

DOI No.: <http://doi.org/10.53550/EEC.2024.v30i02s.027>

Evaluation of *In Vitro* Acid Neutralizing Capacity of Bilwadi Vati

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(Received 10 July, 2023; Accepted 13 September, 2023)

ABSTRACT

Herbs have been used for thousands of years in traditional medicine systems, such as Ayurveda, to treat various ailments, including hyperacidity. The aim of this study was to investigate the acid neutralizing properties of Bilwadi Vati, a polyherbal formulation used to treat the intestinal disorders. A total of 14 herbal ingredients of Bilwadi Vati were tested using an in vitro assay to determine their Preliminary antacid test and acid neutralizing capacity. The results showed that Bilwadi Vati as a whole and all the herbal ingredients tested exhibit acid neutralizing properties to varying degrees. Among the tested herbal ingredients Sunthi (*Zingiber officinale*), Maricha (*Piper nigrum*), Nata (*Valerianawalichi*), Haridra (*Curcuma longum*) and Daruharidra (*Berberis aristata*) five ingredients demonstrated the significantly higher acid neutralizing capacity. This study supports and sheds light on the purported digestive and antacid properties of Bilwadi Vati and its individual ingredients. Further study to determine the *in vitro* neutralizing and buffering capacity of ingredients is in process.

Key words: Acid neutralizing capacity, Bilwadi Vati, Anti acidic properties, Herbal ingredients

Introduction

Bilwadi Vati is an ayurvedic medicine that has been used in traditional Indian medicine for centuries. It is composed of several herbs and minerals, and it is known for its various medicinal properties. Bilwadi Vati is used in the treatment of digestive disorders, including diarrhea, dysentery, and vomiting. It is also used to treat fever, indigestion, and other digestive problems (Kamal *et al.*, 2021). Bilwadi Vati (formulation) is mentioned in Ashtanga Hrudaya Uttarastana 36th chapter, where it has been mentioned as "Bilwadi yoga" (a combination of bilwa and other drugs). In AFI (Ayurvedic Formulary of India) it is named as "Bilwadi Gutika". Bilwadi Vati has also few more references from Saharsrayogam, Vishajotsnika, Kriyakaumudietc (Shubha *et al.*, 2017).

One of the key ingredients of Bilwadi Vati is Bilva or Bael, which is a sacred tree in India. Bilva has been used in Ayurvedic medicine for its anti-inflammatory and anti-diarrheal properties. Bilwadi Vati also contains other herbal ingredients mentioned in Table 1.

In recent years, there has been renewed interest in the use of Bilwadi Vati due to its potential role in the prevention and management of various diseases including COVID – 19 (Rajpuria, *et al.*, 2020). They argue that the herbs and minerals present in Bilwadi Agada have immunomodulatory, antiviral, and anti-inflammatory properties, which can help boost the immune system and reduce the severity of symptoms in COVID-19 patients. Bilwadi Vati has been used in the management of various other conditions. Bilwadi Agada is found to be effective in the management of scorpion stings. It is observed that

the anti-inflammatory and analgesic properties of the herbs present in Bilwadi Vati helped alleviate the symptoms of scorpion sting. Moreover, Bilwadi Vati has also been used in the management of digestive disorders such as amoebic dysentery. It was found to be effective in controlling the symptoms of dysentery and improving the patient's overall health (Rotwar *et al.*, 2017). Bilwadi Vati and its ingredients are known for their anti-acidic and digestive properties. Several of its key ingredients also have been traditionally used in Ayurvedic medicine to improve digestion, relieve constipation, and reduce acidity.

The preparation of Bilwadi Vati involves several stages of processing and purification, including powdering, mixing, and shaping into tablets. The method of preparation ensures that the active ingredients in the formulation are properly extracted and standardized, making it a potent and effective medicine for digestive disorders.

While Bilwadi Vati is known for its digestive properties, there is limited scientific evidence available on its anti-acidic properties. In vitro studies can help to better understand the mechanism of action of Bilwadi Vati and potential for the treatment of acid-related disorders. The evaluation of the acid-neutralizing capacity of Bilwadi Vati and its individual ingredients can provide important insights into its therapeutic potential for the management of acid reflux and other related disorders. It can also help to establish the safety and efficacy of the formulation, and guide the development of new and improved Ayurvedic remedies for the management of acid-related disorders. Additionally, the study can contribute to the overall scientific understanding of the pharmacological properties of traditional Ayurvedic medicines, and help to promote their integration into modern healthcare systems. The present work was undertaken with the principal objective of evaluation of Acid neutralizing capacity of Bilwadi Vati and its individual ingredients.

