



A COMPARATIVE PHARMACEUTICO – ANALYTICAL STUDY OF *BILWADI LEHA* AND ITS *KHANDAPAKA* WITH DIFFERENT *MADHURA DRAVYAS*

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ABSTRACT

Rasashastra and Bhaishajya Kalpana is the branch of Ayurveda which deals with the preparation of herbal, mineral and herbomineral preparations. Various dosage forms have been described in *Bhaishajya Kalpana*. *Avaleha Kalpana* and *Khanda Kalpana* are two of those. One such formulation that is explained in *Sahasrayoga Leha Prakarana* is *Bilwadi Leha*. *Khanda Kalpana* is a modification of *Avaleha Kalpana*. It is done to solve concerns with palatability and prolong the product's shelf life. *Madhura Dravya* is an essential ingredient in the manufacturing of medications. This study was conducted to comprehend the quality of *Leha* and its modification into *Khanda Paka* prepared using two different *Madhura Dravyas* that is Jaggery, and sugar candy in each dosage form.

Key words: *Bilwadi Leha, Guda, Khanda Sharkara, Khanda Kalpana*

INTRODUCTION

Ayurveda mainly aims at maintaining the health of the healthy individual and curing the disease of the patient. The knowledge of *Aushadha* is a very important aspect in the treatment of diseases. *Aushadha* is also considered as one among the *Chikitsa Chatushpadas*.

Avaleha is a semisolid preparation that is in lickable consistency. Various *Avaleha Kalpanas* are mentioned in different classical treatises for the treatment of different diseases. *Bilwadi Leha*¹ is one such formulation that has been explained in *Sahasrayoga Leha Prakarana*. It is also known as *Vilwadi Lehyam* or *Vilwadi Leham*. It is mainly indicated in *Chardi, Praseka* etc.

Khanda Kalpana is a modification of *Avaleha Kalpana*. One-step ahead from 1-2 thread consistency of *Avaleha Paka* is called *Khanda Paka*. This preparation is easier to preserve and has good palatability.

Madhura Dravya plays an important role in the preparation of the medicine as well as its preservation and palatability. The change in *Madhura Dravya* may change the palatability, consistency and appearance of the product.

This study was undertaken to understand the quality of *Leha* and its modification into *Khanda Paka* prepared out of two different *Madhura Dravya* that is Jaggery and sugar candy in each dosage form.

AIMS AND OBJECTIVES

- To prepare *Bilwa Moola Kashaya* as per the reference
- To prepare *Bilwadi Leha* as per the reference of classical literature
- To prepare *Khanda Paka* of *Bilwadi Leha* mentioned in the classical literature
- To prepare *Bilwadi Leha* with *Khanda Sharkara* as *Madhura Dravya*
- To prepare *Bilwadi Khanda Paka* with *Khanda Sharkara* as *Madhura Dravya*

MATERIALS AND METHODS

- Pharmaceutical study was carried out in Laboratory, Department of Rasashastra and Bhaishajya Kalpana in Alva's Ayurveda Medical College Moodubidire.
- Various analytical tests were carried out at SDM centre for research in Ayurveda and allied sciences, Kuthpady, Udupi as a part of this study.

PHARMACEUTICAL STUDY

INGREDIENTS OF *BILWADI LEHA* AND *BILWADI KHANDA PAKA*

Table no.1- List of ingredients and their quantity

Si.no.	Ingredients	Botanical Name	Part used	Quantity mentioned	Quantity taken
1	<i>Bilwa Moola Kashaya</i>	<i>Aegle marmelos(L).correa</i>	Root	<i>Padavashista Kashaya</i> (1536ml)	384g
2	<i>Guda / Khanda Sharkara</i>		-	16 Pala (768g)	192g
3	<i>Prakshepaka Dravya- Musta</i>	<i>Cyperus rotundus L.</i>	Rhizome	1 Karsha(12g)	2.5g
4	<i>Dhanyaka</i>	<i>Coriandrum sativum L.</i>	Seed	1 Karsha(12g)	2.5g
5	<i>Jeeraka</i>	<i>Cuminum cyminum L.</i>	Seed	1 Karsha(12g)	2.5g
6	<i>Ela</i>	<i>Elletaria cardomomum Maton</i>	Seed	1 Karsha(12g)	2.5g
7	<i>Twak</i>	<i>Cinnamomum varum J</i>	Bark	1 Karsha(12g)	2.5g
8	<i>Nagakesara</i>	<i>Messua ferrae L.</i>	Flower	1 Karsha(12g)	2.5g
9	<i>Pippali</i>	<i>Piper longum L.</i>	Dried fruit	1 Karsha(12g)	2.5g
10	<i>Maricha</i>	<i>Piper nigrum L.</i>	Dried fruit	1 Karsha(12g)	2.5g
11	<i>Shunti</i>	<i>Zingiber officinale Rosaceo</i>	Rhizome	1 Karsha(12g)	2.5g

