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Preliminary Formulation, Physical Characterization, and User Evaluation of Ginger, Blumea (Sambong) Peppermint and Turmeric (GIBPET) Herbal Liniment Oil for Gout-Associated Discomfort

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ABSTRACT: This study investigated the preliminary formulation, physical characteristics, and user acceptability of GIBPET Herbal Liniment Oil as a topical complementary preparation for gout-associated discomfort. The formulation contained ginger (*Zingiber officinale*), sambong (*Blumea balsamifera*), turmeric (*Curcuma longa*), peppermint (*Mentha piperita*), and virgin coconut oil (VCO) as the carrier. A developmental-experimental design incorporating descriptive user evaluation was employed, involving 30 adults from Tubay, Agusan del Norte, Philippines. Participants applied the liniment to the affected skin areas two to three times daily for seven consecutive days. Changes in pain intensity, swelling or discomfort, and joint stiffness were assessed using a 0–10 numerical rating scale, while product acceptability was evaluated using a four-point Likert scale. The results showed reductions in pain intensity (from 6.47 to 4.93), swelling or discomfort (from 5.87 to 4.51), and joint stiffness (from 5.43 to 4.32). Overall acceptability was rated as very acceptable (M = 3.56, SD = 0.48), with satisfaction receiving the highest mean score (M = 3.61). Regarding skin reactions, 90.0% of participants reported no adverse reactions, while 6.7% and 3.3% experienced mild redness and itching, respectively. These findings suggested favorable preliminary acceptability and short-term skin tolerability, accompanied by improvements in self-reported discomfort. However, the absence of a control group and the short observation period limited conclusions regarding therapeutic effectiveness and long-term safety. GIBPET Herbal Liniment Oil was not established as a treatment or cure for gout. Further controlled studies with larger sample sizes and extended safety evaluations were recommended.

KEYWORDS: Acceptability; botanical formulation; gout-associated discomfort; herbal liniment oil; physical characterization; skin tolerability.

1. Introduction

Gout is a common inflammatory form of arthritis characterized by the deposition of monosodium urate crystals in and around the joints, resulting in sudden pain, swelling, warmth,

tenderness, and restricted movement. The American College of Rheumatology recommends appropriate urate-lowering therapy for eligible patients, while acute gout flares are commonly managed using colchicine, nonsteroidal anti-inflammatory drugs, or glucocorticoids [1]. Supportive interventions, including topical ice application, may provide additional relief from discomfort but should not replace established medical treatments [3]. Despite the availability of effective pharmacological interventions, managing gout-associated discomfort remains an important concern, highlighting the potential value of complementary approaches that may improve patient comfort without replacing conventional therapy.

Topical herbal liniments have attracted interest as complementary preparations because of their potential to provide localized cooling, soothing sensations, and temporary relief from discomfort. These preparations typically contain plant-derived compounds incorporated into suitable carriers for external application. Menthol, a major constituent of peppermint, activates transient receptor potential melastatin 8 (TRPM8) receptors involved in cold sensation and pain perception [4,5]. However, the sensory effects of topical preparations do not necessarily indicate anti-inflammatory or disease-modifying activity. Furthermore, topical liniments have not been established as effective interventions for lowering serum uric acid, dissolving monosodium urate crystals, or preventing recurrent gout attacks. Therefore, their development requires careful formulation, physical characterization, and preliminary safety assessment before any therapeutic claims can be considered.

GIBPET Herbal Liniment Oil was developed by combining ginger (*Zingiber officinale*), sambong (*Blumea balsamifera*), turmeric (*Curcuma longa*), peppermint (*Mentha piperita*), and virgin coconut oil (VCO). These ingredients were selected based on their traditional applications, reported phytochemical properties, and potential contributions to topical formulation characteristics. Ginger and turmeric have been investigated for their pain- and inflammation-related properties, while sambong contains various biologically active phytochemicals. Peppermint contributes menthol-associated cooling sensations, whereas VCO functions as an oil-based carrier. Nevertheless, the reported properties of individual ingredients do not necessarily establish the effectiveness, safety, or potential synergistic effects of their combined formulation.

Ginger has traditionally been used to manage pain and inflammatory conditions. Terry et al. [4] reported preliminary evidence suggesting that ginger preparations could reduce pain in certain conditions, although the available evidence was insufficient to establish definitive clinical efficacy. Similarly, investigations involving topical ginger preparations have produced inconsistent findings, with some comparisons demonstrating no significant therapeutic advantages [6]. These findings suggest potential applications for ginger-derived compounds but do not establish their effectiveness in managing gout-associated discomfort when incorporated into a topical herbal liniment.

Turmeric has received considerable scientific attention because of curcumin and other bioactive compounds associated with potential anti-inflammatory properties. Bartels et al. [7] reviewed 29 randomized controlled trials involving 2,396 participants and reported improvements in selected pain and inflammatory outcomes among individuals with arthritis. However, differences in formulation composition, administration routes, treatment duration, and clinical conditions limit the direct applicability of these findings to topical preparations intended for gout-associated discomfort. Consequently, the inclusion of turmeric in GIBPET

requires formulation-specific evaluation rather than reliance on previously reported outcomes from different preparations.

Sambong was incorporated because of its traditional medicinal applications and diverse phytochemical composition, including essential oils, flavonoids, and terpenoids [8]. Previous experimental investigations have reported antioxidant and anti-inflammatory activities associated with sambong-derived compounds. However, these findings have not established the clinical effectiveness of topical sambong preparations in humans. Furthermore, its traditional use as a diuretic does not demonstrate that topical application promotes uric acid excretion or reduces serum uric acid concentrations. Its potential contribution to GIBPET therefore requires further investigation.

