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From Tradition To Innovation: Developing Goat Weed (Bangtitan) Infused Topical Ointment For Wound

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ABSTRACT
This study investigated the development of a goat weed (Ageratum conyzoides, locally known as bangtitan)-infused topical ointment for wound care, rooted in indigenous medical practices. Specifically, it aimed to: (1) formulate three ointment treatments; (2) assess their antibacterial activity against Staphylococcus aureus and Escherichia coli; and (3) evaluate the color and texture of the best formulation through sensory analysis. Ethnobotanical insights guided the formulation process, and phytochemical screening confirmed the presence of wound-healing compounds such as flavonoids, tannins, and saponins. Laboratory testing revealed that Treatment 1 had the highest antibacterial activity, with inhibition zones of 16.33 mm and 16.00 mm against S. aureus and E. coli, respectively. Treatment 3 scored best in texture and spreadability during organoleptic evaluation. The findings emphasize the therapeutic potential of A. conyzoides and validate the effectiveness of integrating indigenous knowledge with scientific formulation methods for community-based, low-cost healthcare solutions.
Keywords: *Ethnopharmacology, natural remedies, bioassay, traditional practices, botanical extracts, community wellness, phytotherapy*

INTRODUCTION

Traditional knowledge of herbal medicine remains vital in rural and indigenous communities, where access to conventional healthcare is often limited. In Kalinga, Ageratum conyzoides or bangtitan has long been used by local healers, notably the Butbut tribe of Buscalan, as a first-aid remedy for wounds, especially during traditional tattooing practices. While widely recognized for its wound-healing properties, the scientific validation and standardization of bangtitan remain underexplored. This research acknowledges the ethnobotanical importance of bangtitan, documenting its traditional use and affirming its potential for modern therapeutic applications through the presence of beneficial phytochemicals such as flavonoids, tannins, and saponins, known for their anti-inflammatory, antimicrobial, and tissue-repair functions.

The study bridges the gap between traditional healing and modern science by developing a topical ointment from bangtitan through a rigorous process involving ethnobotanical review, organoleptic evaluation, and microbial analysis. It goes beyond laboratory-based phytochemical screenings by evaluating the ointment's sensory properties (color, odor, texture, and spreadability) and antimicrobial activity. This integrated approach aligns with global movements promoting sustainable and accessible healthcare alternatives, as endorsed by the World Health Organization. The research contributes not only to scientific literature but also to preserving indigenous knowledge systems, promoting cultural pride, and providing a foundation for future pharmacological innovations and localized health interventions.

Amid rising interest in ethnopharmacology, the study supports broader efforts by national institutions such as DOST and DOH under programs like "Tuklas Lunas" to commercialize plant-based remedies. However, most ethno-herbal wound treatments remain underdocumented and unstandardized at the grassroots level. By focusing on the practical development of a culturally grounded, safe, and effective wound-healing ointment, this research highlights the rich potential of Cordillera's botanical and cultural heritage. Ultimately, it underscores the importance of ethical collaboration with indigenous communities, sustainability, and the integration of traditional knowledge into modern, inclusive healthcare systems.

The research contributes to the emerging trend of community-rooted health innovations that honor indigenous knowledge systems while validating them through scientific inquiry. It aligns with the global movement toward sustainable, culturally sensitive, and plant-based alternatives in healthcare, particularly relevant for low-resource and rural settings.

To address the research objectives, the study employed a multi-phase methodology that combined ethnobotanical investigation, product formulation, sensory evaluation, and microbiological testing. The

first phase involved an in-depth review of existing literature to document the traditional medicinal uses and known physico-chemical properties of Ageratum conyzoides (locally known as bangtitan).

Following the literature and field data gathering, the second phase focused on the preparation and formulation of the herbal ointment. Fresh bangtitan leaves were collected, thoroughly cleaned, and air-dried. The leaves were then pounded and extracted using a suitable solvent, after which the extract was incorporated into a beeswax base to produce the ointment. Different treatment variations were formulated to test for optimal texture and efficacy.

