Research Article

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IN-VITRO EVALUATION OF THE ANTIULCER POTENTIAL OF BAVANA KADUKKAI MATHIRAI

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ABSTRACT

The Siddha system of medicine, widely practised in Southern India, includes numerous formulations for treating various ailments. Bavana Kadukkai Mathirai (BVK) is a traditional Siddha formulation for managing Gunmam (Peptic ulcer disease). Peptic ulcers occur due to an imbalance between aggressive factors like gastric acid, pepsin, and H. pylori and defensive factors such as mucin, prostaglandins, and bicarbonate. This study evaluates the acid- neutralizing capacity of BVK using an *in-vitro* method. The formulation was prepared using key herbal ingredients, including *Terminalia chebula, Zingiber officinale, Piper longum,* and *Trachyspermum ammi,* which are known for their gastroprotective properties. The results showed a concentration-dependent increase in acid-neutralizing activity, with BVK at 250 mg/mL exhibiting an acid-neutralizing capacity (ANC) of 4.6, while 500 mg/mL showed an ANC of 11.3, compared to the standard antacid (Aluminium Hydroxide + Magnesium Hydroxide) at 11.90. These findings suggest that BVK exhibits significant acid-neutralizing efficacy comparable to conventional antacids, particularly at higher concentrations. Previous studies on the individual ingredients of BVK support its gastroprotective and antiulcer properties, reinforcing its traditional use in treating gastrointestinal disorders. Further, *in-vivo* studies and clinical trials are needed to explore its pharmacological mechanisms, efficacy, and safety profile for potential therapeutic applications.

Keywords: Siddha Medicine, Kaya Karpam, Bavana kadukkai (BVK), Antiulcer, Acid Neutralizing Capacity.

INTRODUCTION

The Siddha system of medicine is a well-known traditional healing practice widely followed in Southern India. Numerous medicinal formulations for various ailments are documented in Siddha texts. Kayakarpam is one of the therapeutic approaches in Siddha medicine, focusing on longevity and disease prevention. Siddhars classified diseases into 4,448 types, treated using 32 internal and 32 external medicinal preparations. Kaya means "body," and Karpam means "strong as stone," signifying a rejuvenation process. According to Thirumoolar, rejuvenation involves purifying the soul by preserving the body to attain salvation [1]. This study explores the antiulcer activity of the Siddha formulation Bavana Kadukkai Mathirai, referenced in the Siddha Formulary of India Part 1, traditionally used to treat Gunmam (Peptic ulcer), Vayiru Noi (Gastrointestinal disorders), Vaanthi (Vomiting), and Soolai (Throbbing pain). In the Siddha system, Gunmam is synonymous with Peptic ulcer disease (PUD), with eight subtypes described in classical texts [2-3].

PUD is characterized by the gastrointestinal (GI) lining erosion due to excess gastric acid or pepsin secretion, extending into the muscularis propria. It commonly affects the stomach and proximal duodenum but may also involve the lower oesophagus, distal duodenum, or jejunum [4]. Antiulcer agents work by inhibiting gastric acid production, neutralizing acid, or protecting the gastrointestinal mucosa from damage. These agents are used to prevent and treat gastric and duodenal ulcers, acid reflux, esophagitis, and other digestive discomforts [5]. The present study evaluates the antiulcer potential of Bavana Kadukkai through an *in-vitro* acid-neutralizing capacity (ANC) assay to provide scientific validation for its traditional use.

MATERIALS AND METHODS

Collection and Authentication of Raw Drugs

The raw materials for Bavana Kadukkai Mathirai were sourced from “Rajendra herbals in Thakkalai, Kanyakumari, Tamil Nadu, India” and were authenticated by a “Medicinal Botanist and the Gunapadam faculty at the National Institute of Siddha, Chennai, Tamil Nadu, India,” where the sample drug was also prepared in their laboratory.

Ingredients of the Test Drug: Table 1

Preparation of BVK

Kadukkai was soaked in kazhuneer for three days, and this process was repeated twice with fresh kazhuneer over nine days. After soaking, the Kadukkai was washed with water, and the seeds were removed. The purified Kadukkai was allowed to dry. Kadaluppu, Mor, and the purified Kadukkai were placed in a mud pot and boiled until all the water evaporated. Nos. 5 to 11 ingredients were ground into a fine powder and mixed with the Kadukkai mixture. Lemon juice was added, and the mixture was left in sunlight to dry completely. This process was repeated with ginger juice until the Kadukkai reached the desired consistency. Finally, it was stored in an airtight container.