1. Preparation of *Bilwa Moola Kashaya*

Equipments used : *Khalwa Yantra, Tula Yantra, Vessel, Measuring Jar, Cloth, Gas stove*

Table no.2- Ingredients used for *Bilwa Moola Kashaya*

Si.no.	Ingredients	Parts used	Quantity mentioned	Quantity taken
1	<i>Bilwa Moola</i>	Root	½ <i>Adhaka</i> (1536g)	384 g
2	<i>Jala</i>	-	½ <i>Drona</i> (6.144 L)	1.536ml

Procedure :

1. Coarse Powder of *Bilwa Moola* was made and taken in a vessel.
2. Eight times of water was added to it and was soaked overnight.
3. Next day, the vessel containing *Bilwa Moola* and *Jala* was placed over a mild fire, boiled and reduced to 1/4th part.
4. After 1/4th reduction, it was filtered with a clean cloth. The filtered *Kashaya* was taken in a separate vessel and the residue got in the cloth was discarded.

2. Preparation of *Bilwadi Leha*

Two variants of *Bilwadi Leha* were Prepared. one utilizing *Guda*² as the *Madhura Dravya* (sweetening agent) and the other incorporating *Khanda Sharkara*.

Procedure:

1. The Prepared *Kashaya* was taken in a wide mouthed stainless-steel vessel and kept on mild fire.
2. Powdered *Guda* or *Khanda Sharkara* was added and dissolved in it.
3. It was then filtered through a clean cloth to remove the impurities present and was measured.
4. This filtrate was again boiled over a mild fire to obtain thicker consistency of 1 or 2 threads.
5. After *Avaleha Paka Siddha Lakshana* was obtained, it was taken out from the fire and finely powdered. *Prakshepa Dravyas* were added little by little and mixed well till a homogenous mixture was obtained.
6. Later, it was stored in an air-tight container.

2. Preparation of *Bilwadi Khanda Paka*

Two variants of *Bilwadi Khanda Paka* were Prepared. One with *Guda* as *Madhura Dravya* and another with *Khanda Sharkara*.

Equipments used : *Khalwa Yantra*, *Tula Yantra*, Vessel, Cloth, Heating device

Procedure :

1. The Prepared *Kashaya* was taken in a wide stainless-steel vessel and kept over a mild fire.
2. Powdered *Guda* or *Khanda Sharkara* was added to it and made to dissolve.
3. This was filtered through a clean cloth to remove the impurities present in the *Guda* and was measured.
4. This filtrate was again boiled over a mild fire to thicker consistency of 3 to 4 threads.
5. After *Siddha Lakshanas* were obtained, it was taken out from the fire and powdered *Prakshepaka Dravyas* were added little by little and stirred well till a homogenous mixture was obtained.
6. This dough was rubbed over the sieve to obtain even-sized granules.
7. Obtained granules were spread in larger trays and was allowed to cool down.
8. Later, it was stored in an air-tight container.