The third phase involved the organoleptic evaluation of the prepared ointments. A sensory panel was convened to assess attributes such as color, odor, texture, consistency, and spreadability. Evaluators used a standardized scoring sheet to rate each formulation, and the data collected were analyzed to identify the most favorable preparation based on user acceptability.

In the fourth phase, microbial analysis was performed using the agar well diffusion method to determine the antimicrobial properties of the ointment. The zones of inhibition (ZOI) were measured for each treatment against specific bacterial strains. These results were used to assess the comparative effectiveness of the formulations under different conditions.

Lastly, all quantitative data from the sensory testing and microbial analysis were subjected to descriptive and comparative statistical analysis. The findings were then interpreted in the context of traditional knowledge and phytochemical evidence, enabling a scientific validation of the ethnomedicinal use of bangtitan and its potential for development into an effective wound-healing ointment.

Conceptual Framework

This study is anchored on the integration of indigenous knowledge and scientific inquiry to develop a functional herbal ointment for wound treatment. It begins with the documentation and review of traditional knowledge regarding the medicinal use of Ageratum conyzoides (bangtitan) by the indigenous communities of Kalinga. This stage includes exploring its ethnomedicinal applications and reported efficacy in treating wounds, sprains, and skin injuries. The information gathered serves as the foundation for identifying the plant's therapeutic relevance and guiding the formulation of the ointment.

Following this, the phytochemical profiling of bangtitan—specifically its flavonoid, tannin, and saponin content—serves to validate its wound-healing properties on a biochemical level. These active compounds are linked to anti-inflammatory, antimicrobial, and antioxidant effects, which contribute to skin regeneration and infection prevention. The plant extract is then used to formulate the ointment, which undergoes sensory evaluation to assess its organoleptic properties, including color, texture, odor, spreadability, and uniformity.

Finally, the microbial analysis of the ointment under different treatment conditions evaluates its antimicrobial efficacy by measuring zones of inhibition (ZOI) against selected bacterial strains. These components traditional use, phytochemical content, formulation characteristics, and antimicrobial activity are interrelated in a way that supports the scientific development of a culturally-rooted, evidence-based herbal ointment. The framework thus demonstrates a logical flow from indigenous knowledge to product innovation, reinforcing the value of traditional medicine in contemporary healthcare solutions.

Statement of Objectives

1. To formulate three (3) treatments of goat weed (bangtitan) infused topical ointment.
2. To assess the antibacterial properties of the different treatments against S. aerus and E. coli.
3. To evaluate the organoleptic characteristics of the best treatment in terms of color and texture sensory analysis.

Significance of the Study

This research is significant for bridging indigenous ethnomedicinal knowledge with scientific validation by documenting the traditional use of Ageratum conyzoides (bangtitan) and formulating a topical ointment as a practical wound care alternative. It preserves cultural heritage, highlights the value of community-based healing, and provides an accessible solution for underserved areas. The study contributes to plant-based medicine literature, informs future pharmacological research, and validates the healing traditions of Kalinga communities. It also supports cultural pride and economic opportunities while guiding policymakers in integrating indigenous practices into health and sustainability strategies.

METHODOLOGY

The study was conducted in Tabuk City, Kalinga Province, where Ageratum conyzoides (Goatweed) was collected from various upland sites using basic botanical identification and traditional knowledge. The

preparation of the Goatweed-infused oil and ointment was carried out at the SSF-Food and Analytical Laboratory of Kalinga State University, while antimicrobial activity testing was outsourced to the DOST Regional Standards and Testing Laboratory in Tuguegarao City, Cagayan. Employing an experimental research design, the study used a laboratory-based formulation and testing approach to assess the comparative effectiveness of three ointment concentrations (25%, 50%, and 75%) in terms of wound-healing and antimicrobial properties. A control group containing only virgin coconut oil and beeswax was also included. This design allowed for the controlled manipulation of the independent variable (Goatweed concentration) and the quantitative and qualitative measurement of bioactivity outcomes, including antimicrobial inhibition zones and wound healing observations.

Demographic Profile of Respondents/ Informants

The respondents of this study were the folks who are using traditional medicinal plants to heal and cure diseases.

