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Comparative Physio-Chemical Evaluation of *Balarishta* Prepared by Using Six Different Vessels

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ABSTRACT

Background- *Sandhana Kalpana* is a process of self-generated hydro-alcoholic fermented preparation and its quality may be influenced by the type of vessels used during fermentation. As per the classical references, different S*andhana patra* were used, in current practice often alternatives vessels such as stainless steel and plastic are used in the light of convenience and related aspect. Accordingly, this study was undertaken to evaluate the impact of different vessels on the physio- chemical properties and yield of *Balarishta.* **Methods -** Six batches of *Balarishta* were prepared using different vessels such as glass, porcelain, wooden, stainless steel, food-grade plastic and earthen pot, strictly following classical guidelines. **Result -** All six batches exhibited dark brown color, sweet-astringent taste, thick consistency and alcoholic odor. The yield varied, with the highest from food-grade plastic (81.5%) and the lowest from the earthen pot (54.19%). Significant pharmaceutical analytical changes were observed among the batches of *Balarishta* prepared by 6 different *Sandhana patra,* alcohol content was observed more in glass vessel (5.4 %), porcelain vessel (5.32 %) and wooden vessel (6.9 %). **Conclusion-** In *Balarishta*, self-generated alcohol enhances extraction, stability, and efficacy. Among six *Sandhana Patra* tested, wooden, porcelain, and glass vessels produced higher alcohol and better yields, while the earthen pot showed poor performance, making it unsuitable for standardized large- scale preparation.

Keywords: *Arishta, Balarishta,* Different Vessels, *Sandhana Kalpana*

1. INTRODUCTION

Ayurveda has a rich heritage of using polyherbal formulations for the management of various disease conditions. Over time, numerous dosage forms have evolved in *Ayurveda,* considering factors such as stability, palatability, and therapeutic efficacy. Among these, *Asava* and *Arishta* are highly popular fermented formulations categorized under *Sandhana Kalpana*. *Sandhana* refers to the process of fermentation, wherein *Drava Dravya* (liquid media), *Aushadhi Dravya* (herbal ingredients), and sweetening agents such as sugar or jaggery are kept in a suitable vessel for a specific duration to facilitate fermentation. *Asava* and *Arishta* are preferred dosage forms because of their unique attributes, including faster absorption, good palatability, and extended shelf life. They represent classical examples of bio fermented preparations in Ayurveda, possessing self-generated alcohol. Traditionally, *Arishta* are prepared using decoctions, whereas *Asava* are made from freshly expressed herbal juices.[1] Fermentation in both preparations is facilitated by the addition of sugar along with *Dhataki* (*Woodfordia fruticosa* (L.) Kurz) flowers. The process of *Sandhana* is influenced by several factors such as season, temperature, location, nature of raw materials, the type of *Sandhana Patra* (fermentation vessel), quantity of sweetening agents, *Prakshepa Dravya*, atmospheric pressure, and environmental conditions. Classical texts mention various types of *Sandhana Patra* for instance, an earthen pot for *Dashmoolarishta*[2], a golden vessel for *Saraswatarishta*[3], a stone vessel for *Kumariasava*[4], and *Lauha Patra* (iron vessel)for *Madhvasava*[5].

Balarishta is an important *Arishta* formulation described in *Bhaishajya Ratnavali*. It is indicated in *Agnimandya* (digestive impairment), *Daurbalya* (weakness), *Vataja Roga* (*vata*-dominant disorders) and *Karshya* (emaciation). *Bala* (*Sida cordifolia*) serves as the chief ingredient and is known for its strengthening and nourishing properties. Other components like *Ashwagandha* and *Gokshura* further support musculoskeletal strength and contribute to nervous system function. Although several studies have evaluated *Balarishta* in terms of standardization and therapeutic validation, no study has focused on assessing the role of different fermenters in its preparation. Considering this research gap, the present study was designed to prepare and analyze *Balarishta* using various fermenters, including glass jars, earthen jars, porcelain jars, food-grade plastic jars, stainless steel containers and wooden jars.

