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Comparative Phytochemical and Inorganic Ion Analysis of *Vellai Vengaya Kulligai*: A Siddha Herbo-Mineral Preparation using two ingredient variants

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ABSTRACT

With the increasing global recognition of traditional and indigenous medical systems, there is a growing emphasis on the need to standardize and scientifically evaluate the quality of traditional formulations. *Vellai Vengaya Kuligai* (VVK) is a herbo-mineral formulation in Siddha medicine traditionally used for managing conditions such as *Mantham* (indigestion), *Kazhichal* (diarrhea), and *Vaayu* (pain). Comprising 23 ingredients primarily herbal, with detoxified borax and rock salt VVK holds a prominent place in Siddha therapeutics. Although the term "*Vellai Vengayam*" suggests the use of white onion, classical Siddha literature indicates the substitution of garlic (*Ulli*) in its preparation. This study investigates the phytochemical profile of VVK prepared using two methods, one with white onion and the other with garlic and compares their constituents. While white onion is known to contain alkaloids, tannins, phenols, and terpenes, the corresponding VVK tablets were found to have alkaloids, flavonoids, saponins, and terpenes. In contrast, garlic contains alkaloids, phenols, tannins, and saponins, and the tablets prepared with garlic exhibited a broader spectrum, including alkaloids, flavonoids, phenols, tannins, saponins, terpenes, and trace inorganic elements such as iron, nickel, and nitrate. The enhanced phytochemical content observed in the garlic-based tablets suggests greater therapeutic potential as described in classical Siddha texts. This preliminary comparative analysis provides a scientific foundation for understanding the compositional differences arising from variation in preparation methods

Keywords: Herbo-mineral, Phytochemical, Siddha, *Vellai Vankaya Kuligai*

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Introduction

Vellai Vengaya Kuligai (VVK) is a traditional herbo-mineral formulation in Siddha medicine, widely used for the treatment of ailments such as *Mantham* (indigestion), *Kazhichal* (diarrhea), and *Vaayu* (pain due to deranged Vata). The formulation comprises 23 ingredients, predominantly herbal in origin, except for borax and rock salt, which are incorporated after undergoing appropriate detoxification procedures. Herbal medicines are generally regarded as safer alternatives with fewer adverse effects compared to synthetic drugs.

Although the term "*Vellai Vengayam*" translates to "white onion" in Tamil, classical Siddha texts specify the use of garlic (*Ulli*) in the preparation of this medicine. This discrepancy prompted the need for a comparative analysis of VVK prepared with either white onion or garlic. To explore the potential differences in efficacy, two variants of VVK were formulated in the department pharmacy using authenticated raw materials verified by the *Gunapadam* section.

Subsequently, the raw ingredients (white onion and garlic) and the finished tablet forms were subjected to qualitative phytochemical screening in the chemistry laboratory. The study aimed to evaluate the phytochemical constituents present in both versions and to identify which preparation method offers a richer composition, thereby providing a more scientific basis for the traditional formulation guidelines.

Objective

The objective of this study is to conduct a comparative phytochemical analysis of *Vellai Vengaya Kuligai* (VVK) prepared using two different ingredients—white onion and garlic—and to assess how this variation influences the formulation's potential therapeutic properties.

Methodology

The selected formulation, *Vellai Vengaya Kuligai* (VVK), was prepared based on a well-established Siddha text, with bibliographic details cited in the reference section (Ponniahpillai, 1930). A literature review of all ingredients was conducted using both Tamil and English sources, accessed through university library resources and online academic databases between September and November 2023.

Following the literature review, two versions of VVK were prepared at the university pharmacy, adhering to traditional procedures outlined in the Siddha

literature. One formulation utilized white onion as the primary ingredient, while the other used garlic, as recommended in classical Siddha texts. Both formulations contained 21 herbal ingredients in addition to detoxified borax (*Vengaram*) and rock salt (*Induppu*).

After preparation, the samples were shade-dried, properly labeled, and individually packaged. In January 2024, the samples along with raw garlic and white onion were submitted to the Department of Chemistry, University of Jaffna, for qualitative phytochemical analysis.

Extraction Procedure

Ground samples of both the raw ingredients and prepared. Tablets were extracted by heating with 80% methanol for 30 minutes and then filtered to obtain the test extracts.

