Physico-chemical analysis of *Valu kashaya* (decoction prepared by using sand) used in *Suthika roga* (Complication of post-partum)

Wickramasinghe B.H.L.G., Molligoda S.P.*, Nawarathne T. and Bogoda A.I.

Abstract

Valu decoction is a classical formulation mentioned in authentic Traditional textbooks. It is predominantly categorized into two types, namely *Valu* decoction I and *Valu* decoction II. While the method of preparation remains consistent for both methods, the ingredients employed differ. The decoction is primarily utilized to address post-partum complications. It consists of twelve plant-based ingredients and sand of river or stream. The present study primarily focuses to lay down analytical standards for *Valu* decoction I. The selection of quality and correct ingredients was the first step in standardizing herbal decoction. The relevant plant species were identified, and their validity confirmed using phytochemical investigation. The study was conducted to reveal the variations in organoleptic parameters (color, odor, and taste), physico-chemical parameters (pH, specific gravity, refractive index and brix value). Refractive index evaluates purity of preparation was found to be 1.33. pH value which evaluates the quality of the drug was found to be 5.18. Alkaline pH favors high microbial contamination of the herbal preparations, but it is slightly acidic in nature. Brix value use for evaluation of how much dissolved sugar is in a liquid solution was found to be 1.23. Foaming ability index was used to determine the foaming ability of aqueous decoction of herbal material was found to be1.36. Specific gravity is an evaluation parameter affirming wt/ml should always be more than carrier solvent (water). Notably, the majority of phytochemical constituents, including saponins, alkaloids, flavonoids, tannins, and steroids, were present in significant quantities across the samples.

Keywords: *Valu* decoction I, *Sutika roga*, Physico-Chemical

Introduction

Valu decoction is an herbal decoction used in Sri Lankan Traditional medicine for *Suthika roga* (Complication of post-partum). The term *Suthikawa*; refers to the mother until three months following childbirth. Various authentic texts elucidate distinct phases or time frames of the postpartum period, commonly known as *Suthika kala.* Susrutha/ Vagbhata mentioned *Suthika kala* as 11 – 01½ months, Kashyapa mentioned as 06 months and Bhava prakashaya mentioned as 04 months.

Suthika roga which refers to “postpartum disorders”, is widely discussed in Acharya Kashyapa, *Suthika Upakramaniya Adhyaya,* specifically within the *Kheelasthanaya* section, where he presents 64 distinct *Suthika roga*. *Suthika roga* is developed due to improper regimen, diet and mode of life, aggravated dosha, incompatible food, and digestive disturbances. Common signs and symptoms are body aches, fever, and tremors. The *Valu* decoction I mentioned in Pharmacopoeia consists of 12 plant-based ingredients and sand of river, distinguishing it from other decoctions documented in the Pharmacopoeia. However, when considering the historical context characterized by limited childbirth facilities, it is crucial to evaluate the efficacy of herbal decoctions in treating postpartum ailments such as wages *Sanniya* (puerperal fever) and *Suthika unmadaya* (postpartum-psychosis). In ancient times, practitioners used sand in the decoction after heating

Faculty of Indigenous Medicine, University of Colombo, Sri Lanka.

**Correspondence: Molligoda S.P., Department of Basic Principles, Ayurveda Anatomy and Physiology, Faculty of Indigenous Medicine, University of Colombo, Sri Lanka. Email: molligoda@fim.cmb.ac.lk*

it until red-hot. In this regard, Pharmacopoeia highlights that due to a chemical component in the burnt sand, the filaments are poisoned. Further, it highlights the significance of the addition of crushed ingredients in the decoction process[1]. Table 1 mentioned the ingredients of *Valu* decoction I in Ayurveda pharmacopeia 1[2].