PHOTOGRAPHS OF THE PHARMACEUTICAL STUDY

Preparation of *Bilwamoola Kashaya*



Fig1. *Bilwa Moola*



Fig 2. *Prakshepaka Dravyas*



Fig 3. *Madhura Dravya*





Fig 4. Soaking of *Bilwa Moola*



Fig 5. Preparation of *Kashaya*



Fig 6. Filtering of *Kashaya*



Fig 7. Filtered *Kashaya*

Preparation of *Bilwadi Leha* with *Guda*



Fig 8. Ingredients



Fig 9. Addition of *Guda*



Fig 10. Filtering



Fig 11. *Paka*



Fig 12. Addition of *Prakshepaka Dravyas*



Fig13. Final Product

Preparation of *Bilwadi Leha* with *Khanda Sharkara*



Fig 14. Ingredients



Fig 15. Addition of *Khanda Sharkara*



Fig 16. Filtering



Fig 17. *Paka*



Fig 18. Addition of *Prakshepaka Dravyas*

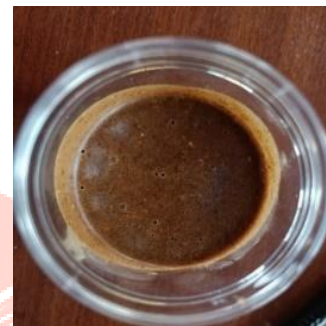


Fig 19. Final Product

Preparation of *Bilwadi Khandapaka* with *Guda*



Fig 20. Ingredients



Fig 21. Addition of *Guda*



Fig 22. Filtering



Fig 23. *Paka*



Fig 24. Addition of *Prakshepaka Dravyas*



Fig 25. Dough was rubbed over the sieve



Fig 26. Final Product

Preparation of *Bilwadi Khandapaka* with *Khanda Sharkara*



Fig 27. Ingredients



Fig 28. Addition of *Khanda Sharkara*



Fig 29. Filtering



Fig 30. *Paka*



Fig 31. Addition of *Prakshepaka Dravyas*



Fig 32. Dough was rubbed over the sieve



Fig 33. Final Product

OBSERVATIONS AND RESULTS

Table no.3- Showing the observations and results of the pharmaceutical study

PREPARATION NAME	OBSERVATIONS	RESULTS	ORGANOLEPTIC CHARACTERS
BILWAMOOLA KASHAYA	<ul style="list-style-type: none"> The drug was soaked in water overnight, giving it a dark brown colour. It was of <i>Katu Rasa</i> predominantly. 	<i>Kashaya</i> obtained- 384ml Time taken for reduction-one hour	<ul style="list-style-type: none"> Colour – Dark Brown Odour – Characteristic Taste- <i>Katu Rasa</i> Consistency- Thick Liquid
BILWADI LEHA WITH GUDA	<ul style="list-style-type: none"> Quantity obtained after dissolving the <i>Guda</i> in <i>Kashaya</i>- 430ml More froth was noticed at the initial stage. After cooling, <i>Avaleha</i> became harder. 	Quantity obtained- 206g	<ul style="list-style-type: none"> Colour – Dark Brown Odour – Characteristic Taste- <i>Katu Pradhana Madhura</i> Consistency- Semi Solid
BILWADI LEHA WITH KHANDA SHARKARA	<ul style="list-style-type: none"> A thin whitish layer was visible at the beginning of the boiling process. It warded off on its own as the boiling progressed. Quantity obtained after dissolving the <i>Khanda Sharkara</i> in <i>Kashaya</i>- 440ml 	Quantity obtained- 154g	<ul style="list-style-type: none"> Colour – Dark Brown Odour – Characteristic smell Taste- <i>Katu Pradhana Madhura</i> Consistency- Semisolid
BILWADI KHANDAPAKA WITH GUDA	<ul style="list-style-type: none"> Quantity obtained after dissolving the <i>Guda</i> in <i>Kashaya</i>- 450ml Dough was slightly soft. Hence rubbing this dough against the sieve was difficult. 	Quantity obtained- 155g	<ul style="list-style-type: none"> Colour – Dark Brown Odour – Characteristic Taste- <i>Katu Pradhana Madhura</i> Consistency- Granular
BILWADI KHANDAPAKA WITH KHANDA SHARKARA	<ul style="list-style-type: none"> Quantity obtained after dissolving the <i>Khanda Sharkara</i> in <i>Kashaya</i>- 430ml Rubbing of dough against the sieve to obtain <i>Khanda Paka</i> was easier 	Quantity obtained- 154g	<ul style="list-style-type: none"> Colour – Dark Brown Odour – Characteristic Taste- <i>Katu Pradhana Madhura</i>. It was sweeter as compared to <i>Bilwadi Khanda Paka</i> with <i>Guda</i> Consistency- Granular

RESULTS OF ANALYTICAL STUDY

Table no. 4- Showing the results of Analytical study

Parameter	Results n = 3 %w/w	Parameter	Results n = 3 %w/w
	<i>Bilwadi Leha with Guda (Avg±SD)</i>	<i>Bilwadi Leha with Khanda Sharkara</i>	<i>Bilwadi Khandapaka with Guda Khanda Sharkara</i>
Loss on drying	11.07±0.01	7.41±0.01	
Total Ash	1.98±0.02	0.80±0.12	Alcohol Soluble extractive - 16.63±0.02
Acid Insoluble ash	0.00±0.00	0.00±0.00	Water soluble extractive - 93.74±0.00
Water soluble ash	0.00±0.00	0.71±0.01	Bulk density 0.67 0.54
Total solids	4.63	3.44	Tapped bulk density 0.67 0.61
pH	6.0	6.0	Compressibility index 0.00 0.11
Total Sugar	36.63	36.25	Total Sugar 32.15 38.82
Reducing sugar	1.20	2.13	Reducing sugar 0.89 1.92

