# SUSTAINABLE PRODUCTION OF MEDICATED SOAP FROM SOME AVAILABLE PLANT BIORESOURCES IN KATSINA STATE

**A RESEARCH PROPOSAL SUBMITTED TO NATIONAL SCIENCE AND ENGINEERING INFRASTRUCTURE (NASENI)**

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**HEALTH AND BIOTECHNOLOGY**

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## Preamble

Preliminary experiments conducted have concentrated on:

Fresh and dried plant materials are extracted using aqueous and solvent methods.

Using locally obtained oil (coconut oil) for cold process saponification

Adding 5–10% (w/w) crude extracts to soap bases, then assessing their efficacy, stability and pH (**Plate 1**)

Physical evaluations: shelf life, hardness, and lather quality in natural tropical settings

**Plate 1:** Some Plants Parts used in Medicated Soap Preparation

## Introduction

According to the United Nations (2015), sustainable development places a strong emphasis on using natural resources responsibly so that current demands can be met without endangering the capacity of future generations to meet their own. The growing demand for natural and herbal goods in the pharmaceutical and cosmetics sectors is consistent with international initiatives to support socially and environmentally responsible practices (García *et al.,* 2021). With its rich biodiversity, Nigeria and Katsina State in particular offers a wealth of native plant species that can be sustainably used for cosmetic and medicinal purposes, lowering reliance on imported chemicals and synthetic ingredients that frequently have negative environmental effects (Ogunleye *et al.,* 2022).

Herbal soap preparations, which are mostly derived from plant parts like leaves, stems, and other parts, are remedies that include antibacterial and antifungal substances and are used to treat wounds, diseases, and boost general health (Wijayawardhana *et al.,* 2021).

Due to a lack of access to efficient treatments and an increase in antibiotic resistance, bacterial and fungal skin infections continue to pose a serious threat to public health throughout Nigeria, with rural areas in northern Nigeria being disproportionately affected (Ukwaja *et al.,* 2020). Northern Nigeria's severe, semi-arid climate has fostered the development of hardy medicinal plants that have long been used to treat skin conditions in traditional medicine (Al-Obaidi *et al.,* 2021). According to preliminary research, certain plants, including *Euphorbia hirta, Azadirachta indica, Balanites aegyptiaca, Calotropis procera, and Acacia nilotica,* have antibacterial and antifungal qualities (Kiran and Sai Prasanna, 2021).

The largest and external organ in the human body is the skin. It carries out a variety of tasks, including percutaneous absorption, organ protection, fluid preservation, maintaining body shape, controlling body temperature, and excreting pollutants from the body through perspiration (McKnight *et al.* 2022). Skin conditions are a serious global health concern (Kavita *et al.,* 2023). Skin disorders can be classed as either infectious or non-contagious. The main types of skin diseases are caused by bacteria, fungi, viruses, and parasites (Abdoos, 2025). Although these illnesses are found

worldwide, they are particularly common in tropical and rural areas (Goyal and Santhanam, 2025).

About 34% of all illnesses in rural areas are skin diseases, which are prevalent among the population (Anwar *et al.,* 2022). They are one of the five causes for seeking medical attention and impact individuals of all ages and genders, from newborns to the elderly (Richard *et al.,* 2022). In line with the global agenda of sustainable development goals (SDGs) (United Nations, 2015), Katsina State's production of herbal medicated soaps from locally sourced plants is an example of a sustainable approach that combines ecological conservation, economic viability, and social responsibility (Goyal and Santhanam, 2025).

Therefore, this research aims to formulate a medicated herbal soap from extracts of locally available plants, contributing to sustainable resource utilization and promoting health and hygiene.

**Problem Statement**

The sustainable use of native plants for pharmaceutical and cosmetic purposes is still lacking in Nigeria, despite the country's great biodiversity and traditional knowledge of medicinal plants. The majority of herbal remedies are made from non-native species or imported substances, which might harm the environment and cause native plant species to disappear (Ogunleye *et al.,* 2022).

Additionally, although there are effective synthetic medicated soaps available, low-income populations in northern Nigeria cannot afford them, which forces them to turn to ineffectual traditional medicines and increases the risk of resistant diseases (Ajekiigbe *et al.,* 2025). Despite having demonstrated antibacterial qualities, many native plants are still underutilized. Despite current restrictions, the production of herbal medicines is nevertheless plagued by inadequate human scientific testing, standardization, and quality control (Abdel-Tawab, 2018).