Table 1: Ingredients of *Valu* decoction I mentioned in Ayurveda pharmacopeia 1

Name	Sanskrit Name	Botanical Name	Used Part
Sudulunu	*Lasuna*	*Santalum album*	Bulb
Asamodagam	*Ajamoda*	*Trachyspermum ammi*	Seed
Kaluduru	*Kalajajii*	*Nigella sativa*	Seed
Thippili	*Magadhi*	*Piper longum*	Fruit
Inguru	*Shunti*	*Zingiber officinale*	Rhizome
Hathawariya	*Shathawari*	*Asparagus recemosus*	Root
Aralu	*Harithaki*	*Terminalia chebula*	Pericarp of the fruit
Iramusu	*Shariba*	*Hemidesmus indicus*	Root
Rasakinda	*Guduchi*	*Tinospora cordifolia*	Stem
Gammiris	*Maricha*	*Piper nigrum*	Fruit
Suduru	*Jeeraka*	*Cuminum cyminum*	Seed
Sassanda	*Ishvari*	*Aristoolochia indica*	Root

The identification and acquisition of the ingredients for *Valu* decoction II posed significant challenges due to their limited accessibility and the paucity of available references. The incorporation of references in research is essential for establishing a solid foundation to assess the quality, safety, and efficacy of drugs. Consequently, in light of the aforementioned limitations, *Valu* decoction I was selected as the subject of investigation for this research, as it offered a more viable opportunity to utilize existing references and comprehensively evaluate its medicinal characteristics[3].

Importance of standardization for Traditional decoction

Standardization helps to verify the identity, purity, and strength of components. It also facilitates scientific research on traditional decoctions, enabling accurate study of effects and correlations between formulations and therapeutic outcomes.

In the present study, The *Valu* decoction I was standardized by detection of physical parameters and chemical parameters, Screening of phytochemicals and developing of TLC profile.

Materials and methods

Collection and authentication of drugs

Raw materials were collected from local market at Embilipitiya and sand was collected from river – "Gin" in Galle.

They were authenticated by the Department of Ayurveda Pharmacology, Pharmaceutics and Community Medicine, Faculty of Indigenous Medicine, University of Colombo.

Preparation of Valu decoction I

There are two methods showing in Thalpathe piliyam[4], Deshiya Aushada Samgrahaya[5] and Ayurveda Pharmacopoeia[2]. However, considering the challenges encountered in sourcing certain ingredients and the constraints imposed by limited time availability, it was decided to proceed with method I as outlined in Ayurveda Pharmacopoeia part I.

First, the ingredients were crushed and subsequently bundled together. Next, a volume of water equivalent to 8 *Patha* (1920 ml) was added, and the mixture was placed within a vessel called "*Pottani*." Following this, clean and desiccated sand was heated until it attained a red-hot state. The vessel was then sealed using a hollow coconut shell, and the red-hot sand was added through the hole. This process facilitated the gradual reduction of the volume to 1 *Patha* (240 ml)[2].

Then did physico-chemical analysis of *Valu* decoction I according to WHO guidelines[6].

Physico-chemical parameters related to decoction

Physical evaluation

As the Physical parameters, pH value, forming index, specific gravity, refractive index and brix value are evaluated.

Chemical evaluation

As the Chemical parameters, qualitative phytochemical analysis, chromatography – TLC fingerprint profile for *Valu* decoction I has done.

Organoleptic properties

As the Organoleptic parameters, taste, odor, color were identified[7].

Quantitative analysis was conducted at equipped laboratory of Bandaranayake Memorial Ayurvedic Research Institute, Navinna.

Physical evaluations were done three times in each decoction and calculated the average on three samples, named S_1, S_2, and S_3.

Determination of the pH value

pH meter was used to measure the pH of the decoction at the 30^0C

Determination Brix value

Brix refractometer was used to measure the brix value.

Determination Refractive index

Determination refractive index was used to refractive meter.

Determination of specific gravity

The specific gravity of liquid is the relative weight of that decoction compared to an equal volume of water.

Determination of Foaming index

The foaming ability of an aqueous decoction of plant materials and their extracts were measured in terms of a foaming index[6].

