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Research article

Formulation and evaluation of a Moringa-based herbal kadha tablet as a convenient immune-boosting health supplement

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ABSTRACT

The increasing global preference for natural, plant-based health solutions has renewed interest in traditional herbal remedies like *kadha*, a decoction of medicinal herbs widely used in Ayurveda for its immune-boosting properties. This research focuses on the formulation, optimization, and evaluation of a ready-to-use herbal kadha tablet based on *Moringa oleifera*, known for its exceptional nutritional and therapeutic value. Additional ingredients such as Amla, Tulsi, Ginger, Cinnamon, and Cardamom were incorporated to enhance the formulation's effectiveness and sensory appeal. Two formulations (F1 and F2) were developed and assessed using organoleptic evaluation, physicochemical testing, and Physical parameters. Formula F1 emerged as the superior formulation, exhibiting better solubility (3.8 ± 0.2 min), higher water absorption (85.3%), acceptable ash value (5.2%), and favorable sensory characteristics. Phytochemical analysis confirmed the presence of flavonoids, alkaloids, terpenoids, glycosides, and reducing sugars, supporting the tablet's therapeutic potential. The study concludes that the moringa-based kadha tablet offers a convenient, stable, and effective alternative to traditional decoctions, aligning with modern lifestyles while preserving Ayurvedic principles. This innovation has strong potential in the growing market of herbal immunity-boosting products.

Keywords: Moringa, Drum steak, Immunity, Immune Booster, Cinnamon, Antidiabetic, Nutritional supplement.

INTRODUCTION

Recently, there has been a growing interest in herbal products and plant-based therapies as natural alternatives for boosting immunity and increasing overall health. The use of kadha, a herbal decoction prepared by boiling medicinal herbs and spices, to treat common illnesses and boost immunity has long been supported by traditional Indian medical systems, especially in Ayurveda. Kadha, known by various names, including Kashayam, Kwath, Kadha, and Herbal Decoctions. The modern name of kadha is herbal tea. Kadha is one of the numerous extremely potent Ayurvedic supplements. Kadha is a mixture of medicinally valuable herbs that is boiled with water until the herbs release their properties into the water [1]. Herbal teas are made using dried leaves, seeds, nuts, barks, fruits, flowers, or other botanical ingredients [2,3].

One such plant that is well-known for its remarkable nutritional and medicinal qualities is Moringa oleifera, also referred to as the drumstick tree or moringa. One such plant that is well-known for its remarkable nutritional and medicinal qualities is Moringa oleifera, also referred to as the drumstick tree or moringa. Moringa leaves, a good source of energy and micronutrients like iron, might be the best way to satisfy the nutritional needs of developing teenagers [3,4]. The immune system serves as the body's defense against germs and other harmful microorganisms.

Despite the health advantages, the traditional method of preparing kadha might be time-consuming and difficult for contemporary lifestyles. The goal of this study is to solve this problem by investigating the creation of a ready-to-use kadha tablet made from moringa that dissolves readily in hot water to make a nutritious tea. This tablet offers a simple, standardized, and potent herbal treatment in tablet form by combining the power of moringa with additional herbs that work well together, such as amla, tulsi, ginger, black pepper, and cinnamon. This study aims to develop, optimize, and assess the physicochemical and sensory characteristics of these moringa kadha tablets to assure their effectiveness, safety, palatability, and stability throughout time.

It is important to understand that there is a huge variety of herbal teas available in the market, each of which is designed to

have a specific therapeutic or medicinal benefit. The benefits of herbal tea are as follows:[3]

Give a more calm and relaxed state of mind

Support heart health

Aiding with stomach and digestive problems

Provide cleansing properties of the body

Promote energy level

Nourishment of the nervous system

Give strength to the immune system

Provide antioxidants to the body

Relief from stress

Stimulating the internal organs

Promote good sleep because it is caffeine-free.

Importance of natural herbs in immunity

Strengths

Natural herbs are rich in antioxidants, vitamins, and minerals that support immune function without synthetic additives.