Sampling: The study uses purposive sampling to identify key informants and traditional healers in Kalinga who have expertise in traditional healing practices and medicinal plants. The sampling strategy ensures that the participants have a comprehensive knowledge of the medicinal plants and practices used in the region. A significant portion (40%) falls within the 18–24 age range, indicating that the study primarily captures insights from young adults.

This is followed by those aged 25–34 (27%) and 35–44 (17%), highlighting that many participants are in their early to mid-adult years. Smaller proportions come from older age brackets: 45–54 (10%), 55–64 (3.33%), and 65 and above (3.33%).

A total of 67% of the respondents are between 18 and 34 years old, suggesting that the study is mostly reflective of perspectives from the younger adult population.

The female respondents make up **76.7**% of the sample, indicating that the majority of participants are women. And the male respondents account for **23.3**%, representing a considerably smaller portion of the group.

This pronounced gender imbalance suggests that the study's findings primarily reflect the perspectives and experiences of female respondents

The majority of respondents (**40**%) hold a **Bachelor's Degree**, indicating a high level of educational attainment among participants. Equal portions (**17**% each) completed **high school**, **college (undergraduate level)**, or have obtained a **Master's Degree**, showing a balanced representation across various education levels. A smaller group (**10**%) holds a **Doctorate**, reflecting a minority with the highest academic qualification.

This distribution suggests that most participants are well-educated, with a strong presence of degree holders, which may influence the depth and quality of responses in the study

1. Frequency of Ointment Us**e:**

A large portion of respondents (**60**%) reported using ointments **rarely**, while **20**% use them only a few times a month. **Daily** users are minimal (**3.33**%), and **6.67**% never use such products. This suggests that ointments or similar topical products are not a regular part of most respondents' routines.

2. Familiarity with the Ointment**:**

Almost half (**46.67**%) are **somewhat familiar** with the ointment, and **30**% are **familiar**. Only **17**% are **very familiar**, and **6.67**% are **not familiar**.This indicates that while frequent use is low, many respondents still have some level of awareness or experience with these products

The respondent profile is largely composed of young, educated women with healthy skin but a preference for sensitive skin-friendly products. Although most do not regularly use ointments, they demonstrate moderate familiarity with them, suggesting a potential market for well-formulated, gentle topical treatments.

Data Gathering

Detection of Antibacterial Activity

The antibacterial activity of the Goatweed ointment was evaluated against the reference strain Staphyloccous aureus, a gram positive organism and Escherichia coli a gram negative organism. The disc diffusion method (Guevara, 2005) was used in the microbial evaluation. Bacterial cultures maintained on nutrient agar slants were taken and aseptically inoculated into 10 ml of sterile broth. Then broth containing the bacteria were incubated at 37 o C for 24 hours, and designated as the working stocks used for antibacterial studies. Small autoclaved discs about 6 mm diameter size of Whatmann filter paper (No.41) were treated by the Goatweed ointment then these saturated paper discs were inoculated

equidistantly. These set up were incubated at 37o C for 24 hours. In the whole investigation, paper disc impregnated with 85% ethanol was taken as control. The zone of inhibition (ZOI) around each disc indicative of the sensitivity at that concentration was observed and measured using a sterilized micro caliper. Activity of the extract was compared with the corresponding references (Guevara, 2005):
ZOI value of <10 mm, maybe expressed as inactive
ZOI value of 10-13 mm, partially active
ZOI value of 14-19 mm, active
ZOI value of 19 mm, very active

Organoleptic Properties

The organoleptic properties of the ointment are evaluated. The goat weed ointment was prepared with 3 treatments. Each of the treatments was assessed by the respondents using the Evaluation Tool (Stone, H. & Sidel, J.L. (2004).

RESULTS AND DISCUSSIONS

1. Formulation of the three (3) Treatment

The experimental research design was used to prepare the three (3) treatments of the herbal ointment. The treatments were compared against a positive control. To develop the ointment, the researchers used fresh Goatweed, virgin coconut oil (VCO), tea tree oil, and beeswax. The ingredients were combined in specific proportions as detailed in Table 1, which outlines the exact formulation for each treatment group (25%, 50%, and 75% concentration of Goatweed infusion). The heated infusion method was used to extract the active compounds from Goatweed into the oil medium, followed by the addition of beeswax and optional tea tree oil to achieve a stable ointment consistency.