Dosage
1 or 2 pieces before food, 40 days.

***In-Vitro* Assessment of Anti-Ulcer Activity Through Acid Neutralizing Capacity**
The acid-neutralizing capacity (ANC) of the aqueous extract was evaluated using 5 mL of the sample at varying concentrations (250 mg/mL and 500 mg/mL) and compared to a standard antacid formulation containing aluminium hydroxide and magnesium hydroxide (AHMH) at 500 mg/mL. The experiment was conducted in a total volume of 70 mL, where 5 mL of the test sample was mixed with water to reach the desired volume, followed by stirring for one minute. To the prepared mixture, 30 mL of 1.0 N hydrochloric acid (HCl) was introduced and continuously stirred for 15 minutes. Subsequently, phenolphthalein was added as an indicator and mixed thoroughly. The excess HCl in the solution was titrated immediately with 0.5 N sodium hydroxide (NaOH) until a persistent pink colouration appeared, indicating the endpoint.

The number of moles of acid neutralized was determined using the formula:

Moles of acid neutralized = (vol. of HCl × Normality of HCl) - (vol. Of NaOH × Normality of NaOH)
Acid neutralizing capacity (ANC) per mL of antacid = moles of HCl neutralized divided by Grams of Antacid/Extract [6,7].

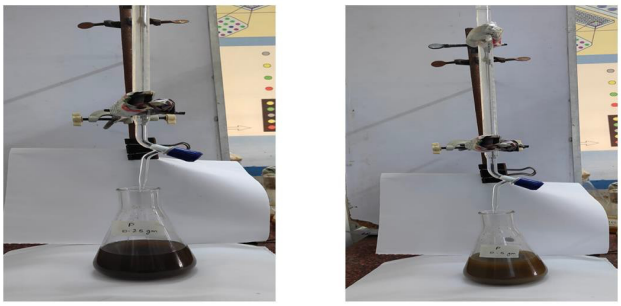
Table 1: Ingredients of Bavana Kadukkai Mathirai

Name of the Ingredient	Scientific name/English name	Quantity
Kadukkai	*Terminalia chebula* Retz.	750 grams
Kazhuneer	Rice-rinsed water	Sufficient Quantity
Mor	Buttermilk	1400 ml
Kadalupppu	Common salt	190 grams
Chukku	*Zingiber officinale* Roscoe	18 grams
Attuppu		18 grams
Inthuppu	Rock salt	18 grams
Omam	*Trachyspermum ammi* L.	18 grams
Chevviyam	The root of *Piper nigrum* L.	18 grams
Chithiramoola verpattai	*Plumbago zeylanica* L.	18 grams
Thippili	*Piper longum* L.	18 grams
Elumichampazha saaru	Juice of *Citrus limon* L.	600 ml
Injisaaru	Juice of *Zingiber officinale*	400 ml

Table 2: Results of ANC of BVK

Sample	Concentration (mg/ml)	NaOH Volume Consumed (ml)	Acid Consumed (mEq)	ANC per gram of Antacid
BVK	250 mg	55.4	2.3	4.60
BVK	500 mg	37.4	11.3	11.30
AHMH	500 mg	47.2	7.75	11.90

*BVK – Bavana Kadukkai, AHMH – Aluminium hydroxide + Magnesium hydroxide



(a) (b)

Figure 1: ANC of BVK at different concentrations: (a) 250 mg/mL, (b) 500 mg/mL.

RESULTS

The Acid Neutralizing Capacity (ANC) of the Bavana Kadukkai extract by the *in-vitro* method is presented in Table 2 and Figure 1.

DISCUSSION

Bavanakadukkai Mathirai is traditionally used for Gunmam (peptic ulcer) disease, which occurs due to an imbalance between offensive factors "(acid, pepsin, and H. pylori)" and defensive factors (mucin, prostaglandin, bicarbonate, nitric oxide, and growth factors) [8]. Excessive secretion of gastric acid (HCl) leads to stomach lining inflammation, resulting in ulceration. Antacids neutralize gastric acid and increase gastric pH, restoring balance. Therapeutic approaches focus on inhibiting gastric acid secretion or enhancing mucosal production to strengthen the mucosal defence mechanism by stabilizing surface epithelial cells and regulating prostaglandin synthesis [9].