Peppermint was included primarily because of its menthol content, which activates TRPM8 receptors and produces a cooling sensation that may influence perceived discomfort [9]. This sensory response may improve the user experience of topical preparations, although its intensity and tolerability depend on ingredient concentration and formulation characteristics. Nevertheless, the presence of menthol does not establish therapeutic effectiveness against gout-related inflammation or its underlying causes.

VCO was selected as the carrier because of its suitability for oil-based topical formulations and its reported skin-conditioning properties. Pergolizzi [10] described improvements in skin hydration and surface lipid levels under the investigated conditions. These findings provide a rationale for considering VCO in topical preparations but do not establish its therapeutic effectiveness against gout or guarantee the safety of the final formulation. Its suitability as a carrier must therefore be evaluated through physical characterization, including consistency, homogeneity, spreadability, and stability.

Although previous studies have investigated the individual properties of ginger, sambong, turmeric, peppermint, and VCO, limited evidence is available regarding their combined formulation as a topical herbal liniment for gout-associated discomfort**.** Existing research has primarily examined individual plant extracts, different formulations, or administration routes that may not directly reflect the characteristics of GIBPET Herbal Liniment Oil. Moreover, the physical stability, user acceptability, short-term skin tolerability, and exploratory changes in self-reported discomfort associated with this specific formulation have not been adequately established. This knowledge gap highlights the need for preliminary formulation development and systematic evaluation before more extensive experimental or clinical investigations are undertaken.

The novelty of this study lies in the preliminary development and integrated evaluation of GIBPET Herbal Liniment Oil, combining five selected ingredients in a single topical preparation. Rather than focusing exclusively on the reported biological properties of individual ingredients, the study evaluated the formulation's physical characteristics, preliminary stability, user acceptability, and observable skin reactions. It also examined short-term changes in self-reported gout-associated discomfort as exploratory outcomes. This integrated approach provided initial formulation-specific evidence to guide product refinement and future controlled investigations. However, the study was not designed to establish therapeutic efficacy, ingredient synergy, or disease-modifying effects.

Accordingly, this study aimed to formulate and preliminarily evaluate GIBPET Herbal Liniment Oil containing ginger, sambong, turmeric, peppermint, and VCO as a topical complementary preparation for gout-associated discomfort. Specifically, the study sought to (i)

characterize the formulation's appearance, color, odor, homogeneity, consistency, spreadability, and observable phase separation or sedimentation; (ii) evaluate its preliminary physical stability during the designated observation period; (iii) assess user acceptability regarding appearance, odor, texture, ease of application, packaging, and overall satisfaction; (iv) document observable skin reactions and other reported safety concerns; and (v) examine exploratory changes in self-reported pain intensity, swelling or discomfort, and joint stiffness following short-term application. The findings were intended to provide preliminary evidence for formulation improvement and future research rather than establish GIBPET as a treatment or cure for gout. Appropriate evidence-based medical management remains essential [1,2].

2. Materials and Methods

2.1. Research Design.

This study employed a developmental-experimental research design incorporating descriptive user evaluation to develop and preliminarily assess GIBPET Herbal Liniment Oil as a topical complementary formulation for gout-associated discomfort. The developmental component focused on selecting herbal ingredients, developing the formulation, preparing and packaging the product, and evaluating its physical and quality characteristics. The experimental component involved assessing changes in participants' self-reported discomfort before and after a seven-day application period using a single-group pretest–posttest approach. Meanwhile, the descriptive component evaluated product acceptability and documented reported skin reactions and other safety-related observations.

The research was conducted in four major phases, comprising formulation development, physical characterization and preliminary stability assessment, participant evaluation through pretest–posttest measurements, and statistical analysis and interpretation of the collected data. The product development process was guided by the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) framework. The analysis phase involved identifying the formulation requirements and selecting appropriate herbal ingredients, while the design and development phases focused on determining ingredient proportions and preparing the herbal liniment. The implementation phase involved product application and participant evaluation, whereas the evaluation phase assessed physical characteristics, preliminary stability, user acceptability, and self-reported outcomes. The study was conducted as a preliminary product-development investigation incorporating an uncontrolled, single-group pretest–posttest evaluation rather than a controlled clinical efficacy trial. Consequently, changes in participants' reported discomfort were considered exploratory findings and were not interpreted as conclusive evidence of therapeutic effectiveness or the ability of the formulation to treat gout.

2.2. Materials and Formulation.

GIBPET Herbal Liniment Oil was formulated using four herbal ingredients: ginger (Zingiber officinale), sambong (Blumea balsamifera), turmeric (Curcuma longa), and peppermint (Mentha piperita), with virgin coconut oil (VCO) serving as the carrier oil. Peppermint essential oil was additionally incorporated to enhance the formulation's aromatic and cooling characteristics. The ingredients were selected based on their traditional applications, reported phytochemical properties, and intended functions within the topical preparation. Fresh herbal materials were collected, sorted, and prepared before undergoing the infusion process.