Phytochemical Screening

Phytochemical analysis was conducted using standard qualitative methods:

Alkaloids

Extracts were acidified with dilute hydrochloric shaken and filtered. A few drops of Wagner's reagent (2 g of iodine + 6 g potassium iodide in 100 mL distilled water) was added to 2 ml of filtrate. The formation of a reddish-brown precipitate indicated the presence of alkaloids.

Flavonoids

The alkaline reagent test was performed by treating the extract with a few drops of sodium hydroxide. The appearance of an intense yellow colour that turned colorless with dilute acid confirmed the presence of flavonoids.

Tannins and Phenolic Compounds

A lead acetate test was performed by adding a few drops of lead acetate solution to the aqueous extract. The formation of a white precipitate indicated the presence of phenolic compounds.

Saponins

A froth test was carried out by diluting the extract with distilled water and shaking vigorously for 5 minutes. The formation of persistent froth layer indicated the presence of Saponins.

Triterpenoids and Steroids

A 0.5 ml of the extract was treated with 3 ml of chloroform, filtered and treated with a few drops of concentrated Sulphuric acid along the sides of the test tube. It was shaken and allowed it to stand. A red lower layer indicated the presence of steroids, while a golden yellow layer indicated triterpenoids (Chauhan & Saxena, 2019).

Glycosides

To 2 ml of extract, 3 ml of glacial acetic acid and one drop of 5% ferric chloride were added. Then 0.5 ml concentrated Sulphuric acid was carefully added along the side of the test tube. The appearance of a blue color in the acetic acid layer indicated the presence of glycosides (Balamurugan *et al.,* 2019).

Proteins and Amino Acids

The extract was treated with 1 ml of 10% sodium hydroxide and heated. A drop of 0.7% copper sulphate solution was added. A violet coloration indicated the presence of proteins (Chauhan & Saxena, 2019). Phytochemical screening was conducted on the two tablet formulations and on the raw materials to compare the variation in phytoconstituents based on the key ingredient used.

Results

Table 1: Phytochemical analysis for raw white onion and raw garlic

Phytochemical	Result for White Onion (*Allium cepa*)	Result for Garlic (*Allium sativum*)
Alkaloids	**+**	**+**
Flavonoids	**-**	**-**
Phenol	**+**	**+**
Tannin	**+**	**+**

Phytochemical	Result for White Onion (*Allium cepa*)	Result for Garlic (*Allium sativum*)
Saponin	-	+
Terpene	+	-
Glycoside	-	-
Protein	-	-
Steroids	-	-

The qualitative phytochemical analysis of both raw white onion and garlic tested positive for alkaloids, phenol and Tannin. However, the garlic-based formulation demonstrated a saponin in addition, whereas white onion has terpene in addition (table -1).

Table 2: Phytochemical analysis of VVK tablet prepared with white onion and garlic

Phytochemical	The result for the tablet with White Onion	The result for the tablet with Garlic
Alkaloids	+	+
Flavonoids	+	+
Phenol	-	+
Tannin	-	+
Saponin	+	+
Terpene	+	+
Glycoside	-	-
Protein	-	-
Steroids	-	-

The phytochemical screening of *Vellai Vengaya Kuligai* (VVK) prepared using white onion and garlic revealed both similarities and differences in their chemical composition. Alkaloids, flavonoids, saponin and terpene were present in both formulations, indicating these as common constituents regardless of the primary ingredient used. However, the two formulations differed in other components. Phenol and tannin were detected only in the garlic-based formulation and absent in the white onion variant (table 2).

Inorganic ion Analysis Results

Ions in white onion NO_3^-, SO_4^{2-}

Ions in tablet with white onion – Fe^{3+}, Ni^{2+}

Ions in garlic Zn^{2+}, Mn^{2+}

Ions in tablet with garlic - Fe^{3+}, Ni^{2+}, NO_3^-

The tablet prepared with white onion has iron and nickel whereas the tablet prepared with garlic has inorganic ions like iron, nickel and nitrate ions.

Discussion

Vellai Vengaya Kuligai (VVK) is a complex polyherbo-mineral formulation traditionally used as an oral medicine for treating a variety of gastrointestinal ailments, including nausea, indigestion, abdominal pain, and dysmenorrhea. It is also employed to relieve uterine discomfort, non-specific pain during pregnancy, and serves as an analgesic. Additionally, some studies have reported its potential in lowering hypertension and cholesterol levels (Ponniahpillai, 1930).

