutic traditions such as Bhaishajya Kalpana and Rasashāstra (Rahimi, R., 2012). These disciplines document detailed procedures for drug preparation and quality testing, although earlier techniques often relied on observational, qualitative assessments. Kerala's regional medical heritage builds on these foundations, with local practitioners referencing compendia such as *Vaidya Tārakam* for clinical guidance and therapeutic recipes (Narayanan, V.C.N., 2023). Among the remedies described in Kerala's folklore practices, Vṛkṣamla (*Garcinia indica*) and Eranda Taila hold a longstanding reputation for mridu virecana (gentle purgation) and digestive support. Experimental and ethnopharmacologic studies highlight Vṛkṣamla's gastrointestinal modulating effects and mild laxative properties (Jayaprakasha, 2006), while castor oil's ricinoleic-acid–mediated laxative effect is well documented (Izzo, A.A., et al., 1999).

To modernise and standardise this practice, the development of an advanced Vṛkṣamla–Eranda Taila suppository provides a scientifically refined, child-friendly formulation inspired by the teachings of *Vaidya Tārakam*. By integrating classical Ayurvedic knowledge with contemporary pharmacological standards, this formulation aims to ensure improved safety, reproducibility, and therapeutic efficacy, bridging traditional wisdom with modern paediatric constipation management.

In traditional Ayurvedic practice, formulations prepared with Vṛkṣamla and Eranda Taila were commonly administered as handmade varti (rectal wick preparations), as referenced in regional Kerala texts such as *Vaidya Tārakam* (Narayanan, V.C.N., 2023). Paediatric acceptability remains a challenge, as classical preparations often have strong tastes, odours, and textures that limit their suitability for children, especially when fresh preparation is required before each administration. The difficulty of maintaining microbial stability and preventing rancidity in oily herbal mixtures over time has been highlighted in several pharmacokinetics reviews addressing the stability of traditional herbal formulations

(Ekor, M., 2014). As a result, large-scale preparation and consistent clinical distribution of handmade varti become impractical. Thus, the development of a standardised Vṛkṣamla–Eranda Taila paediatric suppository represents a scientifically robust transformation of a traditional Kerala practice into a reliable, child-friendly dosage form.

Drug Review

Vṛkṣamla (*Garcinia indica*) (Bhāvamiśra, 2015), known regionally as Kokum, is listed in the Amrādi Varga of Bhāvaprakāśa Nighaṇṭhu, where it is described as a sour, digestive-enhancing, and Vāta-pacifying fruit. Its classical properties are defined as Amla Rasa, Laghu–Rukṣa Guna, Uṣṇa Vīrya, and Amla Vipāka, enabling it to promote Agni-dīpana, reduce abdominal discomfort, and assist in mridu virecana (gentle bowel evacuation). Traditional uses include management of indigestion, abdominal distension, and constipation associated with aggravated Vāta. Modern phytochemical analyses have identified multiple bioactive components in Vṛkṣamla, including hydroxycitric acid (HCA), garcinol, isogarcinol, and potent anthocyanins such as cyanidin and delphinidin. These compounds exhibit antioxidant, anti-inflammatory, and gastroprotective properties (Jayaprakasha, 2006). Studies demonstrate that Garcinia extracts stimulate digestive enzymes and support metabolic activity—consistent with Ayurvedic descriptions of improved Agni (Kumar, A., et al., 2011). Ethnopharmacological investigations confirm gentle laxative action, improved intestinal transit, and stool softening. These findings align with classical Vātānulomana and mridu virecana actions.

Materials & Methods

Procurement of Raw Drugs

Vṛkṣamla was collected from the local market of Nasik, a district in Maharashtra, India. The collected drug was identified and authenticated by the Department of Dravyaguna, Parul Institute of Ayurved and Research (PIAYR), Gujarat. Eranda Taila (castor oil) was obtained from the pharmacy of Parul Institute of Ayurved and Research. Standardisation procedures including High-Performance Thin Layer Chromatography (HPTLC), R_f value determination, and photodocumentation were conducted at the Centre for Research and Development (CR4D) and Parul Institute of Applied Sciences, Parul University, Post Limda, Waghodia, Vadodara, Gujarat, India.

