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FORMULATION AND EVALUATION OF THE EFFECTIVENESS AND STABILITY OF OINTMENT AND CREAM PREPARATIONS CONTAINING KELADI TIKUS EXTRACT (*Typhonium flagelliforme*) FOR TOPICAL USE

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ABSTRACT

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Keladi tikus (Typhonium flagelliforme) is a medicinal plant with potential as an active ingredient in topical pharmaceutical preparations. This study aimed to formulate and evaluate the physical characteristics and stability of ointment and cream preparations containing keladi tikus extract. The study used an experimental method, in which keladi tikus leaves were extracted by maceration using 96% ethanol. The extract was formulated into ointment and cream preparations at concentrations of 2%, 4%, and 6%. The formulations were evaluated for organoleptic properties, homogeneity, pH, spreadability, adhesion, and physical stability during storage. The results showed that all formulations exhibited good organoleptic characteristics and homogeneous preparations. Cream spreadability ranged from 6.2–7.1 cm, while ointment spreadability ranged from 5.3–6.1 cm. Ointments demonstrated greater adhesion than creams, with values of 6.3–7.2 seconds and 4.8–5.6 seconds, respectively. During storage, all formulations maintained relatively good physical stability without significant changes in color, odor, consistency, or homogeneity. The 4% extract cream showed the most favorable characteristics, with a pH of 5.5, spreadability of 6.8 ± 0.3 cm, and adhesion of 5.2 ± 0.3 seconds. These findings indicate that keladi tikus extract has potential for development as an active ingredient in topical cream preparations.

Keywords: Keladi tikus, cream, *Typhonium flagelliforme*, ointment, topical preparation.

INTRODUCTION

The use of plants as sources of medicinal substances has long been an important part of traditional medicine and continues to develop alongside the growing interest in natural products. Medicinal plants contain various secondary metabolites that may exhibit biological and pharmacological activities, making them increasingly valuable for pharmaceutical applications (Erdayani et al., 2023). The development of natural products is not limited to the use of crude extracts but also involves their incorporation into pharmaceutical dosage forms that are practical, convenient to use, and possess appropriate physical characteristics. One medicinal plant with potential for development as a source of active ingredients in topical preparations is keladi tikus (*Typhonium flagelliforme*) (Sianipar et al., 2016).

Keladi tikus (*Typhonium flagelliforme*) is a medicinal plant that has traditionally been used and is known to contain various secondary metabolites. The leaves of keladi tikus have been reported to contain bioactive compounds, including flavonoids, phenolic

compounds, alkaloids, tannins, and other groups of phytochemicals that may contribute to biological activity. These constituents indicate that keladi tikus has potential to be developed as a natural source of active pharmaceutical ingredients. Incorporating keladi tikus leaf extract into topical preparations may provide a practical approach to utilizing natural products while allowing the active constituents to be applied directly to the skin. However, the direct application of plant extracts to the skin has several limitations, including inconvenience, reduced application comfort, and difficulty in maintaining optimal contact between the active constituents and the skin surface (Mirgane et al., 2021). Although previous studies have reported the phytochemical composition and pharmacological potential of *Typhonium flagelliforme*, research on its topical formulation remains limited. In particular, comparative studies evaluating ointment and cream formulations containing different concentrations of *T. flagelliforme* extract are scarce. Previous research has primarily focused on the plant's phytochemical constituents and biological activities, highlighting the need for further formulation studies (Maha et al., 2023).

