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Research Article

PHYTOCHEMICAL ANALYSIS OF A SIDDHA HERBO-MINERAL FORMULATION, *CHUKKU NEI*

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ABSTRACT

The Siddha system of medicine has its root in Tamil culture and encompasses a vast range of drugs. One of its unique features is the inclusion of various types of formulations such as single herbal, polyherbal, herbo-mineral, mineral and from animal origin drugs. Among the 32 varieties of internal medicines mention described in Siddha literature, ghee-based preparation constitutes one category. *Chukku nei*, a traditional ghee-based Siddha formulation mentioned in *Agathiar Vaithiya Kaaviyam 1500* has a wide range of therapeutic indications. This study aims to evaluate the phytochemical constituents of *Chukku nei* and to correlate them with its therapeutic indications described in classical siddha literature. *Chukku nei* was prepared according to classical siddha texts, and preliminary phytochemical analysis was carried out to identify major bioactive compounds. Analytical evaluation revealed the presence of alkaloids, flavonoids, steroids and triterpenoids. These compounds are known for their anti-inflammatory, anti-oxidant, analgesic, anti-spasmodic, anti-diarrheal, hematinic support and diuretic activities. The presence of these phytochemical constituents substantiates the indications mentioned for the formulation. The identified phytoconstituents also suggest potential synergistic interactions that may enhance pharmacological activity. Furthermore, the lipid-based medium (ghee) is likely to improve the bioavailability of bioactive compounds, thereby contributing to the overall efficacy of the formulation. The findings of this phytochemical analysis provide a scientific rationale for the traditional use of *Chukku nei*. However further pharmacological and clinical studies are required to support its therapeutic efficacy and safety.

INTRODUCTION

The Siddha system is an ancient system of medicine known for its diversity in both medicinal preparations and therapeutic indications. Pure herbal preparations contain only plant-based ingredients, whereas other formulations include minerals. Some preparations are classified as herbo-mineral, as they contain both herbs (fresh or dried) and minerals. The Siddha system also describes 32 varieties of internal medicines and 32 varieties of external medicines in classical literature. Among these, Nei (Ghee-based preparations) is one of the internal medicines. *Agathiar Vaithiya Kaaviyam 1500* [1], a classical Siddha text, describes numerous drug preparations under various categories. *Chukku nei* is one such formulation classified under ghee-based medicines. Siddha system is based on the theory of *Mukkutram* namely *Vaatham, Pitham* and *Kabam.* The selection of the drugs for specific diseases in the Siddha system is based on *Suvai, Veeriyam* and *Vibhagam. Chukku nei* is indicated for condition such as are anemia, dropsy, emaciation due to internal heat of the body[2] (Vol.2, p.1353, 1354) diarrhea, abdominal pain, body pain and colicky pain.[2] (Vol.5, p.3675) Although these indications are explained based on M*ukkutram,* these wide range of therapeutic uses raises allows questions regarding the bioactive compounds responsible for its efficacy and therapeutic diversity.

Phytochemical analysis helps in identifying the active constituents and understanding the mechanism of action of a drug. It provides a foundation for advanced studies like pharmacological, toxicological

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and clinical research. It also confirms the genuineness of plant ingredients and prevents the adulteration and substitution. Thus, phytochemical study provides a scientific basis for validating the herbo-mineral formulation such as *Chukku nei*. Therefore, the present study aims to evaluate the phytochemical constituents of *Chukku nei* and to correlate them with the therapeutic indications mentioned in classical Siddha literature.

Herbal and herbo-mineral formulations are traditionally recognized for their multi-component nature, where the therapeutic efficacy is often attributed to synergistic interactions among various bioactive constituents. In such formulations, different classes of phytochemicals act on multiple targets, producing a combined effect greater than the sum of individual actions. This concept of synergy plays a crucial role in enhancing pharmacological activity, improving therapeutic outcomes, and minimizing adverse effects.

In addition, the use of lipid-based media such as ghee (*Nei*) in traditional systems of medicine serves as an effective drug delivery vehicle. Ghee facilitates the solubilization of lipophilic compounds, enhances intestinal absorption, and improves bioavailability of active constituents. It is also considered to act as a carrier that aids in the efficient transport of phytoconstituents to target tissues. Thus, the combined influence of synergistic phytochemical interactions and lipid-mediated drug absorption contributes significantly to the overall efficacy of such formulations.