Botanical identification and authentication were performed to verify the plant species used in the formulation. The ingredient quantities and their respective functions are presented in Table 1. The formulation contained 200 g of ginger, 200 g of sambong, 150 g of turmeric, and 50 g of peppermint leaves, representing a total of 600 g of herbal materials. These ingredients were infused in 1,000 mL of VCO, which served as the primary carrier oil. An additional 10 mL of peppermint essential oil was incorporated after the infusion process to provide aromatic and cooling properties. The formulation proportions were maintained consistently throughout the preparation procedure.

Table 1. Formulation of GIBPET Herbal Liniment Oil.

Ingredients	Quantity	Purpose
Ginger (Zingiber officinale)	200 g	Herbal ingredient
Sambong (Blumea balsamifera)	200 g	Herbal ingredient
Turmeric (Curcuma longa)	150 g	Herbal ingredient
Peppermint (Mentha piperita) leaves	50 g	Aromatic and cooling ingredient
Virgin coconut oil (VCO)	1,000 mL	Carrier oil
Peppermint essential oil	10 mL	Additional aromatic and cooling component
Total herbal materials	**600 g**	—

The preparation process required a digital weighing scale, digital thermometer, stainless-steel knife, cutting board, stainless-steel pot or beaker, stirring rod or spatula, cheesecloth, funnel, amber glass bottles with a capacity of 100 mL each, and product labels. These materials and equipment were used to measure, prepare, infuse, filter, transfer, and package the herbal formulation. The equipment was cleaned before use to minimize contamination and maintain consistency during product preparation.

2.3. Preparation Procedures.

The preparation of GIBPET Herbal Liniment Oil followed a systematic procedure involving the collection, selection, cleaning, drying, cutting, weighing, infusion, filtration, decanting, packaging, and storage of the herbal materials. Fresh ginger, sambong leaves, turmeric, and peppermint leaves were collected from available sources in Tubay, Agusan del Norte, Philippines. The collected materials were inspected, and plant portions showing visible signs of mold, decay, severe bruising, or deterioration were discarded to maintain the quality of the raw ingredients.

The selected herbal materials were sorted to remove soil, foreign particles, damaged portions, and other visible contaminants. They were subsequently washed thoroughly under running water and allowed to drain. Following washing, the materials were shade-dried in a clean preparation area for approximately 12–24 h to reduce surface moisture. Direct sunlight exposure was avoided during drying to minimize potential deterioration of light-sensitive constituents.

After drying, the ginger and turmeric rhizomes were sliced into smaller pieces, while the sambong and peppermint leaves were cut into manageable portions to increase their contact surface area with the carrier oil. The prepared materials were weighed using a digital weighing scale according to the formulation quantities presented in Table 1. The measured ingredients consisted of 200 g of ginger, 200 g of sambong, 150 g of turmeric, and 50 g of peppermint leaves.

The prepared herbal materials were transferred into a stainless-steel container containing 1,000 mL of VCO. The mixture was heated at approximately 40–60 °C for 3–4 h using a warm-infusion procedure. During heating, the mixture was stirred periodically to facilitate contact between the herbal materials and the carrier oil. The temperature was monitored using a digital thermometer to maintain the designated infusion range throughout the preparation process.

Following infusion, the mixture was filtered through clean cheesecloth to separate the infused oil from the remaining solid plant materials. The filtered oil was subsequently allowed to stand undisturbed for approximately 12 h to facilitate the sedimentation of fine suspended particles. After settling, the clearer upper portion of the infused oil was carefully decanted into a clean container, leaving the settled residues behind.

The decanted oil was allowed to cool before 10 mL of peppermint essential oil was added. The mixture was stirred to promote uniform distribution of the essential oil throughout the formulation. The finished GIBPET Herbal Liniment Oil was then transferred into clean amber glass bottles, each with a capacity of 100 mL. The bottles were labeled with the product name, preparation date, batch identification, storage instructions, and the statement "For External Use Only."

The packaged formulation was stored in a cool, dry environment away from direct sunlight until physical quality assessment, preliminary stability observation, and participant evaluation were conducted. Amber glass bottles were used to minimize light exposure during storage. As illustrated in Figure 1, the preparation process consisted of nine sequential stages: collection and selection of herbal materials, sorting and washing, air-drying, cutting and weighing, warm infusion, filtration and settling, decanting and cooling, bottling and labeling, and storage. These procedures were followed to ensure consistent preparation and handling of the herbal formulation before subsequent quality assessments.