Materials and Methods

Collection of samples: Bilwadi Vati and its individual ingredients in pure form were purchased from Reputed Ayurvedic medicine company. All the ingredients were kept in the laboratory in a cool and dry place till further use.

Preliminary antacid test (PAT): 100 mg of each test ingredient was weighed out in a 100 ml beaker and 40 ml distilled water was added to it. and beaker

was kept on Magnetic stirrer for one minute at 300 rpm. 10 ml of 0.5 N HCl was added to the test solution and the mixture was stirred at 300 rpm for 10 minutes. After 10 minutes the pH was read by pH meter and recorded (Rotwar *et al.*, 2017).

Determination of Acid neutralizing Capacity (ANC): The acid neutralizing capacity of Bilwadi Vati and its individual ingredients was determined. The suspension of the test ingredient was prepared by adding 100 mg of the test ingredient 5 ml distilled water. The suspension was transferred to a 250 ml beaker and 70 ml water was added to it. The whole mixture was stirred for one minute. 30 ml of 1.0 N HCl was accurately measured and added into the suspension and the mixture was kept for stirring for exactly 15 mins. The mixture was titrated with 0.5 N NaOH till the threshold pH of 3.5 was attained. The number of milli equivalent (mEq) of acid consumed per gram of test ingredient was calculated (Ayensu *et al.*, 2020; Dhawal *et al.*, 2020)

The acid neutralizing capacity (ANC) was calculated by following formula

$$\text{Total mEq} = (30 \times N_{\text{HCl}}) - (V_{\text{NaOH}} \times N_{\text{NaOH}})$$

N_{HCl} and N_{NaOH} are the Normalities of HCl and NaOH, respectively and V_{NaOH} indicates the volume of NaOH used for the back titration.

Results and Discussion

Preliminary Antacid test

Based on the results of the preliminary antacid test, it appears that all of the ingredients tested have the ability to raise the pH level of a solution above 3.5 after 15 minutes. This suggests that they may have some antacid properties, as antacids are designed to neutralize stomach acid by raising the pH level (Table 2).

It is important to note, however, that this preliminary test is just the first step in evaluating the effectiveness of these ingredients as antacids. Further testing will be necessary to determine the extent to which they are able to neutralize stomach acid and provide relief from symptoms such as heartburn or indigestion (Table 3 & Fig 1).

Based on the acid neutralizing capacity (ANC) of Bilwadi Vati and its individual ingredients mentioned in Table 2. it appears that all of them have some degree of acid neutralizing capacity. The ANC values obtained ranged from 13.29 to 20.84 mEq, indicating that they have the ability to neutralize a

Table 1. List of the ingredients of Bilwadi Vati [5]

Name of the ingredient	Botanical Name	Part used	Quantity (proportion/part)
Bilwa	<i>Aegle marmelos</i>	Mool (Root)	1 Part
Surasa	<i>Ocimum sanctum</i>	Pushpam (Flower)	1 Part
Karanja	<i>Pongamia pinnata</i>	Phala (Fruit)	1 Part
Natam	<i>Valeriana walichi</i>	Mool (Root)	1 Part
Surahwam	<i>Cedrus deodara</i>	Kanda (Rhizome)	1 Part
Haritaki	<i>Terminalia chebula</i>	Phala (Fruit)	1 Part
Vibheetaki	<i>Terminalia belerica</i>	Phala (Fruit)	1 Part
Amalkai	<i>Emblica officinalis</i>	Phala (Fruit)	1 Part
Sunthi	<i>Zingiber officinale</i>	Kanda (Rhizome)	1 Part
Maricha	<i>Piper nigrum</i>	Phala (Fruit)	1 Part
Pipaali	<i>Piper longum</i>	Phala (Fruit)	1 Part
Haridra	<i>Curcuma longum</i>	Kanda (Rhizome)	1 Part
Daruharidra	<i>Berberis aristata</i>	Kanda (Rhizome)	1 Part

Table 2. Results of Preliminary antacid test

Name of the test ingredient	PAT (pH) 0 min	0.5N HCl (pH) 10 min
Bilwadi Gutika	5.9	3.8
Bilwa	5	4.2
Surasa	6.3	3.5
Karanja	6.6	3.5
Natam	6.5	4.5
Surahwam	5.2	3.5
Haritaki	4.3	3.5
Vibheetaki	5.0	3.7
Amalkai	3.9	3.5
Sunthi	6	4.0
Maricha	5.5	4.0
Pipaali	5.6	3.5
Haridra	4.3	3.6
Daruharidra	5.5	3.8
Goat urine	6.5	3.8

certain amount of acid. The fact that the Bilwadi Vati itself also shows an mEQ value of 25.43 suggests

that the combination of these ingredients has a collective acid neutralizing effect (Fig. 1).