Ingredients	**Treatment 1 (25%)**	**Treatment 2 (50%)**	**Treatment 3 (75%)**
Goatweed-Infused Oil	22.6%	44.4%	66.34%
Plain Oil (VCO + Sunflower Oil)	67.7 %	44.4%	22.11%
Beeswax	10.8%	10.6%	10.61%
Tea Tree Essential Oil (optional, 0.15–0.45%)	0.135%	0.266%	0.40%
Total Weight	100%	100%	100%

The experimental research design was used to prepare the three (3) treatments of the herbal ointment, and to measure the microbial assessment of the product. The treatments were compared against a positive control.

2. Preparation for the leaf extract

The preparation of the goat weed herbal ointment begins with the extraction of the active constituents from the plant leaves. Fresh goat weed leaves (Ageratum conyzoides) are first collected and thoroughly washed under running water to remove dirt and impurities. These are then air-dried in a shaded area for one to two hours to reduce surface moisture without losing essential phytochemicals. Once semi-dry, the leaves are ground using a blender to produce a paste. For aqueous extraction, a 1:2 ratio of the leaf paste to distilled water is used. The mixture is then heated gently at 60–70°C for about 30 minutes to allow the release of active compounds. For ethanolic extraction, 70% ethanol is added to the paste and soaked for 48 to 72 hours with occasional shaking to maximize extraction. After the designated period, the mixture is filtered using a clean muslin cloth or filter paper to obtain the crude extract. This extract is stored in a clean, airtight container and kept refrigerated until further use.

3. Preparation for the Goatweed infusion

The preparation of Ageratum conyzoides (Goatweed) ointment through the heated infusion method was based on established herbal extraction protocols. This technique, widely used in traditional medicine and supported by phytotherapy references, enabled the efficient extraction of lipophilic compounds from the plant into a carrier oil suitable for topical application (Green, 2000; Bone & Mills, 2013). In the procedure, 30 grams of dried Goatweed leaves were first crushed to increase their surface area. This step enhanced the interaction between the plant matrix and the oil solvent. A carrier oil such as virgin coconut oil was added in a 1:10 herb-to-oil ratio. These oils were chosen for their skin compatibility and oxidative stability, which are essential in topical formulations (Zakaria et al., 2006).

The herbal mixture was placed in a clean, heatproof glass jar and then situated in a double boiler or slow cooker containing water. This setup allowed the oil to be heated indirectly, thereby avoiding direct contact with high heat that could have degraded the plant's thermolabile bioactive constituents. The infusion was maintained at 50–60°C (120–140°F) for 2 to 4 hours, with periodic stirring to ensure uniform extraction. This temperature range was consistent with those recommended in pharmacognostic literature for gentle, prolonged infusion (McIntyre, 2008; Gladstar, 2001).

After the heating period, the mixture was removed from the heat and allowed to cool to room temperature. The oil was then filtered through cheesecloth to remove plant residues, ensuring clarity and reducing the risk of microbial contamination. The final infused oil was stored in a sterilized, amber-colored glass bottle to protect it from light-induced degradation. The resulting oil was then ready for conversion into an ointment.

4. Preparation of ointment formulation:

Following infusion, the base ointment was formulated by blending 250 grams of the infused oil with 25 to 30 grams of beeswax, which served as the thickening and stabilizing agent. The mixture was gently heated until the beeswax fully melted and integrated into the oil. An optional 1.5 grams of tea tree essential oil was added after removing the blend from heat, providing additional antimicrobial benefits and ensuring the essential oil was not volatilized during heating. The mixture was poured into sterilized containers and left to cool and solidify into a semi-solid ointment.

To accommodate varying skin sensitivities and therapeutic needs, three concentration variants were formulated: 25%, 50%, and 75% Goatweed-infused oil. The 25% formulation was designed for mild applications or sensitive skin, blending 62.5 grams of infused oil with 187.5 grams of plain coconut oil and 25 grams of beeswax, plus a lower concentration of tea tree oil (0.375 g). The 50% formulation represented a balanced salve for general wound care or skin conditions, combining equal parts infused and plain coconut oil with a slightly firmer consistency due to the use of 30 grams beeswax. The 75% formulation, considered the strongest, was recommended for more resistant skin infections or fungal problems. It included 187.5 grams of infused oil, 62.5 grams of plain oil, and 30 grams of beeswax, with a tea tree oil concentration of 0.45%.