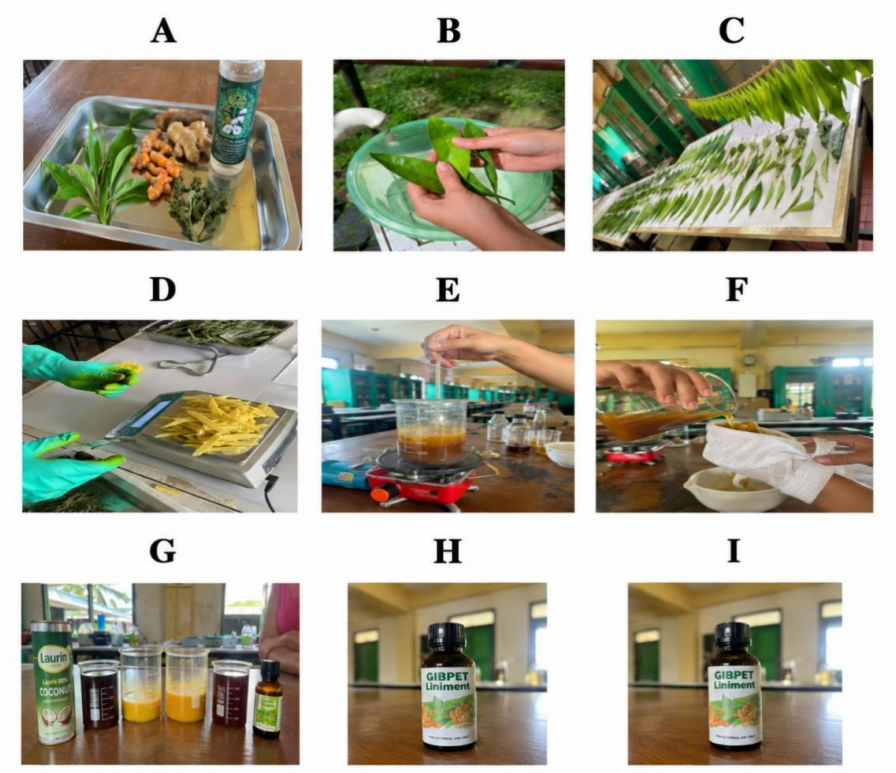

Figure 1. Preparation of GIBPET Herbal Liniment Oil: (A) Collection and Selection of Herbs; (B) Sorting and Washing; (C) Air-Drying; (D) Cutting and Weighing; (E) Warm Infusion; (F) Filtration and settling; (G) decanting and cooling; (H) bottling and labeling; and (I) storage.

2.4. Quality Assessment.

GIBPET Herbal Liniment Oil underwent physical quality assessment to evaluate its appearance, color, odor, homogeneity, consistency, viscosity, spreadability, phase separation, and sedimentation. Appearance and color were assessed through visual observation, while odor was evaluated based on the characteristic herbal and peppermint aroma. Homogeneity was determined by examining the uniformity of the formulation, whereas consistency and viscosity were assessed based on its thickness and flow characteristics. Spreadability was evaluated by observing how easily the oil could be distributed over a surface. Visible phase separation and sedimentation were also recorded. Preliminary stability was evaluated over 30 days, with observations conducted on Days 0, 7, 14, 21, and 30. Changes in appearance, color, odor, homogeneity, viscosity, phase separation, and sedimentation were monitored to assess physical stability during storage. The assessment was limited to observable physical characteristics and did not include chemical, phytochemical, or microbiological analyses.

2.5. Participant Evaluation.

The evaluation involved 30 adults from Tubay, Agusan del Norte, Philippines, who reported gout-associated discomfort or a previous physician diagnosis of gout. Participants were recruited based on their eligibility, willingness to participate, and availability for the seven-day evaluation. The study procedures, potential risks, and participant rights were explained before written informed consent was obtained. Participation was voluntary, and participants could withdraw at any time without penalty. Eligibility was determined through information on gout history, previous medical diagnoses, and current symptoms. Where available and with participant consent, physician-diagnosed gout was verified using medical records, consultation documents, or prescriptions. Participants without supporting medical documentation were classified as having self-reported gout-associated symptoms. No independent clinical diagnosis was performed by the researchers. Eligible participants were adults aged 18 years or older who experienced gout-associated discomfort or reported a previous gout diagnosis and had suitable intact skin for topical application. Individuals with known allergies to the formulation ingredients, open wounds, active skin infections, existing irritation, or other conditions that could make topical application inappropriate were excluded.

A researcher-developed questionnaire was used to collect demographic information, gout-related history, baseline and post-application discomfort scores, product acceptability ratings, reported skin reactions, and participant feedback. Pain intensity, swelling or discomfort, and joint stiffness were assessed using a 0–10 numerical rating scale, where 0 indicated no discomfort and 10 represented the highest level of discomfort. Existing medications and other gout-related treatments were also documented to identify factors that could influence symptom changes. Following the baseline assessment, participants applied GIBPET Herbal Liniment Oil to the affected external skin areas two to three times daily for seven consecutive days. They were instructed to apply the product to clean, dry, intact skin and avoid contact with the eyes, mouth, mucous membranes, wounds, and infected areas. Participants were advised to discontinue application if persistent irritation, itching, redness, burning, or other adverse reactions occurred. They were also instructed to wash their hands after application unless the hands were the intended treatment area.

During the evaluation period, participants monitored changes in discomfort and skin condition. Concurrent medication use and changes in treatment were recorded because these factors could influence the observed outcomes. Participants were not instructed to discontinue or modify prescribed medications during the study. After seven days, participants completed the post-application assessment using the same numerical rating scale. Pretest and posttest scores were compared to examine changes in pain intensity, swelling or discomfort, and joint stiffness. Product acceptability was evaluated using a four-point Likert scale covering appearance, odor, texture, ease of application, packaging, and overall satisfaction. As presented in Table 2, mean scores were classified as highly acceptable (3.26–4.00), acceptable (2.51–3.25), less acceptable (1.76–2.50), or not acceptable (1.00–1.75).

Table 2. Four-point Likert Scale for Product Acceptability.

Scale	Mean range	Verbal interpretation
4	3.26–4.00	Highly Acceptable
3	2.51–3.25	Acceptable
2	1.76–2.50	Less Acceptable
1	1.00–1.75	Not Acceptable

Participants also reported skin reactions, including redness, itching, burning, swelling, rash, and blistering. The frequency, severity, and actions taken were documented. Participants experiencing persistent or worsening reactions were advised to discontinue application and seek medical assessment. Feedback regarding the product's sensory characteristics and overall usability was collected to identify potential formulation improvements. The evaluation provided preliminary information on product acceptability, short-term skin tolerability, and changes in self-reported discomfort. However, the absence of a control group and the seven-day observation period limited conclusions regarding therapeutic effectiveness and long-term safety. Changes in symptoms could also have been influenced by concurrent medication, natural symptom variation, daily activities, and participant expectations.