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2. Material & Method

2.1 Selection & Authentication of raw materials - *Balamoola, Ashwagandha moola, Vidarikanda, Erandmoola, Rasna patra, Sukshmaila, Lavanga, Usira, Gokshura* and *Guda* were procured from Nageshwar Pharmacy, NIA Jaipur. *Dhataki Pushpa, Balamoola* and *Gandaprasarini* were procured from local authentic *Ayurveda* vendor, Haridwar. All raw drugs were authenticated from Arya Vaidyasala, Kottakkal, Central for medicinal plants research laboratory Kerala.

2.2 Place of manufacturing - All the batches were prepared in the departmental laboratory of *Rasashastra & Bhaishajya Kalpana*, NIA, Jaipur and after preparation was kept in *Sandhana Kaksha (*Fermentation room*)* of Nageshwar Pharmacy, NIA Jaipur.

2.3 Method of preparation – Six batches of *Balarishta* were prepared using six different types of fermentation vessels, following the procedure described in *Bhaishajya Ratanavali.*[7] (Figure 1) Each batch was manufactured using an identical formulation and method, with the only variable being the type of fermenter used.

Table 1. Ingredients of *Balarishta* for pharmaceutical preparation with the quantity[8]

S. N.	Name of Drugs	Botanical name	Parts used	Quantity in classical	Quantity used
Kwatha Dravya					
1.	*Bala*	*Sida cordifolia* Linn.	Root	100 *Pala*	2.4 kg
2.	*Ashwagandha*	*Withania somnifera* Dunal.	Root	100 *Pala*	2.4 kg
Madhura Dravya					
3.	*Guda*	*Saccharum officinarum* L.		3 *Tula* (300 *Pala*)	7.2 kg
Sandhana Dravya					
4.	*Dhataki*	*Woodfordia fruticosa* Kurz.	Flower	16 *Pala*	384 g
Prakshepa dravya					
5.	*Vidarikanda*	*Pueraria tuberosa (*Roxb. Willd DC*)*	Tuber	2 *Pala*	48 g
6.	*Eranda*	Ricinus communis Linn.	Root	2 *Pala*	48 g
7.	*Rasna*	*Pluchea lanceolata* (DC.) C.B. Clarke	Leaf	1 *Pala*	24 g
8.	*Suksmaila*	*Elettaria cardamomum* (L.) Maton	Seed	1 *Pala*	24 g
9.	*Prasarini*	*Paederia foetida* Linn.	Whole Plant	1 *Pala*	24 g
10.	*Lavanga*	*Syzygium aromaticum* (Linn.) Merr. & L.M. Perry	Flower Bud	1 *Pala*	24 g
11.	*Ushira*	*Vetiveria zizanioides* (Linn.) Nash.	Root	1 *Pala*	24 g
12.	*Gokshura*	*Tribulus terrestris* Linn.	Fruit	1 *Pala*	24 g
Drava Dravya					
13.	Water	-		4 Drona	24.6 L

2.3. (A) *Purvakarma*

The pharmaceutical preparation of *Balarishta* was carried out using six different fermentation vessels. The batches were designated as follows - BAG, prepared in a 5 L glass vessel; BAP, prepared in a 5 L porcelain vessel, BAW, prepared in a 5 L wooden vessel, BAS, prepared in a 5 L stainless steel vessel, BAF, prepared in a 5 L food-grade plastic vessel, and BAE, prepared in a 5 L earthen vessel. All batches were manufactured using the same formulation and procedure, with the type of vessel being the only variable. All six fermenters, porcelain, glass, food-grade plastic, wooden, earthen, and stainless-steel vessels (5 L capacity) were thoroughly washed with hot water, wiped with a clean cotton cloth, and dried in sunlight. Each vessel was then internally smeared with 20 g of *Ghrita*. For fumigation, 10 g each of powdered *Guggulu (Commiphora mukul*), *Agaru* (*Aquilaria agallocha*), *Haridra* (*Curcuma longa*), *Rala* (*Shorea robusta*), *Vacha* (*Acorus calamus*), *Shweta Sarshapa* (*Brassica campestris*), *Lavana* and *Nimba Patra*

(*Azadirachta indica*) were placed in a *Sharava* and ignited. The *Ghrita* smeared vessels were kept inverted to allow the fumes to remain inside for effective sterilization. *Dhoopana* was performed for 20 minutes for each vessel, and the fermentation chamber was fumigated for 30 minutes using the same materials.