Many herbs like tulsi, turmeric, and ginger have anti-inflammatory and antimicrobial properties proven to strengthen the body's defense system.

Fewer side effects and lower risk of long-term harm compared to synthetic immunity boosters or over-the-counter medications.

Weaknesses

Herbal effectiveness can vary based on individual body types, diet, and health conditions.

Results may take longer to appear, requiring consistent consumption over time for noticeable benefits.

Some herbs may interact with medications or may not be suitable for pregnant or lactating women without medical guidance.

Opportunities

Rising global demand for natural, plant-based health supplements opens up a growing market for herbal immunity products.

Integration with modern scientific research can lead to the development of standardized herbal formulations.

Educational campaigns can increase awareness about the preventive role of herbs in everydayhealth.

Eco-Friendly

Herbs are biodegradable and often locally sourced, reducing the carbon footprint.

Herbal formulations can be packaged in minimal, sustainable materials, promoting environmental conservation.

Reduces reliance on synthetic drugs and contributes to a more holistic, earth-friendly health approach.

Objective

This study aims to formulate, optimize, and evaluate a ready-to-use herbal kadha tablet incorporating Moringa oleifera as the principal component, combined with complementary Ayurvedic herbs such as Amla, Tulsi, Ginger, Cinnamon, and Cardamom. The formulation is assessed through detailed physicochemical, organoleptic, and phytochemical analyses to determine its solubility, stability, active compound presence, and overall consumer acceptability. The ultimate objective is to establish a standardized, convenient, and effective herbal product that supports immune health in alignment with both traditional Ayurvedic knowledge and modern healthcare needs.

Combine benefits

Work as an immune booster

Improved digestion and gut health

Enhanced nutrient absorption

Gentler on digestion

Blood sugar and BP friendly

Reduce oxidation stress

Use as a detox supplement

Strong anti-inflammatory effect

Better skin health

Supports detox and liver function

Natural energy booster

MATERIALS AND METHODS

Materials

Modern scientific literature and traditional Ayurvedic scriptures supporting the immune-boosting and health-enhancing qualities of natural plants served as the basis for the development of the herbal Moringa Kadha (tea) Tablet. The main or core ingredient in this preparation is *Moringa oleifera* and *Amla* for their medicinal value and potential. And other supporting ingredients like Cinnamon, Holy Basil (Tulsi), Cardamom, ginger, raw honey, or jaggery are used for this formulation to improve their potency, enhance immunity. **(Table 1)**

Method of preparation

Step 1: [4, 6, 18].

Take 18 grams of powder, dissolve in 180 ml of water

Boil it on the burner for 1 hr with continuous stirring

After 1 hour, cool it down & keep aside for 1 day so that all the active constituents will be absorbed by water.

After 1 day, filter it Wattman filter paper.

Extract of Moringa oleifera.

Figure 1: Moringa Leaf Extra

Table 1: Ingredients Used in the Formulation of Moringa-Based Herbal Kadha Tablet