2.6. Ethical Considerations.

The study followed ethical principles for research involving human participants. Before participation, individuals received information about the study objectives, procedures, potential risks, expected benefits, confidentiality, and their right to withdraw without penalty. Written informed consent was obtained before data collection and product evaluation. Participant confidentiality was maintained by replacing personal identifiers with identification codes. All collected information was treated confidentially and used exclusively for research purposes. Participants were informed that GIBPET Herbal Liniment Oil was an investigational complementary preparation and should not replace prescribed medications or established gout treatment. Participants were instructed to discontinue application if significant skin irritation or other concerning reactions occurred and to seek medical attention when necessary. Reported adverse reactions were monitored throughout the seven-day evaluation period.

2.7 Statistical Analysis.

Data from the physical quality assessment, participant evaluation, and pretest–posttest measurements were analyzed using descriptive and inferential statistics. Frequencies and

percentages were calculated to summarize participant characteristics, previous experience with topical liniments, and reported skin reactions. Means and standard deviations were used to describe product acceptability ratings and discomfort scores. Paired-samples t-tests were employed to examine differences between pretest and posttest scores for pain intensity, swelling or discomfort, and joint stiffness. The mean differences were reported with 95% confidence intervals, while Cohen's \(d_z\)). was calculated to determine the magnitude of the observed changes. Statistical significance was established at $p < 0.05$. All findings were interpreted cautiously because the single-group pretest–posttest design did not allow causal conclusions regarding the effectiveness of the formulation.

3. Results and Discussion

3.1. Characteristics of the Participants.

The study involved 30 adults who reported a previous gout diagnosis or gout-associated symptoms. Their demographic characteristics, symptom duration, and previous use of topical liniments are presented in Table 3. Most participants were aged 40–59 years (63.3%), and males accounted for 70.0% of the sample. The largest age group was 50–59 years (33.3%), followed by 40–49 years (30.0%). Regarding symptom duration, 30.0% reported experiencing symptoms for 1–3 years, while 53.4% reported symptoms lasting more than three years.

Table 3. Profile of the Participants.

Variable	Category	Frequency	Percentage (%)
Age	30–39 years	6	20.0
	40–49 years	9	30.0
	50–59 years	10	33.3
	≥60 years	5	16.7
Sex	Male	21	70.0
	Female	9	30.0
Duration of gout-associated symptoms	Less than 1 year	5	16.7
	1–3 years	9	30.0
	4–6 years	8	26.7
	More than 6 years	8	26.7
Previous use of liniment	Yes	26	86.7
	No	4	13.3
Total participants		**30**	**100.0**

The predominance of middle-aged and older male participants was consistent with epidemiological studies reporting a higher prevalence of gout among males and older adults [1,8]. However, the sample was not representative of the broader population with gout, particularly because some participants had self-reported symptoms without a clinically confirmed diagnosis. Previous liniment use was also common (86.7%), suggesting familiarity with topical preparations. Such experience may have influenced participants' expectations and product evaluations, as treatment beliefs can affect perceived pain and reported outcomes [13]. These characteristics should be considered when interpreting the findings because joint pain, swelling, and stiffness may arise from conditions other than gout. Furthermore, established gout management includes appropriate urate-lowering therapy and medications for acute flares, while topical preparations may serve only as supportive interventions [2]. Future investigations

should prioritize clinically confirmed diagnoses and document concurrent medication use to improve the reliability of outcome interpretation.

3.2. Development of GIBPET Herbal Liniment Oil.

GIBPET Herbal Liniment Oil was developed using ginger (*Zingiber officinale*), sambong (*Blumea balsamifera*), turmeric (*Curcuma longa*), peppermint (*Mentha piperita*), and virgin coconut oil (VCO). The ingredient quantities and formulation roles are presented in Table 4. The formulation contained 600 g of herbal materials infused in 1,000 mL of VCO, with an additional 10 mL of peppermint essential oil incorporated after cooling.

Table 4. Final formulation of GIBPET Herbal Liniment Oil.

Ingredient	Quantity	Formulation role
Ginger (*Zingiber officinale*)	200 g	Botanical ingredient
Sambong (*Blumea balsamifera*)	200 g	Botanical ingredient
Turmeric (*Curcuma longa*)	150 g	Botanical ingredient
Peppermint (*Mentha piperita*)	50 g	Botanical ingredient
Virgin coconut oil	1,000 mL	Carrier oil
Peppermint essential oil	10 mL	Aromatic and cooling component
Total herbal materials	**600 g**	Botanical fraction

Ginger was selected because its bioactive compounds, particularly gingerols, have been investigated for potential anti-inflammatory and pain-related effects. However, previous reviews reported limited and inconsistent clinical evidence, particularly regarding topical applications [4,14,15]. Turmeric was included because curcumin and related compounds have demonstrated potential benefits in certain inflammatory and musculoskeletal conditions, although findings from oral preparations cannot be directly applied to topical formulations [9]. Sambong was incorporated based on its traditional applications and reported antioxidant and anti-inflammatory properties, but further pharmacological evaluation and standardization remain necessary [8]. Peppermint contributed aromatic and cooling properties through menthol, which activates transient receptor potential melastatin 8 (TRPM8) receptors involved in cold sensation and pain perception [16]. VCO served as the carrier and skin-conditioning component, supported by previous evidence of its moisturizing properties [12]. Nevertheless, the reported properties of individual ingredients did not establish their effectiveness or synergistic activity in the combined formulation. The herbal materials were infused in VCO at approximately 40–60 °C for 3–4 h, followed by filtration, settling, decanting, cooling, and packaging. Although this procedure produced the intended oil preparation, the concentrations of gingerols, curcuminoids, menthol, and other marker compounds were not measured. Consequently, extraction efficiency, phytochemical consistency, and potential interactions among ingredients remained undetermined. Further chemical characterization and formulation standardization are required before stronger claims regarding biological activity can be considered.