Preparation of Vṛkṣamla–Eranda Taila Suppository

A total of 100 g of dried Vṛkṣamla (*Garcinia indica*) fruit rind was collected

and subjected to preliminary cleaning. The raw drug was immersed in 1.4 L of potable water and allowed to macerate for 24 hours to facilitate the extraction of water-soluble constituents (Fig. 1). Following maceration, 2% chloroform (8 mL) was added to the mixture and kept undisturbed for an additional 12 hours to prevent microbial or enzymatic activity during the extraction period (Fig. 2). The mixture was then gently washed to remove residual impurities, and the aqueous extract of Vṛkṣamla was collected (Fig. 3).

The fresh extract was combined with 100 mL of Eranda Taila and subjected to classical Taila Pāka processing, wherein the mixture was heated under controlled temperature until the taila absorbed the active phytoconstituents of the decoction (Fig. 4 & Fig. 5). At the completion of the Pāka process, the medicated oil was filtered through sterile cloth to obtain a clear Vṛkṣamla–Eranda Taila extract. The filtrate was allowed to cool and left to settle, ensuring uniform separation and stabilisation of the infused oil (Fig. 6).

To prepare the suppositories, the medicated oil was incorporated into a lipid base consisting of 80 g cocoa butter and 20 g beeswax. The mixture was heated using the fusion method, with continuous stirring to achieve a homogenous semi-solid mass. Once the medicated base reached a pourable consistency, it was transferred into 2 g paediatric suppository moulds and allowed to solidify at controlled room temperature (Fig. 7 & Fig. 8).

Fig 1: Dried parts of Vrikshamla

Fig 2: Soaked parts of Vrikshamla in water & chloroform

Fig 3: Filtration of Soaked Drug

Fig 4: Adding Eranda taila into filtered extract of Vrikshamla

Fig 5: Boiling of extract using Taila Pāka method

Fig 6: Remains of extract after Taila Paka Method

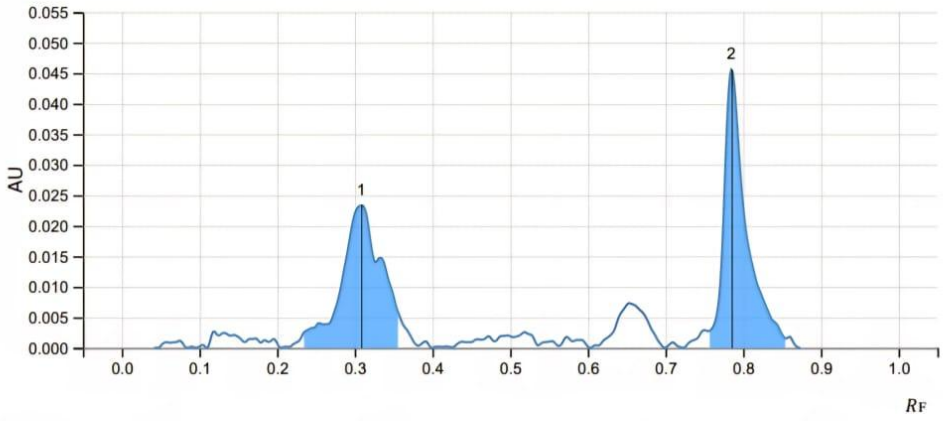
Fig 7: Moulded suppository wax poured into the paediatric moulds for solidifying.

Fig 8: Solidified Advanced Suppository

HPTLC

Herbal suppositories formulated using Vṛkṣamla (*Garcinia indica*) and Eranda Taila (*Ricinus communis* oil) were evaluated through High-Performance Thin Layer Chromatography (HPTLC) profiling. The primary objective was to generate a characteristic chromatographic fingerprint for quality control, standardisation, and batch reproducibility assessment of the formulation. Analysis was performed using Vision CATS software on automated instruments, including Linomat 5 applicator for sample application and TLC Scanner 4 in 254 nm absorbance mode. The stationary phase comprised silica gel 60 F_{254} precoated plates (100 × 100 mm). The mobile phase used was a solvent system of ethyl acetate: methanol: water in an 8:1:1 v/v/v ratio, with a 20-minute chamber saturation aided by a saturation pad. The formulation was applied in four different volumes: 10 µL (Track 1, Fig. 9), 20 µL (Track 2, Fig. 10), 25 µL (Track 3, Fig. 11), and 30 µL (Track 4, Fig. 12). Scanning was performed at 254 nm using a deuterium lamp in absorbance mode, producing reproducible peaks suitable for establishing a stable HPTLC fingerprint for Vṛkṣamla–Eranda Taila paediatric suppositories.