DISCUSSION

Discussion on the modification of *Avaleha* into *Khanda Kalpana*

In the present study, an attempt has been made to modify *Bilwadi Leha* into *Bilwadi Khanda Paka*. It can be a beneficial approach in certain cases, particularly for addressing conditions like *Chardi* (vomiting), *Praseka* (excessive salivation), motion sickness etc. conditions. Converting it into *Khanda Kalpana*, with a granular form, can offer some advantages in managing these conditions:

1. Easy Administration: *Avaleha* preparations can be sticky and might be difficult for some individuals to consume, especially if they are experiencing symptoms like vomiting and excessive salivation. *Khanda Kalpana*, in the form of granules, is easier to take and can be swallowed more comfortably.
2. Quick Action: *Khanda Kalpana* formulations are generally quicker to disintegrate and assimilate in the body. This property might be beneficial in conditions like motion sickness, where rapid relief is desired.
3. Ease of Transportation: Granular form of *Khanda Kalpana* makes it convenient to carry and consume while traveling, making it suitable for managing motion sickness.

Discussion on Pharmaceutical Study

For the preparation of *Bilwa Moola Kashaya*, coarse powder of drug was taken. Coarse powder of *Bilwa Moola* was soaked overnight in water as a preliminary step. Then, *Kashaya* was heated over the mild fire and was filtered through a clean cloth. On soaking the drug there will be increased diffusion pressure inside the cells. This ultimately burst the cell and there by releases the constituents. Continuous heating and agitation during the preparation of *Kashaya* enhance extraction process by weakening the bond and there by separating the hydrophilic substance, the water diffuses into the raw material, dissolves water soluble constituents and discharge it to liquid media due to collapse of cell wall. Thus, the transfer of water-soluble principle into the water is achieved. A pilot study without drug soaking was carried out in the present study, where the colour of the *Kashaya* was light brown and was less concentrated. The colour and flavour of the *Kashaya* that was made by soaking the medication was altered noticeably. Compared to the pilot trial batch, the colour was dark brown, and the *Katu Rasa* of the drug was appreciated. It was more concentrated. These changes are might be because of the dissolving of water-soluble constituents into the liquid media.

The amount of *Madhura Dravya* that should be utilized is described in the classics. That is, if sugar candy - four times of the *Choorna*, if Jaggery, two time of the *Choorna*. However, in the current study, taking into account the issue of palatability, *Guda* was replaced with the same amount of *Khanda Sharkara* for the preparation of the *Bilwadi Leha* and its *Khanda Paka* with *Khanda Sharkara*. When *Guda* was added to *Kashaya* in the current study, additional froth was seen, which gradually reduced. This could be because some air can be tapped in the Viscous Syrup during the Jaggery production process. When heated Jaggery is poured to hot *Kashaya*, the trapped air expands and rises to the surface leading to froth formation.

Avaleha Siddhi Lakshanas like *Tantumvatvam*³ (Thread like appearance), *Apsumajjati*⁴ (Sinks in water), *Kshipthaha Tu Nischala Tisteth Pathitaha Tu Na Shiryathe* (If *Paka* Material is put in water, it does not spread), *Daarvi Pralepathvam*⁵ (*Paka* material sticks to the ladle) etc. were observed.

The reason for *Tantumvatvam* (Thread like appearance) is because when *Madhura Dravya* [Sucrose] is dissolved in water and heated the solubility of sugar in the water increase with temperature. The chemical reason behind this phenomenon is the concept of Solubility and Supersaturation. When *Madhura Dravya* is added to water, the Sugar molecules break down into individual Sucrose molecules, surrounded by water molecules. The water molecules help to keep the sugar molecules dispersed and prevent them from coming together to form crystals. As the Process continues the solubility of sugar decreases. This decrease in solubility causes excess sugar molecule to come together and forms Crystal nuclei. Once a few crystals are formed, more sugar molecules are attached to these nuclei. As the sugar crystals grow, they often form elongated thick threads or fibrous structure. This might be the reason for the appearance of one thread, two threads etc. A step up from *Avaleha Paka* that is 3 to 4 thread consistency will result in *Khanda Kalpana*. To achieve desired appearance of final product controlling this crystallization process is essential i.e., proper assessment of *Paka* is essential. The reason for

Darvipralepa (Sticking to the ladle) is because of Presence of Sugar in the mixture. The reason for *Apsumajjati* (Sinks in water) is might be because of the density of the *Paka*.

In the *Khanda Paka* preparation, the dough obtained was rubbed over the sieve to obtain uniform texture. In this preparation, the semisolid dough was pressed through the sieve with the back of the ladle. As a result, uniformly sized granules were obtained. This process helps to refine the *Khanda Paka* and eliminate any coarse or gritty textures. To prevent contamination the final products were stored in an airtight container after adding and mixing *Prakshepaka Dravyas*.