2.3. (B) *Pradhana Karma*

Raw materials were used as per pharmacopoeial quality standards. *Bala Moola* and *Ashwagandha Moola* (*Kwatha Dravya*) were washed, dried, and powdered. The *Prakshepa Dravya* (Table 1) were cleaned, dried, powdered individually, and passed through sieve no. 85. A total of 24.6 L of water was added to 4.8 kg of *Kwatha Dravya*, soaked overnight, boiled, reduced to one-fourth, and fiLered through muslin cloth to obtain 6.2 L of *Kwatha*. Jaggery was dissolved in the fiLered *Kwatha* and re- fiLered, yielding 9.4 L of wort. This was divided into six equal batches of 1,550 mL each and transferred into the six fermentation vessels. A 100 mL aliquot was reserved for analysis. Finely powdered *Prakshepa Dravya* (240 g) was evenly divided into six portions of 40 g, and 384 g of *Dhataki Pushpa* was similarly divided (64 g per batch). These were added to each vessel and mixed thoroughly using a steel ladle. The vessels were sealed and placed in the fermentation room, where they were regularly observed for signs of fermentation completion.

2.3. (C) *Paschat Karma*

The final opening of all six batches was completed on the 25th day. After confirming the completion of fermentation, the wort was fiLered using a two-fold clean, dry cotton cloth. The remaining marc at the bottom of each vessel was weighed and discarded. On the 14th day after initial fiLration, the liquid was again decanted and fiLered to obtain a clear *Arishta*. Thus, the total duration of fermentation and maturation was 39 days (25 days of fermentation + 14 days of maturation) for all batches. The prepared *Balarishta* was then filled into six clean glass bottles, properly labeled with formulation details, and stored in a dark place to protect it from direct sunlight.

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Figure 1 Pharmaceutical Preparation of *Balarishta*

Fig 1.1 Kwatha preparation

Fig 1.2 Filtrated Kwatha

Fig 1.3 Addition of Guda in Kwatha

Fig 1.4 Wort preparation

Fig 1.5 Vessels dhoopana

Fig 1.6 Vessesls preparation

Fig 1.7, 1.8 Addition of Dhataki pushpa + Prekshepa Dravya in Glass ,Porcelain vessel

Fig 1.9, 1.10, 1.11, 1.12 Addition of Dhataki pushpa + Prekshepa Dravya in Earthen, Food grade plastic, Stainless steel, Wooden vessel

Fig 1.13 Before fermentation

Fig 1.14 Sandhana room

Fig 1.15 After complete fermentation

Fig 1.16 Burning flame test

Fig1.17 Fermentation completed (BAG)

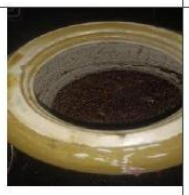

Fig 1.18 Fermentation completed (BAP)

Fig 1.19 Fermentation completed (BAW)

Fig 1.20 Fermentation completed (BAS)

Fig 1.21 Fermentation completed (BAF)

Fig 1.22 Fermentation completed (BAF)

Fig 1.23 Filterate after fermentation

Fig 1.24 Pacakaging ang Labelling

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3. Observations and Results

- **Before the onset of fermentation:** The colour of the mixture (wort) was dark brown, with a less astringent and sweeter taste. Both Dhataki Pushpa and Prakshepa Dravya were floating on the surface of the liquid.