Even though many indigenous plants in Katsina State have therapeutic and cosmetic uses, there aren't many locally made, standardized herbal goods, like medicated soaps, that make sustainable use of these resources. This disparity leads to lost chances for indigenous biodiversity preservation and local communities' economic empowerment

(Ibrahim *et al.,* 2023). Thus, it is imperative to create sustainable ways to use indigenous plants to make herbal medicinal soaps that adhere to green chemistry principles, support local economies, enhance health outcomes, and conserve the environment (García *et al.*, 2021).

**Proposed Solutions**

This research proposes to formulate a medicated herbal soap using extracts from locally sourced drought and non-drought resistant plants. The selected plants are known for their medicinal and antimicrobial properties:

1. *Acacia nilotica* (**Hausa**: Bagaruwa, **Yoruba**: Ayan, Igbo: Mkpo) has antibacterial and anti-inflammatory properties (Akinmoladun *et al.,* 2020).
2. *Balanites aegyptiaca* (**Hausa**: Aduwa,**Yoruba**: Odan,**Igbo**: Ucha or Aki ucha) exhibits antimicrobial activity and skin healing properties (Ogunleye *et al.,* 2017).
3. *Azadirachta indica* (Neem, **Hausa**: Dogonyaro, **Yoruba**: Dongoyaro or Oju Orogbo,**Igbo**: Ogwu akam or Azuju) is renowned for its antiseptic and insecticidal qualities (Kumar *et al.,* 2018).
4. *Euphorbia hirta* (**Hausa**: Baƙon daji, **Yoruba**: Asthma weed (local: Ewe akoko, Igbo**:** Ogwu ngwo) possesses antimicrobial effects and traditional uses for skin ailments (Akinmoladun *et al.,* 2020).
5. *Calotropis procera* (**Hausa**: Tumfafiya,**Yoruba**: Bomubomu or Ọgọrun ọgọrun, Igbo**:** Nwopiri or Akanta) has antifungal and antimicrobial activities (Akinmoladun *et al.,* 2020).
6. *Aloe vera* (**Hausa**: Zabila, **Yoruba**: Ewé Àbúrò, Igbo**:** Ogwu–ahihia or Ọnụnwa) is widely used for skin soothing and healing (Pandit *et al.,* 2017).
7. *Kalanchoe pinnata (***Hausa**: Oda tsuntsu or Lafen yaro, **Yoruba**: Ewe abamoda, **Igbo**: Odaa opue or Nnukwu ogwu) exhibits wound healing and antimicrobial properties (Kumar *et al.,* 2018).
8. *Vigna subterranean* (**Hausa**: kwaruru, **Yoruba**: epa-roro, **Igbo**: okpa) exhibit healing properties (Palamae *et al.,* 2024).

## Objectives

To determine the aqueous and ethanolic extracts from specific endemic medicinal plants in Katsina State.

To use the melt-and-pour method to create medicated soaps with glycerine as the base and incorporate these extracts in different concentrations.

To evaluate the physicochemical quality parameters, such as pH, moisture content, foam stability, foamability, and sensory qualities.

To perform stability tests over predetermined time periods in both ambient and accelerated storage conditions.

Using agar diffusion assays, ascertain the soaps' antimicrobial efficacy against Escherichia coli, Staphylococcus aureus, and Candida spp.

In order to track the medicinal soap's safety and efficacy in treating common skin infections, a community trial will be conducted among Al-majiri Tsangaya schools.

## Benefit of the Research

The biodegradable, affordable medicated soap produced by this study reduces production costs, protects biodiversity, and has a smaller environmental impact by utilizing green processing and locally grown medicinal plants. An effective antimicrobial solution that improves skin health, hygiene, and community well-being, as well as higher revenue and local business empowerment, are all advantages for rural areas.

## Materials and Methods

### Plant Material Collection & Preparation:

Fresh plant parts will be collected from local sources, authenticated by a botanist, washed, and air-dried (Sharma *et al.,* 2022).

### Extraction Procedure:

Extracts will be obtained via cold maceration using solvents such as ethanol or water, depending on the solubility of phytochemicals (Sharma *et al.,* 2022).

### Soap Formulation:

Using the melt and pour method, soap will be prepared with glycerine soap base, incorporating plant extracts at varying concentrations (Sharma *et al.,* 2022).

### Quality Evaluation Tests:

- pH measurement: Using a digital pH meter (Sany and Fahmi, 2019).
- Moisture Content: Determined by oven drying method (AOAC, 2016).
- Foamability and Foam Stability: Using standard foam test apparatus (Sany and Fahmi, 2019).
- Sensory Evaluation: Conducted by a panel for appearance, aroma, texture, and overall acceptability.

### Stability Studies:

The formulated soaps will be stored under different conditions (ambient and accelerated) for stability assessment over time (Sany and Fahmi, 2019).