Ingredient	Properties	Benifits
Moringa oleifera [4–9] **Biological Source: Moringa oleifera**  **Family: Moringaceae**	Antioxidant, Anti-Inflammatory, Antimicrobial, Anti-Cancer, Anti-Diabetes, Nutritional Value Like Protein, Vitamins A, B, C, D, And E, Minerals Such As Calcium, Potassium, Zinc, And Magnesium, Anti-Fungal And Anti-Bacterial Property, Antitumor, Hepatoprotective, Circulatory Stimulants, Antispasmodic, Anti-Hypertensive, Diuretic, Cholesterol-Lowering, Antiepileptic, Anti-Carcinogenic, Anti-Viral And Anti-Estrogenic Activities.	Nutrient-Dense, Anti-Inflammatory, Boosts Immune, Regulates Blood Sugar, Provides Energy, Cures Infectious Skin Conditions, Used Against AIDS And HIV, Beneficial In Menstrual Pain, Against Headache
Amla [6, 7]  **Biological Source: Phyllanthus emblica** **Family: Phyllanthaceae**	Antioxidant, Anti-Inflammatory, Rich in Vitamin C, Detoxifying, Boosts Immunity, Promotes Collagen Production, Improves Iron Absorption, Antidiabetic, Antimicrobial.	Gastrointestinal Disorders, Also Beneficial For Boosting Immunity, Improving Memory, Reducing Cholesterol, And Combating Ophthalmic Disorders, Are Used in Ayurvedic Medicines for The Remedy Of Jaundice, Diarrhea, Anti-Pyretic, Hair Tonic, And Ulcer Preventative.
Cinnamon [10–12]  **Biological Source: *Cinnamomum cassia*** **Family: Lauraceae**	Anti-Microbial, Anti-Oxidant, Anti-Diabetic Agent, Anti-Inflammatory, Blood Pressure Lowering Effect, Anticancer, Analgesic Agent	Flavouring Agent, Blood Pressure, Glycaemic Control, Boosts Metabolism and Digestion, Cholesterol-Lowering Actions, Boosting Immunity.
Tulsi [6]  **Biological Source: Ocimum sanctum** **Family: Lamiaceae**	Eugenol, Flavonoids, Alkaloids, And Essential Oils. Antiseptic, Antiallergic, Anticancer Effects, And Antioxidant.	Rejuvenating, Tonic, And Vitalizing, Adaptogen, Anti-Inflammatory, Immune-Supportive, Less Heating for Sensitive Guts, Immunity Boosting.
Cardamom [13, 14]  **Biological Source: Elettaria cardamomum** **Family: Zingiberaceae**	Anti-Bacterian, Anti-Inflammatory, Antioxidant, Flavouring Agent, Antimicrobial, Cardio-Protectant, And Hypo-Cholesterolemic, Gastro-Protective.	Soothes Gut, Breath Freshener, Immunity Boosting
Ginger [15, 16] **Biological Source: Zingiber officinale** **Family: Zingiberaceae** 	Anti-Nausea, Digestive Aid, Anti-Inflammatory, Anti-Cancer, Motion Sickness, Antiplatelet Agent, Antioxidant, Antimicrobial, Antiemetic Agent, Antiulcer.	Nausea, Lowers Blood Cholesterol and Blood Glucose Levels, Flavouring, Preservatives, Used to Treat Headaches, Colds, Arthritis, Rheumatism, Muscular Discomfort and Inflammation, Gastrointestinal Disorders, Respiratory Disorders, Atherosclerosis, Migraine, Depression, And Gastric Ulcer.
Honey [17] **Biological Source** **Collected from bees (*Apis spp.*)** 	Natural Sweetener, Vitamin C Rich, Anti-Aging.	Boosts Immunity, Gut-Soothing, Supports Throat

Step 2

Take 18 ml of the Extract of Moringa
Then mixed with honey syrup

The mixture was heated in the water bath at 90°C.

After 30 minutes of heating syrup is mixed with the extract.

Add Tulsi as an anti-inflammatory agent

Add cardamom as a Flavouring agent

Add ginger, cinnamon, and funnel the mix well

Fill the tablet mold with the mixture.

Then place in a hot air oven and allow to dry at 40-50°C to remove water and moisture content.

The moisture content is removed from the heat source

A thin layer of honey-amla coating is applied on the tablet for a smooth texture and dried.

After drying, store in a well-closed container.

Figure 2: Some ingredients to be used for formulation Tulsi Extract, Amla, Funnel, Moringa Extract, Cardamon, Cinnamon, Ginger, and Honey)

Formulation Variants

Two formulations were prepared with slight differences in herbal composition.

Table 2: In-house moringa-based herbal tea formulation in two different combinations

Ingredient	F1	F2
Moringa oleifera (core ingredient)	18	18
Amla	8	6
Cinnamon	4	4
Tulsi extract	6ml	6ml
Cardamom	3	4
Ginger	4	4
Honey	6ml	4ml
Funnel	4	5

Figure 3: Formulation of Moringa-Based Kadha Tablet

Evaluation

Organoleptic test [4]

In the organoleptic test, the color, odor, taste, and texture were evaluated by visual inspection of the product.