3.3. Physical and Quality Characteristics of the Developed Formulation.

The physical characteristics of GIBPET Herbal Liniment Oil were evaluated through appearance, color, odor, homogeneity, viscosity, spreadability, phase separation, and sedimentation. As presented in Table 5, the formulation exhibited a clear to slightly cloudy appearance, yellowish-brown color, characteristic herbal-peppermint aroma, and homogeneous

consistency. No visible phase separation was observed, while sedimentation remained minimal. The formulation's appearance and odor were consistent with its botanical composition, while the measured viscosity of approximately 42 cP and spreadability of 6.80 cm suggested favorable handling and application characteristics. These properties are important because physical uniformity, viscosity, and spreadability influence topical product performance and user experience [17,18,21]. However, the presence of VCO may contribute to a greasy sensation, potentially affecting user preference and repeated application [22,23]. Although the physical characteristics were generally favorable, visual observations alone could not establish chemical stability or confirm the concentration of active constituents [20]. Standardized rheological measurements, controlled spreadability testing, and additional quality assessments would provide more reliable information regarding formulation consistency and performance [24–26].

Table 5. Physical and Quality Characteristics of GIBPET Herbal Liniment Oil.

Parameter	Actual result	Interpretation
Appearance	Clear to slightly cloudy oil	Acceptable visual clarity
Color	Yellowish-brown	Consistent with botanical infusion
Odor	Herbal with peppermint aroma	Characteristic aromatic profile
Homogeneity	Homogeneous	No visible nonuniformity
Viscosity	Approximately 42 cP	Suitable for topical spreading
Spreadability	Approximately 6.80 cm	Easy topical spreading
Phase separation	None observed	No visible separation
Sedimentation	Minimal	Limited particulate settling

3.4. Stability of the Developed Formulation.

The preliminary stability of GIBPET Herbal Liniment Oil was monitored over 30 days. Table 6 presents change in its physical characteristics at five observation points. The formulation remained homogeneous without visible phase separation, while sedimentation was consistently minimal. Slight darkening and reduced aromatic intensity were observed during storage, accompanied by an increase in viscosity from 42 to 44 cP.

Table 6. Stability Characteristics During the Observation Period.

Parameter	Day 0	Day 7	Day 14	Day 21	Day 30
Appearance	Clear/slightly cloudy	Unchanged	Unchanged	Slightly darker	Slightly darker
Color	Yellowish-brown	Unchanged	Slight darkening	Slight darkening	Moderate slight darkening
Odor	Herbal/peppermint	Unchanged	Unchanged	Slightly reduced	Slightly reduced
Homogeneity	Homogeneous	Homogeneous	Homogeneous	Homogeneous	Homogeneous
Phase separation	None	None	None	None	None
Sedimentation	Minimal	Minimal	Minimal	Minimal	Minimal
Viscosity (cP)	42	42	43	43	44

The absence of visible separation indicated that the formulation maintained its physical uniformity during the observation period. However, gradual color changes may have resulted from pigment alterations or oxidation of susceptible constituents, although the underlying mechanisms could not be confirmed without chemical analysis [30]. Changes in viscosity may also influence spreading and product handling, emphasizing the importance of standardized measurements under controlled conditions [29]. Storage conditions and packaging can influence the stability of botanical preparations through exposure to temperature, light, oxygen, and moisture [27,28]. Amber glass bottles were used to reduce light exposure, consistent with

general stability considerations for pharmaceutical preparations [34]. Nevertheless, the 30-day observations were insufficient to establish product shelf life. Longer-term studies involving multiple batches, controlled storage conditions, and chemical and microbiological assessments are required [35–38].

3.5. Pretest and Posttest Pain Intensity.

Pain intensity was evaluated before and after the seven-day application period using a numerical rating scale. As shown in Table 7, the mean score decreased from 6.47 to 4.93, representing a reduction of 1.54 points. The difference was statistically significant (p<0.001), with a 95% confidence interval of 1.20–1.88 and an effect size of 1.12. The observed reduction indicated an improvement in self-reported pain during the evaluation period. Ginger-derived compounds have previously been investigated for their potential pain-related properties, although clinical evidence remains limited, particularly for topical preparations [4,39]. Peppermint may also have influenced perceived comfort through menthol-mediated activation of TRPM8 receptors, which produce cooling sensations and modulate pain perception [40]. However, these mechanisms were not directly examined in the present study. The findings differed from studies involving isolated botanical extracts because GIBPET combined several ingredients in an oil-based preparation. Nevertheless, the contribution of individual components could not be determined. Natural symptom fluctuations, concurrent medication, physical activity, and participant expectations may also have influenced the results [41]. Therefore, the statistically significant reduction should be interpreted as an observed change in self-reported pain rather than evidence of a direct therapeutic effect.