VVK is described with two distinct preparation methods in classical Siddha texts such as *Pararajasekaram (Karpa Roga Nithanam)* and *Pararajasekaram (Bala Roga Nithanam)*, where each method is intended for different clinical applications. Although white onion is known to contain alkaloids, tannins, phenols, and terpenes, the tablets prepared using white onion showed the presence of alkaloids, flavonoids, saponins, and terpenes. In contrast, garlic contains alkaloids, phenols, tannins, and saponins; the garlic-based tablets exhibited a broader phytochemical profile including alkaloids, flavonoids, phenols, tannins, saponins, terpenes, and trace inorganic elements such as iron, nickel, and nitrate.

Tannins, recognized for their astringent properties, have traditionally been valued for their ability to form protective layers over mucous membranes. This effect is particularly useful in managing excessive water and electrolyte secretion during conditions like diarrhea, dysentery, and external bleeding. Historical use of astringent substances such as *Cynomorium*, *Cytinus*, and gall apples exemplifies the role of tannins in protein precipitation and protection (Leonti et al., 2020). Moreover, tannins and flavonoid glycosides have been applied as nerve tonics to alleviate anxiety and headaches, as well as astringents

for diarrhea and topical gargles for mouth and throat irritations (National Institute of Child Health and Human Development, 2021). These properties suggest that tannins and flavonoids may contribute significantly to the management of *Kazhichal* (diarrhea).

Saponins have demonstrated effectiveness in reducing neuropathic pain in several nerve injury models, exerting analgesic effects through anti-inflammatory, immunoregulatory, antioxidant, and neuroprotective mechanisms (Tan *et al.,* 2022), For example, asperosaponin VI, the predominant compound found in *Dipsacus asper* rhizomes, has traditional applications for treating lower back pain, traumatic hematomas, and bone fractures (Wang et al., 2015). This indicates that saponins may play an important role in alleviating *Vaayu* (pain).

Terpenes and their derivatives, which are major constituents of essential oils, exhibit strong antimicrobial properties, showing both bacteriostatic and bactericidal activity against a variety of pathogens (Mahizan *et al.,* 2019). Consequently, terpenes may aid in addressing infections that contribute to *Mantham* (indigestion). Alkaloids such as vincristine, hydroxycamptothecin, and ligustrazine have been documented for their therapeutic efficacy against tumors, inflammation, and immune suppression (Zheng *et al.,* 2018). Alkaloids commonly found in food and medicinal plants display diverse bioactivities including anti-inflammatory, anticancer, analgesic, anesthetic, neuropharmacological, antimicrobial, and antifungal effects (Kurek, 2019), thus playing a pivotal role in treating multiple conditions.

Iron, an essential mineral largely present in red blood cells and muscle tissue, supports treatment for anemia, cardiovascular health, cognitive function, fatigue reduction, and child development (WebMD, n.d.), It is critical for oxygen transport and numerous physiological processes. Dietary nitrates and nitrites, known as exogenous sources of biological nitric oxide (NO), offer protective cardiovascular effects, potentially reducing risks of stroke, myocardial infarction, and hypertension, while also aiding in gastric ulcer management (Ma *et al.,* 2018).

Flavonoids are widely recognized for their antibacterial, antiviral, antioxidant, anti-inflammatory, antimutagenic, and anticarcinogenic properties (Roy *et al,* 2022). Phenols, initially introduced for antiseptic use, demonstrate local

anesthetic effects at low doses and induce apoptosis at higher concentrations through protein denaturation (Sadahira *et al.,* 2021).

Taken together, these findings indicate that garlic-based VVK tablets contain a broader spectrum of phytochemicals including tannins, flavonoids, and phenolic compounds as well as inorganic elements such as nitrate ions, which were not detected in the white onion formulation. This richer phytochemical profile suggests that garlic-based tablets may possess enhanced therapeutic benefits in line with Siddha medicinal principles.

Conclusion

The comparative phytochemical analysis of *Vellai Vengaya Kuligai* tablets prepared with garlic and white onion demonstrated clear differences in their chemical profiles. While both formulations contained alkaloids, flavonoids, saponins, and terpenes, the garlic-based tablets additionally exhibited phenols, tannins, and nitrate ions. These variations suggest that the garlic-based preparation could possess greater therapeutic efficacy. Nevertheless, further comprehensive qualitative and quantitative studies are necessary to standardize the formulation and to scientifically confirm the clinical benefits of both versions.

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