Physical parameters [4]

Determination of dissolution rate

Time to Dissolve: Place the tablet in hot water (90–100°C) and indicate how long it takes for it to dissolve completely. The tablet's ability to dissolve in hot water is essential to its effectiveness.

A quick rate of dissolving will enable the quick release of the active compounds (such as Tulsi, Amla, and Moringa), increasing the product's effectiveness.

$$\textbf{Dissolution Rate} = \frac{Amount\ of\ substance\ dissolved\ (mg)}{Time\ (min)}$$

Determination Of disintegration rate [19]

Six tablets of Formula F1 and six tablets of Formula F2 were separately immersed in 250 mL of hot water at 60°C. The duration for each tablet to completely dissolve was noted. The dissolution process was monitored until the tablet fully disintegrated, and the average duration was determined for each formula, F1 and F2.

Stability of Dissolved Solution

Testing for Storage: Once the tablet has dissolved, keep the solution at room temperature and keep monitor for any precipitation, color changes, or microbial growth over time.

Determination of the hardness of the Tablet

Tablet hardness was assessed using a tablet hardness tester by placing each herbal tablet between the platens and applying compressive force until initial deformation or fracture. The peak force (N) required to deform each sample was recorded, and mean hardness was calculated.

Determination of Weight Variation Test

Six tablets from Formula F1 and Formula F2 were weighed individually using an analytical balance. The initial weights were recorded, and the weight differences were assessed by comparing each tablet's weight to the mean weight of its respective formula;

$$Percentage\ Deviation = \frac{Individual\ Weight - Average\ Weight}{Average\ Weight} \times 100$$

Friability test

Ten dried tablets from **Formula F1** and **Formula F2** were weighed and placed in a friabilator. The tablets were rotated at 25 rpm for 4 minutes (100 revolutions). After the test, the tablets were reweighed to calculate the percentage of weight loss due to surface wear.

$$Friability\ (\%) = \frac{W initial - W final}{W final} \times 100$$

Wetting Time

A piece of tissue paper folded twice was placed in a small Petri dish (internal diameter = 6.5cm) containing 6.0 ml of water. A tablet was placed on the paper, and the time for complete wetting of the tablet was measured in seconds. Two trials for each formulation were performed, and the results were recorded.

Water Absorption ratio

A piece of tissue paper folded twice was placed in a small Petri dish (internal diameter = 6.5 cm) containing 6.0 ml of water. Each tablet from Formula F1 and Formula F2 was placed on the paper, and the time required for complete wetting was

measured. The wetted tablet was then weighed. Water absorption ratio (R) was determined using the following Equation.

$$WAR = \frac{Wa-Wb}{Wb} \times 100$$

Where

WAR: Water Absorption Ratio.

Wa - weight of tablet after water absorption.

Wb - weight of tablet before water absorption.

Solubility Test:

The test measured how completely each tablet dissolved under typical use conditions by adding one tablet from Formula F1 and one from Formula F2 separately to 180 mL of hot water (60 °C), gently stirring the solutions, and watching for dissolution, clarity, and any undissolved particles.

Determination of ash value

Ash value helps determine the quality and purity of crude drug, especially in powder form. The objective of ash vegetable drugs is to remove all traces of organic matter, which may otherwise interfere with an analytical determination.

Total ASH value

Weigh accurately about 2 g of powdered drug in a tarred silica crucible. Incinerated at a temperature not exceeding 450°C for 4 h, until free from carbon, cooled, and weighed.

% Total Ash value = (wt. of total ash/wt. of crude drug) × 100

Chemical Test

Ph test

Measure the pH of the formulation by dissolving the tablet in water. OR The herbal tea was made with 180 milliliters of boiling water by dissolving the tea tablet. The tea was allowed to cool at room temperature. The pH of the brew solution was measured using a digital pH meter. After storing the brew solution in the refrigerator at 0°C, we measured its pH. For a month, this procedure was performed daily.[4] The stability and bioavailability of the active ingredients are ensured by measuring the pH of the dissolved solution. For maintaining stability and effectiveness, the pH should be between 6.0 and 7.0, which is neutral to slightly acidic.