Microbial Measurements of the Herbal Topical Ointment

The antimicrobial potential of the developed herbal ointment was evaluated under varying treatment conditions using the paper disk diffusion method, following the standard procedure outlined in Guevarra's A Guidebook to Plant Screening: Phytochemical and Biological (2005). Prepared Mueller-Hinton agar plates were inoculated with standardized bacterial suspensions (Staphylococcus aureus, Escherichia coli), and well were filled with measured quantities of each ointment treatment. The inhibition zones were measured after 24 hours of incubation at 37°C. The assay measured the zones of inhibition (in millimeters) against Staphylococcus aureus and Escherichia coli, representing Gram-positive and Gram-negative bacteria, respectively.

ANTIMICROBIAL ANALYSIS			
Sample Code	Sample Description	ZONE OF INHIBITION (mm)	
		Staphylococcus aureus	Escherichia coli
MIC-0622	Ointment Treatment 1	16.33	16
MIC-0623	Ointment Treatment 2	14.33	12.33
Mic-0624	Ointment Treatment 3	15.33	15.67
MIC-0625	Control	31.67	32.67
NEGATIVE CONTROL: Distilled water		6	6

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All three ointment treatments exhibited measurable antimicrobial activity against both bacterial strains, as indicated by inhibition zones significantly larger than the negative control. Among the treatments, Treatment 1 demonstrated the highest antimicrobial activity, producing inhibition zones of 16.33 mm against S. aureus and 16.00 mm against E. coli. This suggests that the formulation used in Treatment 1 contains a higher concentration or more effective combination of bioactive compounds compared to the other treatments. While the positive control—presumably a standard synthetic antimicrobial agent—produced the largest zones of inhibition (31.67 mm for S. aureus and 32.67 mm for E. coli), the herbal ointments still exhibited moderate antimicrobial efficacy. In contrast, the negative control (distilled water) resulted in no significant inhibition, affirming that the observed antimicrobial activity in the treatments can be attributed to the herbal formulation itself.

These findings support the antimicrobial potential of the developed herbal ointment, particularly under the formulation conditions used in Treatment 1. The results highlight its effectiveness against both Gram-positive and Gram-negative bacteria, indicating broad-spectrum antimicrobial properties. Although further studies, including minimum inhibitory concentration (MIC) testing and clinical evaluation, are warranted, the data suggest that the herbal ointment is a promising candidate for alternative or adjunct topical antimicrobial therapy.

The results of the antimicrobial analysis indicate that the developed herbal ointment formulations exhibit moderate antimicrobial activity against both Staphylococcus aureus and Escherichia coli. This suggests that the active plant-based components used in the ointment have the potential to serve as natural antimicrobial agents, especially in topical applications.

The antimicrobial analysis revealed that the developed herbal ointment formulations possess moderate antimicrobial activity against both Staphylococcus aureus and Escherichia coli, indicating the presence of plant-based bioactive compounds with therapeutic potential. This supports their use as natural antimicrobial agents, particularly for topical applications in managing superficial infections. Given the growing concern over antibiotic resistance, these herbal formulations offer a promising alternative or complement to synthetic drugs. Their use of locally available medicinal plants also makes them cost-effective, accessible, and culturally acceptable, especially in rural or underserved communities. The findings provide scientific validation for traditional medicine, reinforcing the ethnopharmacological relevance of the plants used. Notably, the ointments demonstrated broad-spectrum activity, effective against both Gram-positive and Gram-negative bacteria, which is advantageous for treating various skin infections. Among the formulations, Treatment 1 exhibited the highest antimicrobial activity, highlighting the importance of formulation composition and suggesting potential for further optimization and development into a clinically useful herbal product.