Phytochemical screening of Valu decoction I

Freshly prepared extracts of *Valu* decoction I was subjected to detect the presence of phytochemicals[8].

Test for Tannins

Ferric Chloride Test - 5 drops of $FeCl_3$ were added 5ml of water extract of decoction and mixed well. Appearance of a black precipitate indicates the presence of Tannins.

Test for Flavonoids

Lead Acetate Test

Add few drops of 10% Lead Acetate to the 5ml water extraction of decoction. The appearance of a yellow color perception indicates the presence of Flavonoids.

Test for Alkaloids

Wagner's Test

To 5ml of water extraction of decoction add the 1% of HCL and Wagner's region. The appearance of a reddish-brown precipitation indicates the presence of Alkaloids.

Test for Saponins

Foam Test

Mix 5ml of decoction with distilled water and shake vigorously. Identification of positive result formation of stable more than 1mm.

Test for Steroid Glycosides

Equal volumes acetic anhydride and $CHCL_3$ were dissolved. The mixture was transferred to a dry test tube and con. H_2SO_4 acid was introduced to bottom of the tube. Formation of a reddish brown or violet-brown ring at the interface of the two liquids indicates presence of Steroid[8].

Development of Thin Layer Chromatography (TLC)

Valu decoction I was extracted in to Ethyl Acetate, concentrated and spotted on a pre-coated TLC plate. TLC fingerprint profile was developed using Toluene: Ethyl acetate: Methanol in a ratio of 6:2.5:1.5 v/v. The plate was visualized under UV radiation (both 254nm and 366nm).

Results

Organoleptic properties of prepared *Valu* decoction I is shown in Table 2.

Table 2: Organoleptic properties of prepared *Valu* decoction I

Taste	Astringent Taste (*Kashaya rasa*)
Color	Red-brown color
Odor	Mixed herbal odor

Physico-chemical of prepared *Valu* decoction I is shown in Table 3.

Table 3: Physico-chemical of prepared *Valu* decoction I

Test	S_1	S_2	S_3	(Mean Value)
pH value	5.24	5.12	5.2	5.18
Refractive index	1.33	1.33	1.33	1.33
Brix value	1.1	1.3	1.3	1.23
Foaming index	1.4	1.4	1.3	1.36
Specific gravity	0.8	0.89	0.8	0.83

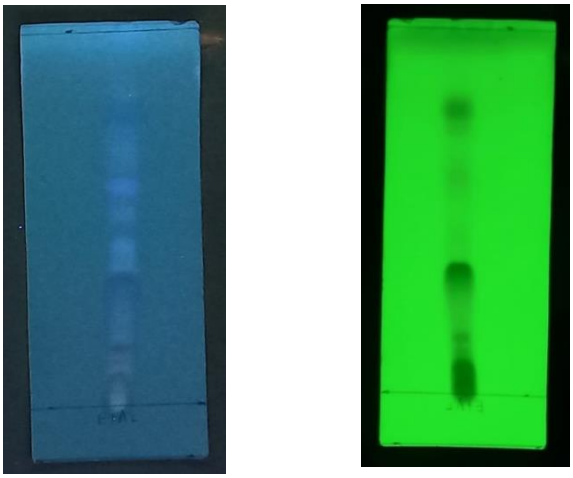
Table 4 shows the results of phytochemical analysis of *Valu* decoction I

Table 4: Phytochemical analysis of *Valu* decoction I

Phytochemical parameter	Results
Tannins	+
Flavonoids	+
Steroid glycosides	+
Alkaloids	+
Saponins	+

Figure 1 shows the TLC Fingerprint profile for prepared *Valu* decoction I

Sample: Ethyl - Acetate extract of *Valu* decoction I
Solvent system - Toluene:Ethyl Acetate: Methanol in a ratio of 6:2.5:1.5.
Visualization - (Under U.V Radiation)
Short U.V. 254 nm
Long U.V 366nm