### Antimicrobial Testing:

The antimicrobial efficacy will be tested against common skin pathogens such as Candida spp., *Staphylococcus aureus* and *Escherichia coli* using agar diffusion methods.

**Data Analysis:**

Results will be statistically analyzed using SPSS and presented in graphs and tables (Mutonga *et al.,* 2019).

***Packaging and Labeling***

** Moisture-proof paper or bio-packaging will be used for packaging.*

** Labeling will be done with:*

** Ingredients*

** Date of production*

** Usage directions*

** Safety warnings (*Wallelign *et al.,* 2022*)*

**Community Implementation Plan**

The formulated medicated soap will be evaluated for its efficacy against common skin infections caused by bacteria and fungi species in some Al-majiri Tsangaya schools within and around Katsina metropolis. The almajirai guardians/mallam will be informed on how to apply the soap to affected body part for certain period and healing progression will be monitored.

**BUDGET**

| **Budget for Bioactive Compound Extraction & Medicated Herbal Soap Formulation** | |
|---|---|
| **Description** | **Total (₦)** |
| **1.0 Personnel & Training** | |
| 1.1 Principal *Investigator* | ₦700,000 |
| **1.2 Team members** 4*337,500 | ₦1,350,000 |
| 1.3 Research assistants/lab technicians (hours x rate)-3*200,000- | ₦600,000 |
| 1.4 Training/workshop for sensory evaluation | ₦350,000 |
| 1.5 **Subtotal:** | ₦3,000,000 |
| | |
| **2.0 Raw Materials & Supplies** | |
| 2.1 Plant materials (endemic plants) — species x 1 kg each @ ₦28,000 per kg | ₦140,000 |

| | |
|---|---|
| 2.2 Chemicals & reagents | ₦750,000 |
| 2.3 Solvents (ethanol, water, etc.) | ₦400,000 |
| 2.4 Glycerine soap base — 10 kg @ ₦9,500 per kg | ₦95,000 |
| 2.5 Extractants (methanol, acetone, etc.) | ₦400,000 |
| 2.6 Disinfectants & cleaning agents | ₦150,000 |
| 2.7 Laboratory glassware & consumables | ₦455,000 |
| 2.8 Beakers, test tubes, petri dishes, pipettes, filters | ₦235,000 |
| 2.9 Disposable gloves, masks, lab coats | ₦193,000 |
| **Subtotal:** | |
| | ₦2,818,000 |
| **3. Equipment & Instruments** | |
| 3.1 Rotary evaporator (if available) or alternative extraction equipment | ₦1,050,000 |
| 3.2 pH meter calibration solutions | ₦95,000 |
| 3.3 Viscosity meter, sensory evaluation tools | ₦330,000 |
| 3.4 Incubator, oven, or drying chamber | ₦550,000 |
| **Subtotal:** | **₦2,025,000** |
| | |
| | |
| **4. Laboratory & Facility Usage** | |
| 4.1 Laboratory space rental (if applicable) | ₦200,000 |
| 4.2 Utilities (electricity, water) | ₦200,000 |
| **Subtotal:** | **₦400,000** |
| | |
| **5. Analytical & Microbiological Testing** | |
| 5.1 Microbial culture media and supplies | ₦300,000 |
| 5.2 Antimicrobial testing kits | ₦550,000 |
| 5.3 External laboratory testing (if outsourced) | ₦350,000 |
| **Subtotal:** | **₦1,200,000** |
| | |
| **6. Data Analysis & Documentation** | |
| 6.1 Software licenses (SPSS, GraphPad, etc.) | ₦115,270 |

| | |
|---|---|
| 6.2 Printing and documentation | ₦105,000 |
| **Subtotal:** | **₦220,270** |
| | |
| **7. Miscellaneous & Contingency** | |
| 7.1 Transportation of samples | ₦241,581 |
| 7.2 Unexpected expenses (10% of total budget) | ₦322,109 |
| **Subtotal:** | **₦563,690** |
| | |
| **Total Estimated Budget:** | **₦9,663,270** |
| **VAT (7.5%)** | **₦767,022** |
| **Grand Total** | **₦10,993,982** |

**Estimated Time-frame**

| Activity | Month 1 | Month 2 | Month 3 | Month 4 | Month 5 | Month 6 |
|---|---|---|---|---|---|---|
| Literature review | X | | | | | |
| Plant collection/authentication | X | X | | | | |
| Extract preparation | | X | X | | | |
| Soap formulation | | | X | X | | |
| Antimicrobial testing | | | X | X | X | |
| Quality & stability testing | | | | X | X | |
| Data analysis | | | | | X | X |
| Final write–up | | | | | X | X |

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