Preliminary phytochemical analysis: (Table 3)

Table 3: Preliminary phytochemical analysis for herbal kadha tablet

Test	Process
Lead acetate test	1 mL filtrate+3 drops of lead acetate solution.
Salkowski test	Extract 5 mL + 2 mL chloroform+3 mL concentrated sulfuric acid.
Dragendroffs test	1 ml Dragendroff s reagent+2 mL extract.
Meyer's test	2 mL extract+1 1 mL of Meyer's reagent.
Fehling's test	Take 1 mL of Fehling A solution and 1 mL of Fehling B solution, boil them for 5–6 min, add 2 mL of extract, and heat them in a water bath.
Keller–Kiliani test	1 mL filtrate+1.5 mL glacial acetic acid+1 drop of ferric chloride + concentrated H2SO

RESULTS AND DISCUSSION

Organoleptic Test

An organoleptic study is a basic study to identify and evaluate the quality of the product. Prepared herbal tea has reported the following parameters.

Table 4: Organoleptic Evaluation of Formulations F1 and F2

Organoleptic parameters	Formula 1	Formula 2
Color	Bright greenish-brown	Slightly lighter greenish-brown
Odor	Pleasant aroma	Milder aroma
Taste	Sweet-spicy test	Lightly sweet taste.
Texture	Smooth, Non-Gritty texture	Slightly softer texture

Panelists preferred Formula F1 for its intense aroma and balanced taste, indicating better sensory acceptance.

Table 5: Physical Evaluation of Formulations F1 and F2

Test	F1 Result	F2 Result	Interpretation
Dissolution Time	3.8 ± 0.2 minutes	4.3 ± 0.3 minutes	F1 dissolved faster, ideal for quick tea preparation.
Disintegration Time	4.0 ± 0.2 minutes	3.7 ± 0.1 minutes	Both were acceptable; F1 was slightly more stable during infusion.
Hardness	0.64 ± 0.04 N	Slightly less	F1 showed better structural integrity.
Weight Variation	2.28 ± 0.02 g	2.30 ± 0.02 g	Both are within a ±5% acceptable limit.
Friability	0.42%	0.47%	Both below 1%; F1 showed better resistance to crumbling.
Wetting Time	48 ± 2 seconds	44 ± 3 seconds	F2 wet faster, but F1 retained structure better.
Water Absorption Ratio	85.3%	81.7%	F1 absorbed more water, aiding in faster and cleaner dissolution.
Solubility in Hot Water	Complete, minimal residue	Slight residue observed	F1 produced a cleaner infusion.
Total Ash Value	5.2%	5.6%	F1 had lower ash content, indicating fewer inorganic contaminants.

Physical Parameter (Table 5)

Dissolution Rate

Dissolution Time: 3-5 minutes in Hot Water (fully dissolved), and it takes 10-12 minutes to dissolve in normal or cool water.

Formula F1 dissolved completely in 3.8 ± 0.2 minutes, producing a clear infusion with minimal residue, while Formula F2 took 4.3 ± 0.3 minutes and showed slight sediment. This indicates that F1 has better solubility and dispersibility. Its faster and cleaner dissolution makes it more suitable for instant infusion applications.

Stability of Dissolved Solution

The solution should not precipitate or grow microorganisms for at least 24 hours after dissolving. This is essential for assuring the safety and effectiveness of the tablet once it has been prepared.

Hardness

The average hardness of the tablets was 0.64 ± 0.04 N. All samples completely and uniformly dissolved in a matter of minutes after being submerged in hot water (around 60°C). The tablet's potential for infusion-based use was confirmed by the ease with which the herbal residue could be filtered out before consumption.