Table 7. Pretest and Posttest Pain Intensity.

Measure	Pretest M	Posttest M	Mean difference	95% CI	p-value	Effect size	Decision
Pain intensity	6.47	4.93	1.54	1.20–1.88	<<0.001	1.12	Reject H_0

3.6. Pretest and Posttest Swelling/Discomfort.

Changes in swelling or discomfort were assessed using the same numerical rating scale. Table 8 shows that the mean score decreased from 5.87 to 4.51, with a mean difference of 1.36 points. The reduction was statistically significant ($p < 0.001$), with a 95% confidence interval of 0.98–1.74 and an effect size of 0.91. The reduction suggested that participants experienced less perceived swelling-related discomfort following the application period. Previous studies have investigated the potential anti-inflammatory properties of ginger, turmeric, and sambong [4,7,8]. However, findings involving isolated compounds or oral administration cannot establish comparable effects when these ingredients are incorporated into a topical oil. Their biological activity may depend on concentration, extraction efficiency, formulation stability, and skin penetration. Importantly, the assessment relied on self-reported symptoms rather than objective measurements of joint inflammation. Therefore, the results did not confirm reductions in physical swelling, serum uric acid, or monosodium urate deposits. Sambong's reported pharmacological properties, including those associated with oral administration, should not be interpreted as evidence of urate-lowering effects following topical application [8]. Future investigations should incorporate objective joint measurements and appropriate clinical assessments to distinguish perceived discomfort from measurable inflammatory changes.

Table 8. Pretest and Posttest Swelling/Discomfort.

Measure	Pretest M	Posttest M	Mean difference	95% CI	p-value	Effect size	Decision
Swelling/discomfort	5.87	4.51	1.36	0.98–1.74	<>0.001	0.91	Reject H_0

3.7. Pretest and Posttest Joint Stiffness.

Joint stiffness was assessed before and after the seven-day application period. As presented in Table 9, the mean score decreased from 5.43 to 4.32, representing a reduction of 1.11 points. The difference was statistically significant ($p < 0.001$), with a 95% confidence interval of 0.69–1.53 and an effect size of 0.78. Joint stiffness exhibited a smaller numerical reduction than pain intensity and swelling/discomfort. This difference may reflect the distinct factors influencing perceived stiffness, including inflammation, restricted movement, symptom duration, and joint condition. Although menthol-associated cooling and ginger-derived compounds may influence perceived comfort, previous studies have not established that these ingredients directly improve joint mobility when applied in the present formulation [12,13,32]. The findings represented changes in perceived stiffness rather than objectively measured improvements in joint function [2]. Future studies should include range-of-motion assessments, functional mobility measurements, and longer observation periods to determine whether reported improvements correspond to measurable changes in joint performance.

Table 9. Pretest and posttest joint stiffness.

Measure	Pretest M	Posttest M	Mean difference	95% CI	p-value	Effect size	Decision
Joint stiffness	5.43	4.32	1.11	0.69–1.53	< 0.001	0.78	Reject H_0

3.8. Overall Pretest–Posttest Outcomes.

The combined pretest–posttest results are presented in Table 10. All three indicators showed statistically significant reductions ($p < 0.001$). Pain intensity exhibited the largest mean reduction (1.54 points), followed by swelling/discomfort (1.36 points) and joint stiffness (1.11 points). The corresponding effect sizes were 1.12, 0.91, and 0.78, respectively.

Table 10. Overall Pretest–Posttest Outcomes.

Outcome	Pretest M	Posttest M	Difference	p-value	Effect size	Interpretation
Pain intensity	6.47	4.93	1.54	< 0.001	1.12	Large reduction
Swelling/discomfort	5.87	4.51	1.36	< 0.001	0.91	Large reduction
Joint stiffness	5.43	4.32	1.11	< 0.001	0.78	Moderate-to-large reduction

The greater reduction in pain intensity may have reflected changes in sensory perception, potentially associated with menthol-mediated cooling and the reported pain-related properties of ginger [4,12,13,39,40]. Meanwhile, the smaller changes in swelling/discomfort and joint stiffness suggested that participants experienced different degrees of improvement across the assessed symptoms. Although ginger, turmeric, and sambong have been investigated for inflammation-related activities, their contribution to these outcomes remained uncertain [4,7,8]. Despite the statistically significant differences, the uncontrolled study design prevented causal attribution to GIBPET. Natural symptom improvement, concurrent medication, changes in daily activities, and participant expectations may have contributed to the observed reductions [19,26,41]. Furthermore, current gout management guidelines emphasize appropriate anti-inflammatory treatment and urate-lowering therapy when indicated [2,5]. Consequently, the formulation should not be considered a substitute for established medical treatment. Controlled

investigations involving clinically confirmed gout, standardized assessments, and appropriate comparator formulations are necessary to evaluate its potential complementary role.