Discussion on Analytical Study

Loss on drying at 105°C- The prepared sample of *Bilwadi Leha* with *Guda* was below the limit which indicates Less moisture content. *Bilwadi Leha* with *Khanda Sharkara* had less value of moisture content as compared *Bilwadi Leha* with *Guda* which indicates less chance of spoilage. Total Ash - The prepared sample of *Bilwadi Leha* with *Guda* was significantly lower than the limit which indicates a smaller number of Inorganic substances. pH value-pH value was 6.0 which indicates it is slightly acidic in nature. Bulk Density- Bulk density of *Bilwadi Khandapaka* with *Guda* and *Bilwadi Khandapaka* with *Khanda Sharkara* was 0.67g/mL and 0.54g/mL respectively. It indicates that the *Bilwadi Khandapaka* is lighter and less dense.

Bilwadi Khandapaka with *Khanda Sharkara* is very light, dense as compared to the other *Khanda paka*. Tapped Bulk Density- Tapped bulk density of *Bilwadi Khandapaka* with *Guda* and *Bilwadi Khandapaka* with *Khanda Sharkara* was 0.67 g/mL and 0.61 g/mL respectively. This indicate that they flow easily. Alcohol Soluble Extractive-Results show that a small portion of *Bilwadi Khandapaka* with *Khanda Sharkara* is soluble in alcohol. Water Soluble Extractive - The Water-Soluble extractive of *Bilwadi Khandapaka* with *Khanda Sharkara* 93.75 % w/w suggest that it dissolves quickly in water. This property can be useful where rapid absorption/immediate effect are desired. Total Sugar- Total sugar value of *Bilwadi Leha* with *Guda*, *Bilwadi Leha* with *Khanda Sharkara*, *Bilwadi Khanda Paka* with *Guda*, *Bilwadi Khanda Paka* with *Khanda Sharkara* was 36.63% w/w, 36.25% w/w, 32.15% w/w, 38.15% w/w respectively. This indicates that *Bilwadi Khanda Paka* with *Khanda Sharkara* is having more sugar concentration when compared to others.

CONCLUSION

The study of *Bilwadi Leha* and its *Khanda Paka* with different *Madhura Dravya* has provided valuable insights into the potential benefits and variations of this formulation. Throughout the study, several key points have emerged, shedding light on its efficacy and comparative effectiveness.

Indeed, the study's findings such as Moisture Content, Total Ash etc clearly demonstrate the significant role played by the *Madhura Dravya* i.e., *Guda* and *Khanda Sharkara* in the preparation of *Bilwadi Leha*. The variations observed in the preparation of the formulation solely by changing the *Madhura Dravya* emphasize its crucial importance in determining the characteristics and therapeutic properties of the final product.

Bilwadi Leha with *Khanda Sharkara* has lesser moisture content and total ash as compared to *Bilwadi Leha* with *Guda*. This indicates that the *Leha* prepared with *Khanda Sharkara* has longer shelf life and has fewer inorganic substances.

Bilwadi Khandapaka made with *Guda* has higher bulk density, tapped bulk density as compared to *Bilwadi Khandapaka* with *Khanda Sharkara*. This indicates that the *Khandapaka* with *Guda* is heavy and is dense. But *Bilwadi Khanda Paka* with *Guda* has excellent flow property.

Even though it is denser, the *Khandapaka* with *Guda* shows good flow, which is a desirable characteristic for certain applications, especially in pharmaceuticals and manufacturing processes where smooth flow is essential.

REFERENCES

1. Krishnan K.V. and Pillai Gopala S, Sahasrayogam, Vidyarambham Publishers Alapupuzha, 29th Edition, 2010, Page No.233.
2. Ibid, Page No.233.
3. Agnivesha, Charaka Samhita, Ayurveda Deepika Commentary by Chakrapani Datta, Edited by Yadavji Trikamji, Chaukhamba Prakashan, Varanasi, Edition 2013, Page No.658.
4. Vagbhata, Ashtanga Hridaya, with Commentaries Sarvangasundara of Arunadatta and Ayurveda Rasayana of Hemadri, Chaukhamba Surbharathi Prakashan, Varanasi, Edition 2012, Page No.774.
5. Sharangadhara, Sharangadhara Samhita, 'Deepika' Commentary by Aadhamalla, Chaukhamba Orientalia, Varanasi, Edition 2012, Madhyama Khanda, Chapter 8, PageNo.206.