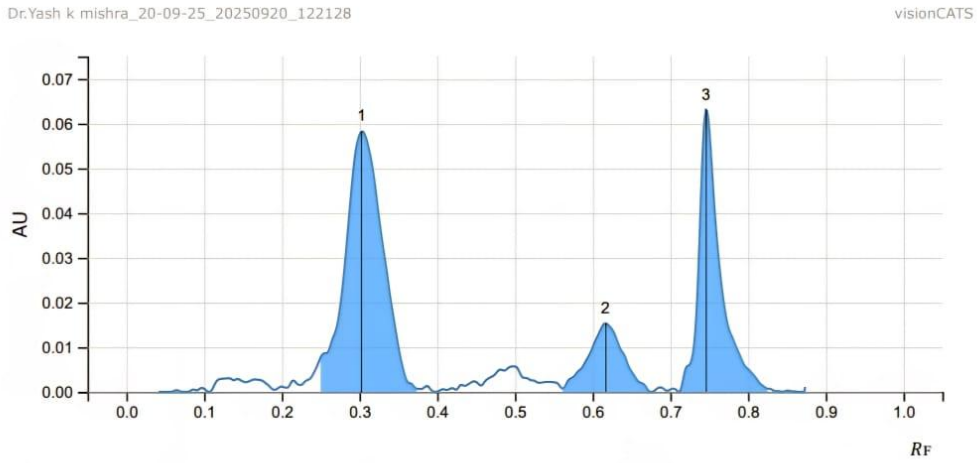
FIG 9: TRACK NO. 1 HERBAL SUPPOSITORY



Peak #	Start		Max			End		Area	
	R_F	H	R_F	H	%	R_F	H	A	%
1	0.234	0.0025	0.308	0.0233	33.88	0.358	0.0050	0.00139	47.77
2	0.756	0.0027	0.785	0.0455	66.12	0.854	0.0015	0.00152	52.23

Peak #	Resolution (None)		Manual peak	Substance Name
	(n-1)	(n+1)		
1	n/a	n/a	Yes	
2	n/a	n/a	No	

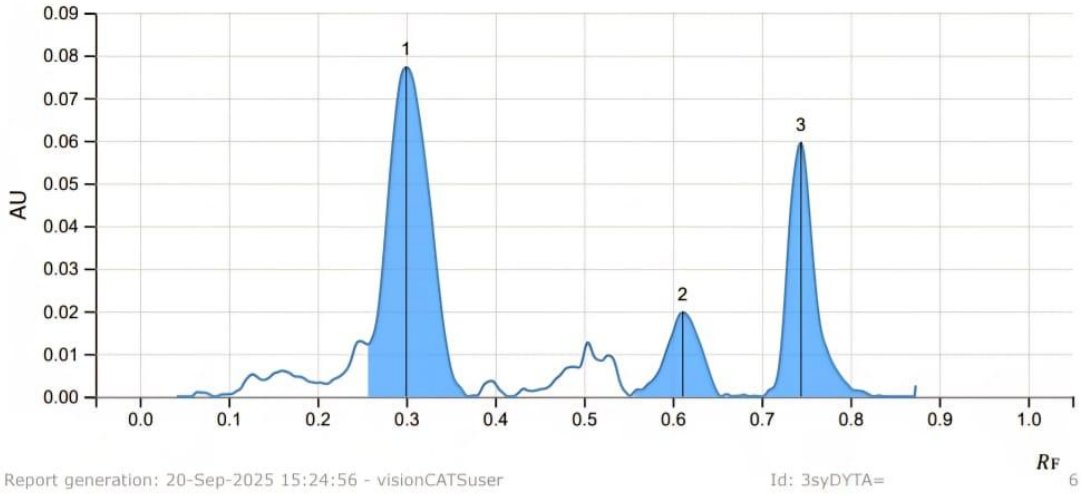
FIG 10: TRACK NO 2 HERBAL SUPPOSITORY



Peak #	Start		Max			End		Area	
	R_F	H	R_F	H	%	R_F	H	A	%
1	0.250	0.0077	0.303	0.0582	42.63	0.376	0.0007	0.00326	53.84
2	0.561	0.0007	0.617	0.0153	11.21	0.675	0.0000	0.00080	13.17
3	0.711	0.0000	0.746	0.0630	46.16	0.825	0.0007	0.00200	32.98