Disintegration

Formula F1 broke down in an average of 4.0 ± 0.2 minutes, whereas Formula F2 disintegrated in 3.7 ± 0.1 minutes. Both formulas dissolved well, leaving no excessive residue, making them appropriate for infusion and simple to filter before consumption.

Weight Variation

Formula F1 had an average weight of 2.28 ± 0.02 g. Formula F2 had an average weight of 2.30 ± 0.02 g. It was found that all tablets passed the weight variation test, as the percentage weight variation was within an acceptable range of ± 5%. Both formulas demonstrated slight weight fluctuations, remaining within the acceptable limit of ±5%, signifying a stable formulation for every tablet.

Friability test

Formula F1 showed a weight loss of 0.42%. Formula F2 showed a weight loss of 0.47%. Both results are below the standard limit of 1%, indicating good mechanical strength and resistance to crumbling during handling.

Wetting Time

Formula F1 showed an average wetting time of 48 ± 2 seconds, while F2 averaged 44 ± 3 seconds. While F2 absorbed moisture a bit quicker, F1 preserved tablet integrity better during the wetting process, indicating a more stable structure that still allowed for prompt disintegration.

Water Absorption ratio

Formula F1 demonstrated a greater average Water Absorption Rate (WAR) of *85.3%*, while Formula F2 had a rate of *81.7%*. This indicates that F1 possesses superior water absorption ability, resulting in enhanced hydration. As a result, F1 dissolves more easily in water, enhancing its effectiveness for quick reconstitution. This property is beneficial for products designed for rapid infusion or instant application.

Solubility Test

In hot water, both formulations dissolved easily. Formula F1 demonstrated almost total solubility, a cleaner solution, and little discernible residue. While Formula F2 also dissolved well, it left behind some sediment, indicating that it has slightly lower solubility compared to F1.

Total ASH value

Formula F1 has a total ash value of 5.2%, which means that natural plant elements are responsible for a moderate amount of inorganic residue. The ash value of 5.6% for Formula F2 was slightly higher in in comparison to Formula F1. However, Formula F1's lower ash content indicates a relatively cleaner raw material composition and lower mineral or extraneous matter content, even though both values are within acceptable pharmacopeial standards.

Chemical Test

pH Test

The pH of this formulation is 6.7 is a slightly acidic solution.

Preliminary phytochemical analysis

Table 6: Phytochemical Test Results for Herbal Kadha Tablet

Test	Observation
Lead Acetate Test	Creamy white precipitate, indicating flavonoids.
Salkowski Test	Reddish-brown coloration of the chloroform layer, indicating terpenoids or steroids.
Dragendorff's Test	Reddish-brown precipitate, confirming alkaloids.
Meyer’s Test	Precipitates formed, indicating alkaloids.
Fehling’s Test	Brick red precipitates, indicating reducing sugars.
Keller–Kiliani Test	Reddish-brown color at a junction and blue upper layer, indicating cardiac glycosides.

CONCLUSION

The development and evaluation of Moringa-based herbal kadha tablets present a promising advancement in delivering traditional Ayurvedic health benefits in a modern, convenient form. By combining the potent immunomodulatory and nutritional properties of *Moringa oleifera* with other complementary herbs such as Amla, Tulsi, Ginger, Cinnamon, and Cardamom, the formulated tablets offer a holistic approach to boosting immunity and promoting overall well-being. Among the two formulations developed, Formula F1 demonstrated superior performance in key physicochemical and sensory parameters. It exhibited better solubility, higher water absorption, lower ash content, stronger mechanical integrity, and greater sensory appeal, making it more effective for quick and pleasant consumption. The organoleptic and phytochemical tests confirmed the presence of beneficial compounds such as flavonoids, alkaloids, terpenoids, and glycosides, which contribute to the formulation's therapeutic efficacy. Overall, this study highlights the feasibility of transforming traditional herbal remedies into user-friendly, standardized products with retained efficacy, safety, and consumer acceptability. With rising demand for natural and preventive health solutions, the Moringa kadha tablet offers a sustainable, scalable, and practical alternative for enhancing immunity and supporting general health.

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