MATERIALS AND METHODS

Drug Selection: *Chukku nei*, a traditional ghee-based siddha medicine is mentioned in *Agathiar Vaithiya Kaaviyam 1500.*

Table 1: Ingredients of *Chukku Nei*

S.No	Name	Botanical Name	Family Name	Part used	Quantity
1	*Chukku*	*Zingiber officinale*	Zingiberaceae	Rhizome	*20 Balam (700 gm)*
2	*Aayilupattai*	*Chukrasia tabularis*	Meliaceae	Bark	*20 Balam (700 gm)*
3	*Perungaayam*	*Ferula asafoetida*	Apiaceae	Oleogum Resin	*2 Kalanju (10.2 gm)*
4	*Milagu*	*Piper nigrum*	Piperaceae	Fruit	*2 Kalanju (10.2 gm)*
5	*Sevviyam*	*Piper nigrum*	Piperaceae	Root	*2 Kalanju (10.2 gm)*
6	*Omam*	*Trachyspermum ammi*	Apiaceae	Fruit	*2 Kalanju (10.2 gm)*
7	*Athithippili*	*Scindapsus officinalis*	Araceae	Fruit	*2 Kalanju (10.2 gm)*
8	*Kodiveli ver*	*Plumbago Zeylanica*	Plumbaginaceae	Root	*2 Kalanju (10.2 gm)*
9	*Thippili*	*Piper longum*	Piperaceae	Fruit	*2 Kalanju (10.2 gm)*
10	*Thippili Moolam*	*Piper longum*	Piperaceae	Root	*2 Kalanju (10.2 gm)*

S.No	*Name*	Chemical Name			Quantity
1	*Yevatcharam*	Potash carbonate			*2 Kalanju* (10.2 gm)

Collection of raw drugs: The raw drugs are brought from raw drug shops in and around Tirunelveli.

Authentication of raw material: The collected drugs are authenticated by Department of Gunapadam in Government siddha medical College, Palayamkottai.

Purification: The drugs are purified as per the Siddha literature.

Preparation of the drug: *Chukku* and *Aayilupattai* are crushed into coarse powder. Add 8 times of water into it and boil well. Prepare the decoction by reducing it into 1/8 ratio. Other ingredients are made into a fine powder. Add cow ghee (3.4 litres) and water extract of curd (2.6 litres) to the prepared decoction. Then add the prepared fine powder to the above preparation. Boil it still it forms as ghee consistency.

Authentication of prepared drug: The resulting product of the preparation will be authenticated by the trained experts from Department of Gunapadam in Government Siddha Medical College, Palayamkottai.

Administration of the drug: Oral administration

Dosage: 3 *Kalanju* (15.3 g) once a day after food.

Phytochemical Analysis of *Chukku nei*

Phytochemical analysis of *Chukku nei* (Table 2) was performed at Noble Research Solutions, Chennai.

Table 2: Phytochemical Analysis of *Chukku Nei*

S.No	Experiment	Observation	Inference
1.	Test for alkaloids Mayer's Test: Two milliliters of Mayer's reagent were added to the test sample.	A dull white precipitate formed, indicating the presence of alkaloids.	Positive
2.	Test for coumarins To the test sample, one milliliter of 10% sodium hydroxide was added.	The formation of a yellow color indicates the presence of coumarins.	Negative
3.	Test for saponins Five milliliters of water were added to the test sample, and the tube was shaken vigorously.	The formation of a lot of foam suggests the presence of saponins.	Negative
4.	Test for glycosides- Borntrager's Test The test drug was hydrolyzed with concentrated hydrochloric acid for two hours on a water bath, then filtered. The hydrolysate was subjected to the following tests. Two milliliters of the filtered hydrolysate were mixed with three milliliters of chloroform, shaken well, and the chloroform layer was isolated. Ten percent ammonia solution was then added to the chloroform layer.	A pink color indicates the presence of glycoside.	Negative
5.	Test for flavonoids Alkaline reagent test: Two to three drops of sodium hydroxide were added to 2ml of extract.	A deep yellow color initially appeared but gradually turned colorless upon the addition of a few drops of dilute HCl. This indicates the presence of flavonoids.	Positive
6.	Test for phenols Lead acetate test: Three milliliters of 10% lead acetate solution were added to the test sample.	A bulky white precipitate formed, indicating the presence of phenolic compounds.	Negative
7.	Test for steroids Two milliliters of chloroform were added to the test sample along with a few drops of concentrated sulfuric acid (3 ml), and the mixture was shaken thoroughly.	The upper layer in the test tube was turn into red and sulphuric acid layer showed yellow with green fluorescence. It showed the presence of steroids.	Positive
8.	Triterpenoids Liebermann–Burchard test: To the chloroform solution, few drops of acetic anhydride was added then mixed well. 1ml concentrated sulphuric acid was added from the sides of the test tube.	The appearance of a red ring indicates the presence of triterpenoids.	Positive
9.	Test for cyanins A. Anthocyanin One milliliter of 2N sodium hydroxide was added to the test sample and heated for five minutes at 100°C. B. Betacyanin The test sample was mixed with ethanol	A bluish green color indicates the presence of anthocyanin. A red-violet color indicates the presence of betacyanin.	Negative
10.	Test for carbohydrates - Benedict's test About 0.5 milliliters of Benedict's reagent were added to the test sample. The mixture was heated on a boiling water bath for two minutes.	A characteristic-colored precipitate indicates the presence of sugar.	Negative