Therefore, this study aims to address this research gap by developing and comparatively evaluating ointment and cream formulations containing different concentrations of *T. flagelliforme* extract, with a focus on their physical characteristics and stability. This comparative approach is expected to provide new insights into the influence of dosage form and extract concentration on formulation quality and support the selection of suitable topical preparations for further development. In particular, the effects of extract concentration on key physical properties, such as homogeneity, pH, spreadability, and adhesion, as well as the stability of these formulations during storage, remain insufficiently investigated. Therefore, further research is needed to determine an appropriate topical formulation and extract concentration that can provide favorable physical characteristics and maintain stability during storage. In addition, crude extracts may not possess suitable physical characteristics for topical application and may undergo changes during storage. Therefore, the incorporation of keladi tikus leaf extract into semisolid dosage forms, particularly creams and ointments, was selected to improve ease of application, enhance contact and retention of the extract on the skin surface, and maintain the physical characteristics and stability of the preparations during storage (Sandriya et al., 2021). Cream and ointment formulations were specifically compared because they provide different semisolid characteristics that may influence spreadability, adhesion, and user comfort. Furthermore, extract concentrations of 2%, 4%, and 6% were selected to evaluate the effect of increasing extract concentration on the physical properties and stability of the formulations and to identify a concentration that provides an appropriate balance between extract content and desirable formulation characteristics.

Topical preparations are dosage forms applied directly to the skin surface to produce a local effect. Ointments and creams are commonly used semisolid dosage forms for delivering active ingredients through the skin (Putra et al., 2020). Ointments generally have a thicker consistency and greater occlusive properties, allowing them to adhere well to the skin and maintain contact with the skin surface for a relatively longer period. In

contrast, creams have a lighter texture and are generally easier to spread over the skin, providing greater comfort and convenience during application. Differences in the characteristics of these bases may affect the physical properties, spreadability, adhesion, and stability of preparations containing keladi tikus leaf extract (*Typhonium flagelliforme*) (Priosoeryanto et al., 2020).

The quality of topical preparations should be determined through various evaluation parameters to ensure that the resulting formulations meet the expected characteristics. Organoleptic evaluation is performed to assess the color, odor, appearance, and consistency of the preparations. Homogeneity testing aims to ensure that the extract is uniformly distributed throughout the base, resulting in a relatively consistent composition in each portion of the preparation. pH is also an important parameter because preparations with pH values that are excessively low or high compared with the physiological condition of the skin may cause discomfort or irritation (Crystalia & Hillary, 2022). In addition, spreadability is evaluated to determine the ability of the preparation to spread across the skin surface, while adhesion testing assesses the ability of the preparation to maintain contact with the skin. Stability evaluation is conducted to determine the ability of the preparations to maintain their physical characteristics during storage (Siswanto et al., 2022).

In this study, keladi tikus leaf extract (*Typhonium flagelliforme*) was developed into two semisolid dosage forms, namely ointments and creams, with extract concentrations of 2%, 4%, and 6% (Maha et al., 2023). The use of different extract concentrations was intended to investigate the effect of increasing extract concentration on the physical characteristics of each preparation. Both dosage forms were subsequently evaluated and compared based on organoleptic properties, homogeneity, pH, spreadability, adhesion, and physical stability during storage (Ng et al., 2023). The comparison is expected to provide information regarding the most appropriate dosage form for the development of keladi tikus leaf extract as an active ingredient in topical preparations.

Based on the aforementioned considerations, further research on the development and evaluation of ointment and cream preparations containing keladi tikus leaf extract (*Typhonium flagelliforme*) is warranted. This study aimed to formulate and comparatively evaluate ointment and cream preparations containing different concentrations of *Typhonium flagelliforme* extract by assessing their physical characteristics and stability to determine the dosage form and extract concentration that exhibited the most favorable formulation properties (Erdayani et al., 2024). The findings are also expected to serve as preliminary information for the development of keladi tikus as a natural-based active ingredient in topical preparations that are practical, stable, and comfortable for application to the skin (Harlina et al., 2024).

RESEARCH METHOD

Collection and Preparation of Crude Drug Material

Keladi tikus leaves (*Typhonium flagelliforme*) used in this study were selected based on their good physical condition, with no signs of damage, fungal growth, or

contamination, and were free from visible dirt and other foreign materials. The collected leaves were subjected to initial sorting to remove plant materials that did not meet the predetermined criteria.