Peak #	Resolution (None)		Manual peak	Substance Name
	(n-1)	(n+1)		
1	n/a	n/a	No	
2	n/a	n/a	No	
3	n/a	n/a	No	

FIG 11: TRACK NO 3 HERBAL SUPPOSITORY



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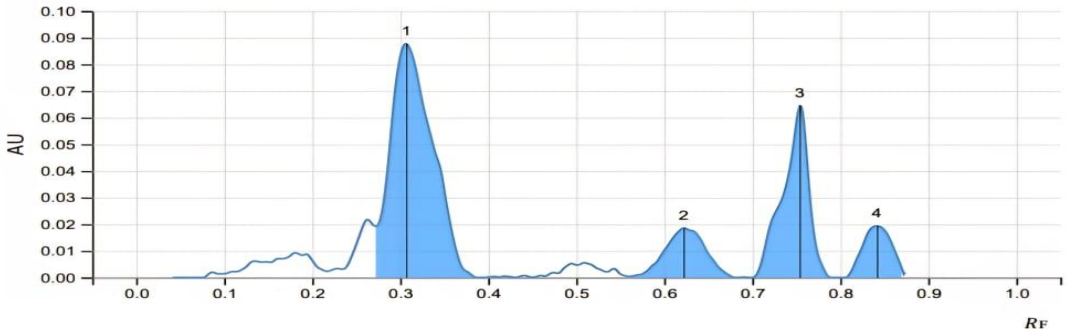
Peak #	Start		Max			End		Area	
	R_F	H	R_F	H	%	R_F	H	A	%
1	0.257	0.0122	0.300	0.0772	49.39	0.371	0.0000	0.00423	58.70
2	0.557	0.0011	0.611	0.0197	12.60	0.654	0.0000	0.00089	12.35
3	0.700	0.0000	0.744	0.0594	38.01	0.825	0.0000	0.00208	28.95

Peak #	Resolution (None)		Manual peak	Substance Name
	(n-1)	(n+1)		
1	n/a	n/a	No	
2	n/a	n/a	No	
3	n/a	n/a	No	

FIG 12: TRACK NO 4 HERBAL SUPPOSITORY



Peak #	Start		Max			End		Area	
	R_F	H	R_F	H	%	R_F	H	A	%
1	0.272	0.0192	0.307	0.0877	46.14	0.388	0.0000	0.00490	55.41
2	0.560	0.0004	0.622	0.0186	9.79	0.681	0.0000	0.00100	11.31
3	0.700	0.0000	0.754	0.0644	33.90	0.790	0.0000	0.00218	24.69
4	0.806	0.0000	0.842	0.0193	10.17	0.872	0.0013	0.00076	8.59

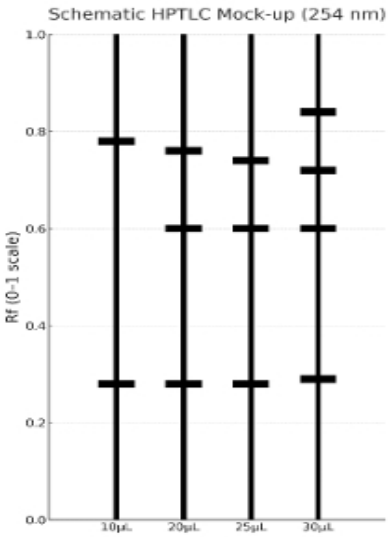
Peak #	Resolution (None)		Manual peak	Substance Name
	(n-1)	(n+1)		
1	n/a	n/a	No	
2	n/a	n/a	No	
3	n/a	n/a	No	
4	n/a	n/a	No	