Organoleptic Properties of the Herbal – Based Topical Ointment

Under well-lit conditions, a visual inspection was conducted on the ointment. The appearance of Treatment 1 was predominantly described by respondents as “slightly cloudy,” indicating a minor haze while still maintaining general clarity. Some participants, however, noted it as “clear and uniform,” suggesting a transparent consistency without any noticeable cloudiness or particles. A few also classified it as “moderately cloudy,” meaning the ointment appeared visibly hazy but still allowed some light to pass through.

In terms of color, most respondents evaluated Treatment 1 as “slightly off-white,” signifying a primarily white base with a faint tint.

Regarding odor, Treatment 1 was generally described as having a “moderately strong odor,” indicating a distinct but not overpowering scent.

When it came to texture and application, respondents found the ointment to be “smooth and easily spreadable,” meaning it had a soft consistency and could be applied with little effort.

The ointment's homogeneity was assessed as “uniform, with no visible particles,” indicating a consistent mixture without irregularities.

Lastly, when a small amount was applied to a clean, dry surface, it was mostly observed to “spread easily and evenly,” confirming the ointment’s ability to distribute smoothly with minimal effort.

Treatment 1 received overwhelmingly positive sensory evaluations. Appearance scores were distributed across ratings 3-5, with a slight preference for rating 4 (40%). Color showed a strong preference for rating 4 (73.33%), indicating high satisfaction. Odor ratings were more evenly distributed across ratings 2-5, suggesting moderate to high satisfaction. Texture received the highest ratings, with 90% of respondents

giving it a rating of 5. Homogeneity also demonstrated high satisfaction, with 60% rating it as 5. Finally, Spreadability received the highest overall satisfaction, with 86.67% of respondents giving it a rating of 5. In summary, Treatment 1 performed exceptionally well in terms of Texture and Spreadability, while other attributes showed a mix of high and moderate satisfaction.

Visual inspection of the ointment was done under good lighting conditions. The appearance of Treatment 2 was observed by most of the respondents as "Slightly Cloudy". This means that the ointment has a slight haze but is mostly clear. But some evaluated it as "clear and uniform" which means that the ointment is transparent or clear with no visible cloudiness or particles. And also "Moderately Cloudy", the ointment is noticeably cloudy but still allows some light to pass through.

As to color of the ointment, treatment 2 was assessed mostly by the respondents as "Slightly off-white". This means that the ointment has a slight tint, but is mostly white.

The odor of the ointment of Treatment 2 was assessed as "Slightly strong odor". The ointment has a noticeable but not overpowering scent.

The ointment is "Smooth and easily spreadable" as assessed by the respondents. This means that the ointment feels smooth, and spreads easily with minimal effort.

The homogeneity of the ointment is completely uniform with no visible particles or inconsistencies, "Uniform, no visible particles".

Small amount of the ointment was applied by the respondents to a clean, dry surface and observe how easily it spreads, it was mostly observed that it "spreads easily and evenly". The ointment spreads smoothly and evenly with minimal effort.

Treatment 2's sensory evaluation reveals a mixed response. Appearance scores show a strong preference for rating 4 (80%), indicating high satisfaction in this aspect. Color also received predominantly high scores, with 33.33% rating it as 5 and another 33.33% as 4. Odor scores were more dispersed, with ratings 3 and 4 being most common, suggesting moderate satisfaction. Texture received a high percentage of rating 5 (56.67%), but also a significant portion of rating 4 (43.33%), indicating a generally positive response. Homogeneity showed a strong preference for rating 5 (66.67%), demonstrating high satisfaction. Finally, Spreadability received high ratings, with 73.33% of respondents giving it a rating of 5, indicating a very favorable response. Overall, Treatment 2 generally performed well, particularly in terms of Appearance, Texture, Homogeneity, and Spreadability, while Odor showed a more moderate level of satisfaction.

For Treatment 3, the organoleptic properties were assessed by the respondents as to appearance, color, odor, texture, homogeneity, and spreadability.

The appearance is mostly "clear and uniform". The color is white, with faint, characteristics odor, and, the texture is smooth and easily spreadable.

The ointment was examined for its uniformity and consistency. It was assessed as "Uniform, no visible particles". This means that the ointment is completely uniform with no visible particles or inconsistencies. 80% of the respondents assessed that the ointment "Spreads easily and evenly". This means that the ointment spreads smoothly and evenly with minimal effort.