The selected leaves were then washed thoroughly under running water to remove adhering dirt and impurities from the surface. After washing, the leaves were cut into smaller pieces to facilitate the drying process and promote more uniform moisture removal. The plant material was dried in a drying oven at 40 °C for 48 hours until it reached a sufficiently dry condition and a constant weight was obtained before further processing. The drying process was performed to minimize the degradation of active compounds that may occur due to exposure to excessively high temperatures (Meher et al., 2025). The dried crude drug material was subjected to a second sorting process to ensure its quality before grinding. The dried leaves were then ground into a powder of suitable particle size. The powdered keladi tikus leaves were stored in a tightly closed container and protected from moisture and direct light until further use for the extraction process.

Extraction Process

Extraction of the powdered keladi tikus leaves (*Typhonium flagelliforme*) was performed using the maceration method with 96% ethanol as the extraction solvent. A total of 800 g of powdered crude drug material was placed in a maceration container, followed by the addition of 1,000 mL of 96% ethanol. The mixture was macerated for 72h at room temperature (25–30°C) in a tightly closed container and stirred every 8 h to improve contact between the plant powder and the solvent, thereby facilitating the extraction of bioactive compounds (Khan et al., 2025). After maceration, the mixture was filtered to separate the filtrate from the plant residue. The residue was then remacerated twice using fresh 96% ethanol, with each remaceration performed for 24h under the same conditions. All filtrates were combined and concentrated using a rotary evaporator at 40–50°C under reduced pressure until most of the solvent had evaporated. The concentrated extract was subsequently heated in a water bath at approximately 40–50°C to remove residual solvent and obtain a thick extract. The final extract was weighed, and the percentage yield was calculated by dividing the weight of the concentrated extract by the initial weight of the powdered crude drug material and multiplying by 100%.

The resulting concentrated keladi tikus leaf extract was weighed and evaluated for its organoleptic characteristics, including color, odor, and physical form or consistency. The extraction yield was determined by comparing the weight of the concentrated extract with the initial weight of the powdered crude drug material. The extraction yield was calculated using the following formula:

Extraction Yield (%) = (Weight of Concentrated Extract / Initial Weight of Crude Drug Powder) × 100%

For example, if 80 g of concentrated extract is obtained from 800 g of powdered crude drug material, the extraction yield is calculated as follows:

Extraction Yield (%) = $(80 \text{ g} / 800 \text{ g}) \times 100\% = 10\%$

Formulation of Ointment and Cream Preparations

The concentrated keladi tikus leaf extract (*Typhonium flagelliforme*) obtained from the extraction process was subsequently used as the active ingredient in the preparation of ointment and cream formulations. Each dosage form was prepared using three different extract concentrations, namely 2%, 4%, and 6%. These variations in extract concentration were applied to determine the effect of increasing extract concentration on the physical characteristics and stability of the formulations (Sianipar et al., 2025). Variations in extract concentration show in Table 1.

Table 1. Variations in Extract Concentration

Formula	Dosage Form	Extract Concentration
S1	ointment	2%
S2	ointment	4%
S3	ointment	6%
K1	Cream	2%
K2	Cream	4%
K3	Cream	6%

The ointment and cream bases were first prepared according to the predetermined formulations. The concentrated keladi tikus leaf extract (*Typhonium flagelliforme*) was then gradually incorporated into each respective base while continuously stirring until the extract was uniformly dispersed and thoroughly mixed. Once homogeneous preparations were obtained, each formulation was transferred into clean, tightly closed containers and appropriately labeled according to the dosage form and extract concentration (Lee et al., 2026).

Preparation of Ointment Formulations

The preparation of the ointment formulations began with the preparation of the ointment base according to the predetermined formula. Each ingredient was accurately weighed according to the required amount and gradually melted using the fusion method at an appropriate temperature until all components were completely incorporated and a homogeneous mass was obtained. The prepared base was then allowed to cool while being gently stirred until the desired consistency was achieved (Simões et al., 2018).