Interpretation Track-Wise And Comparative Evaluation

The HPTLC analysis of Vṛkṣamla (*Garcinia indica*)–Eranda Taila (*Ricinus communis* oil) paediatric suppositories revealed track-wise phytochemical profiles with characteristic peaks suitable for quality control and standardisation. Track 1 (10 µL) exhibited two major peaks at RF 0.234–0.308 (area contribution 47.77%) and RF 0.756–0.854 (area contribution 52.23%), indicating two primary constituents dominating the fingerprint with nearly equal intensities. Track 2 (20 µL) showed three peaks: RF 0.250–0.376 (53.84%), RF 0.561–0.675 (13.17%), and RF 0.711–0.825 (32.98%), suggesting the presence of additional minor constituents at higher sample loading. Track 3 (25 µL) displayed three peaks: 58.70%, 12.35%, and 28.95%, with the first peak remaining predominant, marking the major component of the suppository. Track 4 (30 µL) revealed four peaks: 55.41%, 11.31%, 24.69%, and 8.59%, with an additional minor peak at RF ~0.80–0.87 corresponding to a lipophilic component detectable at higher concentration. Comparative evaluation indicated consistency of major peaks at RF ~0.23–0.31 and RF ~0.70–0.82 across all tracks, serving as potential reference peaks for future quality control. The dose–response pattern confirmed that no peaks disappeared with increasing sample loading while minor peaks emerged, demonstrating linearity and chemical stability. Analytical significance includes: (1) development of a

reproducible multicomponent fingerprint characteristic of Vṛkṣamla–Eranda Taila formulations, (2) stability of components indicated by absence of degradation peaks, (3) reproducibility confirmed through consistent band visibility across all tracks, and (4) identification of potential standard marker peaks at RF 0.25–0.30 and 0.70–0.80 for future validation studies (Fig. 13).

FIGURE NO. 13 FINGERPRINT PROFILE OF HERBAL SUPPOSITORY (VRIKSHAMLA + ERANDA TAILA) AT 254 NM



Results

The HPTLC fingerprint of Vṛkṣamla (*Garcinia indica*)–Eranda Taila (*Ricinus communis* oil) paediatric suppositories revealed multiple reproducible peaks, indicating the presence of diverse phytoconstituents likely contributed by Vṛkṣamla (hydroxycitric acid derivatives, phenolics) and Eranda Taila (fatty acids, triglycerides). Peak positions were primarily observed in two RF ranges: 0.23–0.31, likely corresponding to mid-polar phenolics, and 0.69–0.85, likely representing lipophilic fractions derived from castor oil components. This pattern remained consistent across all applied doses, confirming the reproducibility and stability of the formulation.

Discussion

Functional constipation remains a clinical challenge in pediatric populations, with many children experiencing incomplete relief even with modern

pharmacologic interventions. The growing interest in natural and integrative medicine necessitates safer and more tolerable alternatives, particularly for children. The development of the Vṛkṣamla–Eranda Taila suppository integrates classical Ayurvedic formulations with modern pharmaceutical practices, bridging this gap. Vṛkṣamla (*Garcinia indica*), known for its Agni-dīpana (digestive stimulation) and mridu virechana (gentle purgation) actions, was standardised in correlation with Eranda Taila (*Ricinus communis* oil), a well-established laxative enhancing intestinal motility through ricinoleic acid activity. Together, these components provide localized soothing and mild stimulatory effects, facilitating smooth bowel evacuation while minimising systemic side effects. The use of cocoa butter and beeswax as the suppository base improves pediatric acceptability, stability, and controlled release of active constituents. HPTLC analysis confirmed the reproducibility and phytochemical integrity of the formulation, with consistent peaks across concentrations validating the stability of the active compounds. Marker peaks at RF 0.25–0.30 and 0.70–0.80 serve as reference points for future validation and large-scale production, ensuring quality control and standardisation.

Conclusion

This study demonstrates that the modernisation of traditional Ayurvedic formulations can yield clinically viable and standardised dosage forms. The Vṛkṣamla–Eranda Taila suppository represents a child-friendly, evidence-based herbal intervention for functional constipation, aligning with the WHO's vision of integrating traditional medicine into global healthcare frameworks while maintaining scientific rigor. Future clinical trials are recommended to evaluate therapeutic efficacy, pharmacokinetics, and long-term safety. Overall, the formulation successfully combines Ayurvedic wisdom with modern pharmacology, offering a sustainable and culturally grounded approach to pediatric constipation management.

Conflict Of Interest – Nil

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