11.	Proteins (Biuret Test) A 1% solution of copper sulfate was added to the extract, followed by a 5% solution of sodium hydroxide.	The formation of a violet purple color indicates the presence of proteins.	Negative
12.	Test for tannins Five milliliters of water were added to the test sample.	A dark blue or greenish-black color was formed.	Negative

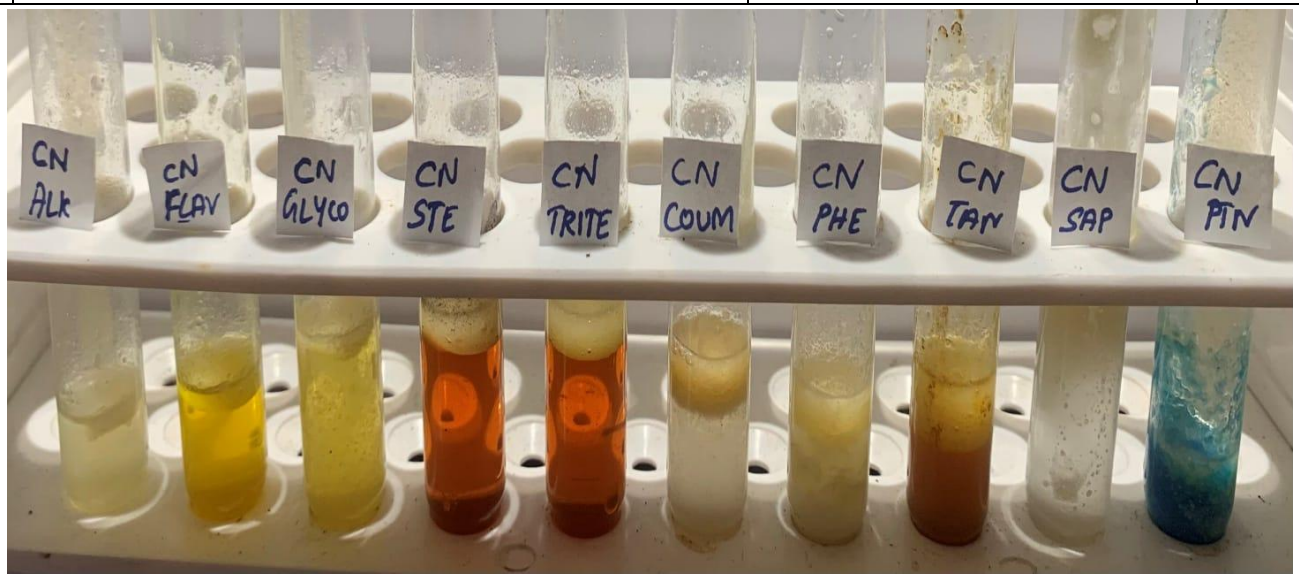

Fig.1: Preliminary phytochemical screening of *Chukku nei* showing the presence of alkaloids, flavonoids, steroids and triterpenoids

RESULTS AND DISCUSSION

The analytical evaluation showed the presence of alkaloids, flavonoids, steroids and triterpenoids, as shown in Fig.1. Flavonoids are widely appreciated for their strong antioxidant and free radical scavenging properties. Oxidative stress plays a key role in the pathogenesis of anemia by causing damage to red blood cells and impairing erythropoiesis. Flavonoids help in stabilizing red blood cell membranes and increasing iron absorption, thus aiding hemoglobin synthesis and improving anemic conditions.[3,4] Additionally, their anti-inflammatory and capillary stabilizing effects reduce vascular permeability and fluid leakage, which explain the use of the formulation in dropsy (edema). [5] Triterpenoids also support bone marrow function and erythropoiesis.