3.9. Acceptability of GIBPET Herbal Liniment Oil.

Product acceptability was assessed through appearance, odor, texture, and overall satisfaction. As presented in Table 11, the formulation obtained an overall mean score of 3.56 (SD = 0.48), indicating favorable participant acceptance. Overall satisfaction received the highest rating (M = 3.61), followed by appearance (M = 3.60), texture (M = 3.54), and odor (M = 3.48). The favorable appearance rating suggested that participants appreciated the formulation's color, clarity, and presentation. These characteristics are important because visual uniformity and the absence of undesirable separation can influence perceptions of product quality. However, appearance alone cannot establish formulation stability or chemical consistency. Odor received the lowest rating, potentially reflecting individual preferences regarding the combined herbal and peppermint aroma. Sensory characteristics, particularly fragrance, can influence the acceptance and repeated use of topical preparations [38]. Adjusting peppermint concentration or botanical proportions may improve fragrance balance, although such modifications would require additional skin compatibility and stability assessments. Texture also received a favorable rating, although the oil-based formulation may have produced a slightly greasy sensation. Carrier oils can influence spreadability, skin feel, and residual film formation, affecting user preferences [16]. Alternative carrier ratios or delivery approaches could be investigated to improve application characteristics without compromising formulation stability. The high overall satisfaction rating indicated that participants generally accepted the product's physical and sensory characteristics. However, favorable acceptability ratings should not be interpreted as evidence of therapeutic effectiveness. Future formulation development should prioritize improvements in odor and texture while maintaining consistent physical quality, ingredient distribution, and skin compatibility [11].

Table 11. Acceptability of GIBPET Herbal Liniment Oil.

Indicator	Mean	SD	Interpretation
Appearance	3.60	0.47	Very Acceptable
Odor	3.48	0.49	Acceptable
Texture	3.54	0.48	Acceptable
Overall satisfaction	3.61	0.47	Very Acceptable
Overall	**3.56**	**0.48**	**Very Acceptable**

3.10. Safety and Adverse Skin Reactions.

Short-term skin tolerability was evaluated by recording adverse reactions during the seven-day application period. As presented in Table 12, 27 participants (90.0%) reported no noticeable skin reactions, while two participants (6.7%) experienced mild redness and one participant (3.3%) reported mild itching. No burning, swelling, or other reactions were recorded. The reported redness and itching indicated that some participants experienced localized skin responses. Such reactions may arise from irritation or individual sensitivity to botanical ingredients, essential oils, or carrier components. Their occurrence can depend on ingredient concentration, exposure duration, application frequency, and individual skin characteristics [1,6,8,20]. Peppermint essential oil requires particular attention because menthol-containing topical preparations may produce irritation or stinging in susceptible individuals [9,13].

However, the observed reactions could not be attributed to a specific ingredient without controlled dermatological assessment. Furthermore, irritant and allergic contact dermatitis may present similar symptoms but involve different mechanisms, making clinical evaluation necessary when reactions persist or worsen. Although most participants reported no adverse reactions, the small sample size and short observation period limited the assessment of uncommon, delayed, or cumulative skin responses. The findings therefore provided preliminary information on short-term tolerability rather than comprehensive evidence of product safety. Further investigations should incorporate standardized irritation and sensitization assessments, longer monitoring periods, and evaluation of ingredient concentrations before wider product application is considered [1,6,8,20].

Table 12. Observed Skin Reactions During Product Use.

Reaction	Frequency	Percentage (%)	Severity	Action taken
Redness	2	6.7	Mild	Monitored; application temporarily discontinued if needed
Itching	1	3.3	Mild	Monitored
Burning	0	0.0	None observed	None
Swelling	0	0.0	None observed	None
Other	0	0.0	None observed	None
No skin reaction	27	90.0	None	Continued monitoring

4. Conclusions

This study successfully developed and preliminarily evaluated GIBPET Herbal Liniment Oil containing ginger, sambong, turmeric, peppermint, and virgin coconut oil as a topical complementary preparation for gout-associated discomfort. The formulation exhibited favorable physical characteristics, including homogeneity, a viscosity of approximately 42 cP, and spreadability of 6.80 cm. During the 30-day stability assessment, no visible phase separation occurred, although slight changes in color, odor, and viscosity were observed. These findings indicated preliminary physical stability under the investigated storage conditions. Following seven days of application, participants reported significant reductions in pain intensity (6.47 to 4.93), swelling/discomfort (5.87 to 4.51), and joint stiffness (5.43 to 4.32), with all differences statistically significant ($p < 0.001$). The formulation also demonstrated favorable user acceptability (M = 3.56, SD = 0.48), with overall satisfaction receiving the highest rating (M = 3.61). Regarding short-term tolerability, 90.0% of participants reported no skin reactions, while 6.7% experienced mild redness and 3.3% reported itching. Despite these encouraging preliminary findings, the small sample size, absence of a control group, reliance on self-reported outcomes, and short evaluation period prevented conclusions regarding therapeutic effectiveness and long-term safety. Future research should prioritize formulation standardization, phytochemical characterization, extended stability testing, dermatological safety assessments, and randomized controlled studies involving participants with clinically confirmed gout. GIBPET should therefore remain an investigational complementary preparation rather than an established gout treatment.

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Competing Interest

The author declares that there are no competing interests associated with this research or its publication.

Author Contribution

The author solely conceptualized, designed, and conducted the study. The author developed the research methodology, prepared and processed the materials, implemented the experimental procedures, collected and analyzed the data, interpreted the findings, and prepared the manuscript. The author also reviewed and finalized the manuscript and assumes full responsibility for the integrity, accuracy, and overall content of the research.

Data Availability Statement

The data used in this study may be requested from the corresponding author for reasonable purposes.

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Artificial Intelligence (AI) Declaration

The authors used AI-assisted tools to improve the grammar, clarity, and readability of the manuscript. However, the authors reviewed and checked all scientific content, data analysis, interpretations, and conclusions. The authors are fully responsible for the accuracy and integrity of the manuscript.

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