The results of the ANC test indicate that the 14 herbal ingredients tested have some degree of acid neutralizing capacity. However, further research will be necessary to determine the extent of their effectiveness as acid neutralizing and buffering capacity.

The ANC value of 25.43 for Bilwadi Vati suggests that it has a collective acid neutralizing effect, likely due to the combination of herbal ingredients it contains. Further research will be necessary to determine the exact proportions and concentrations of these ingredients, as well as their effectiveness as an acid neutralizing and buffering capacity.

It is important to note that while all of these ingredients have some level of ANC, the degree to which they can neutralize acid may vary. This means that some ingredients may be more effective than others at reducing symptoms of acid reflux,

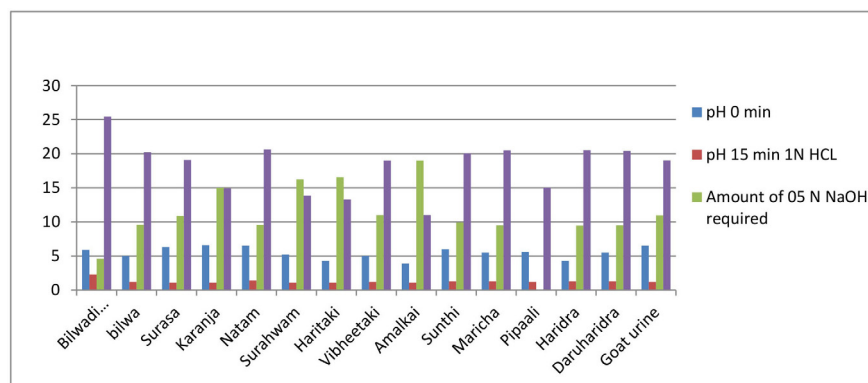
**Fig. 1.** Acid Neutralizing Capacity of Bilwadi Vati

Table 3. Results of acid neutralizing capacity (Antacid test)

	pH 0 min	pH 15 min 1N HCL	Amount of 0.5 N NaOH required	ANC mEq
BilwadiGutika	5.9	2.3	4.6 (0.29)	25.43(0.05)
Bilwa	5	1.2	9.59(0.42)	20.20((0.34)
Surasa	6.3	1.1	10.89 (0.33)	19.07(0.06)
Karanja	6.6	1.1	15.01(0.33)	14.92 (0.10)
Natam	6.5	1.4	9.57(0.49)	20.62 (0.33)
Surahwam	5.2	1.1	16.23 (0.40)	13.84(0.13)
Haritaki	4.3	1.1	16.56 (0.36)	13.29 (0.25)
Vibheetaki	5.0	1.2	11(0.16)	19.00 (0.11)
Amalkai	3.9	1.1	19(0.16)	11.00 (0.80)
Sunthi	6	1.3	9.92 (0.50)	20.05 (0.04)
Maricha	5.5	1.3	9.5 (0.16)	20.50 (0.28)
Pipaali	5.6	1.2	14.9 7(0.46)	15.02(0.01)
Haridra	4.3	1.3	9.46 (0.20)	20.52 (0.01)
Daruharidra	5.5	1.3	9.5 (0.24)	20.40 (0.17)
Goat urine	6.5	1.2	10.96 (0.20)	19.02 (0.01)

All data are shown as the mean±SD for triplicate.

heartburn, or indigestion.

Conclusion

This study supports and sheds light on the purported digestive and anti acidic properties of Bilwadi Vati and its individual ingredients. Further research will be necessary to evaluate the safety and efficacy of these ingredients as acid neutralizers.

Acknowledgements

The authors are grateful to the Honorable Chancellor, KVV, deemed to be University, Karad for the valuable support and Dean, KIAS for providing all the research facilities to conduct the work.

Conflicts of Interests

The authors declare that there are no conflicts of interests

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