Alkaloids are known for their significant pharmacological actions, such as analgesic, antimicrobial, and antispasmodic effects. These properties are particularly beneficial in managing of diarrhea and abdominal pain. The anti-microbial activity helps control infectious causes of diarrhea, while the ability of alkaloids to reduce gastrointestinal motility contributes to decreased intestinal secretion and stool frequency.[6] Furthermore, alkaloids have smooth muscle relaxant effects, which are essential in relieving colicky pain associated with intestinal spasms. [7]

Steroids and triterpenoids are well documented for their anti-inflammatory and immunomodulatory activities. These compounds inhibit the production of inflammatory mediators such as prostaglandins and cytokines, thereby reducing inflammation and associated pain.[8] This explains the drug's effectiveness in managing body pain and abdominal discomfort. Triterpenoids are also known for their hepatoprotective properties, which may improve metabolic functions and nutritional status, thus addressing conditions like emaciation due to internal heat. [9]

The diuretic activity of flavonoids further contributes to the therapeutic use in dropsy by promoting the excretion of excess fluid from the body.[5] The combined antioxidant and anti-inflammatory effects of flavonoids, steroids, and triterpenoids help restore homeostasis and reduce chronic inflammatory states, which are often implicated in tissue wasting (emaciation). Moreover, the synergistic interaction between these phytoconstituents enhances the overall efficacy of the formulation by targeting multiple pathological pathways simultaneously.

The formulation exhibits a multi-target therapeutic profile (Table 3), where various phytoconstituents contribute to multiple pharmacological actions.

Table 3: Pharmacological Correlation of Phytoconstituents Indicating Multi-Target Therapeutic Profile

S.No	Pharmacological Action	Responsible Phytoconstituents
1.	Anti-inflammatory	Flavonoids, steroids, triterpenoids
2.	Anti-oxidant	Flavonoids
3.	Analgesic	Alkaloids, triterpenoids
4.	Anti-spasmodic	Alkaloids, flavonoids
5.	Anti-diarrhoeal	Alkaloids, flavonoids
6.	Hematinic support	Alkaloids, triterpenoids
7.	Diuretic	Flavonoids

The presence of ghee as a lipid base may enhance the bioavailability of plant compounds by increasing their solubility and intestinal absorption, thereby facilitating better therapeutic efficacy. Lipid based formulations are known to improve absorption of poorly water-soluble compounds and may also promote lymphatic transport, reducing first-pass metabolism. [10]

The therapeutic efficacy of *Chukku nei* can be attributed to the synergistic interaction among its plant components, mineral components, and lipid base.[11] The presence of alkaloids, flavonoids, steroids, and triterpenoids, each possessing distinct pharmacological activities, contributes to this effect. When present together, these components do not act independently, instead, they interact in a complementary manner, enhancing the overall therapeutic effect of the formulation. Flavonoids, with their antioxidant properties, may protect biological systems from oxidative stress and enhance the stability and activity of other constituents. Alkaloids contribute analgesic and antispasmodic actions, while triterpenoids and steroids contribute anti-inflammatory and antimicrobial effects. This multi-targeted action enables the formulation to address various pathological processes simultaneously.

Furthermore, the mineral components present in the formulation may interact with phytoconstituents to modulate their activity, potentially enhancing efficacy and reducing toxicity. The inclusion of ghee (*Nei*) as a lipid base plays a crucial role in this synergism by facilitating the solubilization and absorption of lipophilic compounds, thereby improving their bioavailability. It may also act as a carrier, ensuring better delivery of active constituents to target tissues. This integrated interaction between herbal, mineral, and lipid components reflects the traditional concept of polyherbal synergy, where the combined effect is greater than the sum of individual actions.

CONCLUSION

The present study demonstrates that the formulation contains significant phytoconstituents such as alkaloids, flavonoids, steroids and triterpenoids. The combined pharmacological actions, including anti-oxidant, anti-inflammatory, analgesic, antimicrobial, anti-spasmodic, and diuretic effects, effectively correlate with the claimed indications such as anemia, dropsy, emaciation, diarrhea, abdominal pain, body pain, and colicky pain. Also, the lipid-based nature of ghee likely facilitates improved absorption and bioavailability of phytoconstituents, thereby enhancing the overall therapeutic efficacy of the formulation. Thus, the synergistic interplay in *Chukku Nei* significantly contributes to its broad-spectrum therapeutic efficacy. This supports the therapeutic potential of the formulation and validates its use in traditional medicine. However, the study is limited to qualitative analysis, and further quantitative, pharmacological, and clinical studies are required to validate these findings.

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