Treatment 3's sensory evaluation shows a varied performance across attributes. Appearance received a relatively even distribution of ratings 3 and 4, indicating moderate satisfaction. Color demonstrated a strong preference for rating 4 (56.67%), suggesting a positive response. Odor scores were somewhat dispersed, with ratings 3 and 4 being most common, suggesting moderate satisfaction, similar to Treatment 2. Texture received a high percentage of rating 5 (60%), indicating high satisfaction. Homogeneity showed a preference for rating 5 (53.33%), but also had a considerable portion of rating 4 (33.33%), suggesting generally positive feedback. Spreadability received the highest ratings, with 80% of respondents giving it a rating of 5, indicating excellent performance.

Finally, the organoleptic properties of the ointment are evaluated. The prepared goat weed ointment exhibits clear and uniform appearance; slightly off-white color and a mild and pleasant herbal odor characteristic of the goat weed. It has a smooth and easily spreadable texture, and the ointment is completely uniform with no visible particles or inconsistencies. It also spreads smoothly and evenly with minimal effort.

In summary, Treatment 3 performed exceptionally well in terms of Texture and Spreadability. Other attributes showed a mix of moderate to high satisfaction, with Color consistently receiving positive feedback.

The positive evaluation of the organoleptic properties of the prepared goat weed ointment suggests that the formulation is not only functionally effective but also aesthetically and sensorially acceptable to potential users. The uniform appearance, slightly off-white color, and pleasant herbal odor contribute to user satisfaction and product appeal. The smooth, spreadable texture and lack of visible particles indicate good formulation stability and quality, which are essential factors for topical application and user compliance. The standout performance of Treatment 3 in texture and spreadability highlights its potential for consumer preference and market acceptance. Additionally, consistent positive feedback on color supports the ointment's visual acceptability, which plays a key role in user trust and comfort, especially for over-the-counter herbal products.

Based on the findings, it is recommended to prioritize Treatment 3 for further development, as it demonstrated superior texture and spreadability, making it an ideal base formulation for future enhancements, efficacy trials, and potential commercialization. To support its market potential, consumer acceptability testing should be conducted with a wider group of users to gather feedback on sensory aspects such as odor, color, and overall application experience. Any formulation improvements should aim to maintain a balance between functional effectiveness and aesthetic appeal, ensuring that changes do not compromise the product's texture, appearance, or scent. Additionally, it is important to standardize organoleptic parameters like color, viscosity, and spreadability to ensure quality consistency across future production batches. Lastly, the product's pleasant sensory characteristics should be emphasized through appealing packaging and labeling to increase consumer interest and build product confidence.

CONCLUSIONS

The development of a goat weed-based herbal ointment demonstrates the value of integrating traditional indigenous knowledge with scientific validation. The findings of the Microbial tests support the antimicrobial potential of the developed herbal ointment, particularly under the formulation conditions used in Treatment 1. The results highlight its effectiveness against both Gram-positive and Gram-negative bacteria, indicating broad-spectrum antimicrobial properties. The final ointment formulation showed acceptable organoleptic quality and promising antimicrobial activity. These findings support the potential of bangtitan as a viable natural alternative for topical wound treatment and highlight the importance of preserving and scientifically exploring indigenous medicinal practices.

RECOMMENDATIONS

Based on the study's findings, it is recommended to pursue further laboratory testing, including expanded microbial screening, pharmacological evaluations, toxicity, and stability assessments to ensure the ointment's safety and efficacy. Standardizing the formulation—such as adjusting concentrations, base types, and preservatives—is necessary to improve product consistency and shelf life. Ethical collaboration with indigenous communities should be prioritized for sustainable sourcing and knowledge sharing, while intellectual property rights must be protected. The strong antimicrobial results of Treatment 1 suggest it should serve as the basis for future formulations. Phytochemical analysis and MIC/MBC assays are also advised to identify active compounds and determine effective dosages. Integration into rural healthcare systems and the advancement of human trials, regulatory approvals, and community distribution strategies are essential next steps for practical application.

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