At UV 366nm At UV 254nm

Figure 1: TLC photo documentation of ethyl alcohol extract of *Valu* decoction I

Discussion

The current preliminary investigation was undertaken to generate data on physic-chemical properties, including organoleptic characters, and chromatographic profiles to determine the quality and purity of *Valu* decoction I. The standardization parameters of liquid oral formulations such as refractive index, brix value, pH value, specific gravity, organoleptic properties were assessed to confirm flow property of formulation. Refractive index evaluates purity of preparation was found to be 1.33. pH value which evaluates the quality of the drug was found to be 5.18. Alkaline pH favors high microbial contamination of the herbal preparations, but it is slightly acidic in nature. Brix value use for evaluation of how much dissolved sugar is in a liquid solution was found to be 1.23. Foaming ability index was used to determine the foaming ability of aqueous decoction of herbal material was found to be1.36. Specific gravity is an evaluation parameter affirming wt/ml should always be more than carrier solvent (water). In the present study, it was found to be 0.83. The results of all three samples exhibited substantial similarity due to the use of correct raw materials in all three decoctions including identical temperature and location. The observed values remained consistent throughout the study. Notably, the majority of phytochemical

constituents, including saponins, alkaloids, flavonoids, tannins, and steroids, were present in significant quantities across the samples. *Valu* Decoction I was found to contain glycosides, which were detected through phytochemical screening tests. Most common postpartum complications are cardiovascular diseases, infection or sepsis, excessive bleeding after giving birth (hemorrhage), thrombotic pulmonary embolism, stroke, high blood pressure, anesthesia and anesthesia complications. Saponins, a major component in the formulation, play a significant role in the formation of immune-stimulating complexes and exhibit anti-inflammatory properties[4]. The primary pharmacological action of saponins is the reduction of blood lipids[5]. Alkaloids, on the other hand, possess anesthetic, cardio protective and anti-inflammatory properties. Flavonoids are known for their anticancer, antioxidant, anti-inflammatory, and antiviral properties. Tannins exhibit antioxidant, antimicrobial, and anti-inflammatory characteristics. The presence of these phytochemicals collectively contributes to the mitigation of postpartum complications.

Furthermore, Garlic (*Allium sativum*) possesses anti-inflammatory, analgesic, anti-stress and wound healing effects. *Suduru (Cuminum cyminum*) stimulates the digestive fire and promotes digestion, helping treating vomiting and diarrhea. *Sassanda (Aristoolochia indica)* helps in strengthening the uterus and promoting the overall well-being of women after childbirth. Ginger (*Zingiber officinale*) is commonly used to boost digestive power, hypertension, improve immunity and reduces pain. *Aralu* (*Terminalia chebula*) is used for its efficacy in managing diarrhea and dysentery, in addition to its anti-oxidant, antimicrobial, anti-inflammatory and cardio protective properties. *Kaluduru (Nigella sativa)* use for diarrhea and inflammatory conditions. Therefore, all these ingredients contribute to reducing postpartum complication.

Present study presents a preliminary attempt on development of a standardized manufacturing procedure for *Valu* decoction I. Further investigations can be conducted to assess the microbial composition through microbial testing and analyze the presence of heavy metals through heavy metal analysis. Moreover, additional research can be conducted to explore the therapeutic efficacy of *Valu* decoction I, as well as the two formulations of *Valu* decoction II. These subsequent studies would contribute to a more comprehensive understanding of the potential benefits of decoction and support its evidence-based application in therapeutic contexts.

Conclusion

Valu decoction I, as documented in Ayurveda Pharmacopoeia Volume 1, was prepared three times, using three distinct samples. Each of these samples was further divided into three sub-samples to facilitate the development of a standardized manufacturing procedure for *Valu* decoction I. It is important to note that the analytical values of *Valu* decoction I have not been specified in any authoritative literature. Therefore, these parameters can be taken as the preliminary standards for the further studies pertaining to *Valu* decoction I.

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