- **During the onset of fermentation:** Mild effervescence appeared on the 4th day, followed by a faint alcoholic smell on the 7th day. The wort remained sweeter and less astringent, with a slight increase in consistency and minimal colour change. Slight fungal growth was observed on the surface, and Dhataki Pushpa began to sink. Mild flocculation was noted, particularly in the glass vessel.

- **After completion of fermentation:** On the 25th day, the fermentation process was completed. A burning candle continued to burn near the vessel, indicating the end of active fermentation. The wort became clear, with no bubbling or effervescence, though fungal growth persisted. Dhataki Pushpa settled completely at the bottom, and deep sedimentation was evident. The final product exhibited a characteristic aromatic alcoholic odor, a more astringent taste, and reduced sweetness. (As shown in Table 2)

Table 2. Signs of *Siddhi Lakshana* onset and completion of fermentation[8]

S.N.	Onset of fermentation	Completion of fermentation
1.	*Prakshepa Dravya* floats on the surface of the liquid	*Prakshepa Dravya* settles at the bottom
2.	Hissing sound is present	Hissing sound is disappeared
3.	Mild alcoholic odor and taste	Strong alcoholic odor and taste
4.	Effervescence is observed	Effervescence ceases
5.	Burning candle is extinguished when placed near the mouth of vessel	Burning candle continues to burn
6.	Lime water test turns milky white	Lime water test becomes negative; no change occurs

Table 3. ResuLs of *Kwatha* and Wort preparation

Sample	Yield	Color	Odor	Taste	pH	Specific gravity
Kwatha	6.2 L	Light brown	Characteristic	Astringent	5.02	1.034
Wort (mixture)	9.3 L	Drak brown	Small of jaggery	Sweetish	4.67	1.321

Table 4. Total quantity of final product of *Balarishta* from different batches

Batches	Total volume	Final yield	Loss in %
BAG	1.550 L	1.240 L	20 %
BAP	1.550 L	1.250 L	19.35 %
BAW	1.550 L	1.040 L	32.9 %
BAS	1.550 L	1.250 L	19.35 %
BAF	1.550 L	1.260 L	18.7 %
BAE	1.550 L	0.840 L	45.8 %

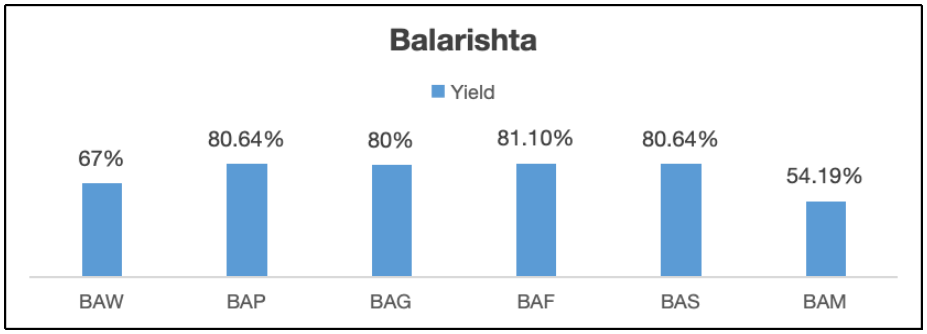

Figure 2. Obtained yield (in percentage) of six batches of *Balarishta*

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4. Analytical evaluation

Orangoleptic and Physio-chemical analysis were carried out in Drug testing laboratory of *Rasashastra* & *Bhaishajya Kalpana*, NIA, Jaipur. (mentioned in Table 5, Table 6)

Table 5. Organoleptic analysis of six batches of *Balarishta*

S.N.	Batches	Color *(Rupa)*	Odour *(Gandha)*	Taste *(Rasa)*	Consistency *(Sparsha)*
1.	BAG	Dark brown+	Aromatic alcoholic +	Madhura, Kashaya+	More than water+
2.	BAP	Dark brown +	Aromatic alcoholic+	Madhura, Kashaya+	More than water+
3.	BAW	Dark brown++	Aromatic alcoholic +	Madhura, Kashaya+	More than water++
4.	BAS	Dark brown +	Aromatic alcoholic	Madhura, Kashaya	More than water+
5.	BAF	Dark brown++	Aromatic alcoholic	Madhura, Kashaya	More than water+
6.	BAE	Dark brown++	Aromatic alcoholic	Madhura	More than water+++