In the Siddha system of medicine, acid peptic disease is managed naturally through herbal formulations, dietary modifications, and lifestyle changes, following the principle: Food is medicine, Medicine is food [10]. The present study evaluated the acid-

neutralizing capacity of the Siddha formulation Bavana Kadukkai (BVK) through an *In-vitro* method. The results indicated a concentration-dependent increase in acid-neutralizing activity, with BVK at 250 mg/mL showing an ANC value of 4.6, while 500 mg/mL exhibited an ANC value of 11.3. The standard antacid, Aluminium Hydroxide + Magnesium Hydroxide (AHMH) at 500 mg/mL, demonstrated an ANC value of 11.90, suggesting that BVK at higher concentrations has comparable acid-neutralizing efficacy to conventional antacids.

The antiulcer properties of BVK may be attributed to its key ingredients, including *Terminalia chebula* (Kadukkai), *Zingiber officinale* (Chukku), *Piper longum* (Thippili), and *Trachyspermum ammi* (Omam), which are known for their gastroprotective and carminative effects. These ingredients may aid in neutralizing gastric acid, enhancing mucosal defence, or modulating gastric secretion. The traditional use of BVK in treating Gunmam and related gastrointestinal disorders aligns with its observed *in-vitro* acid-neutralizing effects, warranting further studies to explore its pharmacological mechanisms.

Several studies support the gastroprotective potential of BVK's ingredients. Sharma *et al.* (2011) evaluated the antiulcerogenic activity of *T. chebula* in ulcer models, including aspirin-induced, ethanol-induced, cold restraint stress-induced, and pylorus ligation-induced ulcers in rats. The study reported significant ulcer inhibition at doses of 200 and 500 mg/kg, with reductions in lesion index and increases in gastric pH, indicating its antisecretory potential. Additionally, *T. chebula* enhanced mucus production, essential for gastric protection (Malckzadeh *et al*., 2002) [11,12]. Similarly, Shin *et al*. (2020) investigated the antiulcer activity of steamed ginger extract (GGE03) against ethanol/HCl-induced gastric mucosal injury in rats and found that GGE03 significantly reduced gastric lesions, suggesting its potential as a gastroprotective agent [13].

Furthermore, Mathew *et al*. (2001) explored the antiulcer activity of *Piper longum* (Pipal) extract in experimentally induced ulcer models in rats, including pylorus ligation, acetylsalicylic acid-induced ulcers, and necrotizing agent-induced lesions. The ethanol extract significantly reduced gastric acidity, lesion severity, and ulcer index in a dose-dependent manner, demonstrating cytoprotective and ulcer-healing properties [14]. Likewise, Hajhashemi *et al*. (2019) assessed the anti-peptic ulcer effects of *T. ammi* essential oil and its major components in ethanol-induced gastric ulcers in rats. Their findings indicated that the essential oil, particularly its thymol component, significantly reduced gastric lesions, reinforcing its potential as a natural treatment for gastric ulcers [15].

These studies collectively support the traditional use of BVK and its ingredients in managing peptic ulcers. The observed acid-neutralizing effect, combined with the documented gastroprotective properties of its key components, suggests that BVK could be an effective natural remedy for peptic ulcer disease.

CONCLUSION

This study highlights the *in-vitro* acid-neutralizing potential of Bavana Kadukkai (BVK), a traditional Siddha formulation for Gunmam (peptic ulcer). The results showed a concentration-dependent increase in efficacy, with higher doses demonstrating acid-neutralizing activity comparable to standard antacids. Scientific evidence supports its therapeutic value in managing peptic ulcers and other gastrointestinal disorders. While promising, further *in-vivo* studies and clinical trials are needed to confirm its effectiveness and safety.

ABBREVIATIONS

BVK- Bavanakadukkai
PUD- Peptic Ulcer Disease
ANC- Acid Neutralizing Capacity
AHMH- Aluminium Hydroxide + Magnesium Hydroxide
HCl- Hydrochloric acid

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