Table 6. Physio-chemical analysis of six batches of *Balarishta*[10]

S. N	Physico-chemical parameters	BAG	BAP	BAW	BAS	BAF	BAE
1.	pH	4.52	4.52	4.31	4.45	4.42	4.46
2.	Specific gravity	1.281	1.270	1.262	1.273	1.263	1.321
3.	Viscosity (cP)	12.38	12.17	14.62	12.73	14.52	86.64
4.	Refractive index	1.4396	1.4396	1.4352	1.4329	1.4329	1.4558
5.	Total solids(%w/w)	50.31	51.44	53.24	51.47	52.36	64.41
6.	Total sugar(%w/w)	51.90	47.67	48.21	48.48	42.15	44.67
7.	Reducing sugar(%w/w)	23.50	24.58	32.44	24.62	31.00	38.45
8.	Alcohol %	5.4	5.32	6.9	1.07	1.08	1.05

5. Discussion

Traditionally, earthen pots were widely used for the preparation of *Asava* and *Arishta* due to their porous nature, which supports natural fermentation. However, limitations such as poor durability, handling difficuLies, and inconsistent availability have led to their gradual replacement by aLernative *Sandhana Patra* in modern pharmaceutical practice. In the present study, fermentation began uniformly on the 4th day in all vessels and was completed within 25 days. The final yield of *Balarishta* differed significantly among the batches. Glass (BAG) and porcelain (BAP) vessels yielded 1.240 L and 1.250 L respectively, with losses around 19–20%, whereas the wooden vessel (BAW) showed markedly lower yield (1.040 L) with the highest loss (32.9%). Food-grade plastic (BAF) produced the highest yield (1.260 L, 18.7% loss), while the earthen vessel (BAE) showed maximum reduction, yielding only 0.840 L (45.8% loss). Yield reduction was primarily due to liquid absorption by *Prakshepa Dravya* and sediment discarded after completion of fermentation.

Physico-chemical evaluation revealed noticeable variations among batches. All six preparations exhibited dark brown color, sweet-astringent taste, thick consistency, and characteristic alcoholic odor. The pH ranged from 4.57 (wooden) to 4.67 (plastic), remaining within an ideal acidic range for fermented preparations. Specific gravity was highest in the earthen vessel (1.321) and lowest in the wooden vessel (1.262), suggesting differential concentration of dissolved solids. Total sugar content varied from 42.15% (plastic) to 51.90% (glass), while reducing sugars were maximum in the plastic vessel (38.45%) and minimum in the glass vessel (23.50%). Non-reducing sugars were highest in glass (28.4%) and lowest in the earthen vessel (6.22%). Alcohol content showed wide variability, ranging from 1.06% in stainless steel to 6.9% in the wooden vessel, indicating the influence of vessel material on yeast activity and fermentation dynamics. Total solids were highest in the earthen pot (64.41%) and lowest in glass (50.31%), reflecting its porous nature and associated evaporative and absorptive effects. These findings clearly establish that vessel characteristics significantly influence fermentation rate, yield, and the physico-chemical profile of *Balarishta*.

6. Conclusion

Ethanol content is a critical determinant of the quality, therapeutic efficacy and stability of *Asava- Arishta* formulations. In *Balarishta*, self-generated alcohol enhances drug extraction, bioavailability, preservative action, and therapeutic potency. Among the six vessels studied, wooden and porcelain vessels produced comparatively higher alcohol content, indicating more efficient fermentation. When considering alcohol production, yield and active principle extraction, the glass, porcelain, and wooden vessels emerge as superior *Sandhana Patra* for *Balarishta* preparation. While the earthen pot holds classical importance, its high absorption, low yield, and reduced alcohol content make it less suitable for large-scale or standardized pharmaceutical production.

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Conflicts of interest

There are no conflicts of interest.

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