The concentrated keladi tikus leaf extract (*Typhonium flagelliforme*) was subsequently incorporated gradually into the ointment base. The mixture was triturated using a mortar and pestle until the extract was evenly distributed throughout the base. Mixing was continued until a homogeneous ointment with an appropriate consistency was obtained (Shaikh et al., 2018).

The finished ointment was transferred into clean, tightly closed ointment containers and labeled according to the extract concentration. The same procedure was applied to formulations S1, S2, and S3, containing 2%, 4%, and 6% keladi tikus leaf extract,

respectively.

Preparation of Cream Formulations

The cream formulations were prepared by separately preparing the oil and aqueous phases according to the predetermined formulation. Each phase was heated separately at an appropriate temperature until the respective ingredients were completely dissolved and uniformly mixed (Sandokar et al., 2019).

Once both phases reached the appropriate temperature and condition, the aqueous phase was gradually incorporated into the oil phase with continuous stirring until a homogeneous cream emulsion was formed. The concentrated keladi tikus leaf extract (*Typhonium flagelliforme*) was then gradually added to the cream base while continuously stirring to ensure uniform dispersion of the extract throughout the formulation (Bhawar et al., 2019).

After a cream with the desired consistency was obtained, the preparation was allowed to cool to room temperature. The cream was then transferred into clean, tightly closed containers and labeled according to the respective formulation. The same procedure was applied to formulations K1, K2, and K3, containing 2%, 4%, and 6% keladi tikus leaf extract, respectively.

Organoleptic Evaluation

Organoleptic evaluation was conducted by directly observing the physical characteristics of the ointment and cream preparations containing keladi tikus leaf extract (*Typhonium flagelliforme*). The parameters assessed included appearance, color, odor, texture, and consistency of each formulation.

This evaluation was performed to determine the initial physical characteristics of the preparations and to monitor potential changes during storage. Observations included changes in color or odor, alterations in consistency, phase separation in the cream formulations, and any visible signs of microbial growth. Any changes observed were recorded and compared among the ointment and cream formulations at each extract concentration.

Homogeneity Test

The homogeneity test was performed by placing an appropriate amount of ointment and cream samples onto a glass slide and spreading them into a thin, even layer. The samples were then examined visually to assess the uniformity of mixing and to identify any coarse particles, lumps, agglomerates, or portions of the preparation that had not been adequately incorporated.

The preparation was considered homogeneous when all components were uniformly distributed, no coarse particles or lumps were observed, and the keladi tikus leaf extract was evenly dispersed throughout the formulation base.

pH Test

The pH of the ointment and cream preparations containing keladi tikus leaf extract was determined using a previously calibrated pH meter to ensure measurement accuracy. The samples were prepared according to the applicable measurement procedure, and the pH electrode was immersed in the sample or its appropriate dispersion. The measurement was continued until a stable reading was obtained. The pH values of each formulation were recorded and compared. This test was conducted to assess the compatibility of the preparations with the physiological pH of the skin, thereby ensuring user comfort and minimizing the potential risk of skin irritation.

Spreadability Test

The spreadability test was performed to determine the ability of the ointment and cream preparations containing keladi tikus leaf extract to spread evenly over the skin surface. A predetermined amount of sample was placed at the center of a flat glass plate and covered with another glass plate. The initial diameter of the spread preparation was measured before applying an external load.

Loads of 50 g and 100 g were subsequently applied in stages. After each load had been applied for a predetermined period, the diameter of the spread preparation was measured using an appropriate measuring instrument. The test was performed for all ointment and cream formulations, and the results were recorded in centimeters.

The spreading diameter was used as an indicator of the formulation's ability to be evenly distributed over the skin surface. A greater spreading area under a given load indicated better spreadability, while the consistency and specific characteristics of each dosage form were also taken into consideration.

Adhesion Test

The adhesion test was conducted to determine the ability of the ointment and cream preparations to maintain contact with the skin surface. A predetermined amount of sample was placed between two glass slides, and pressure was applied using a specified load. After the predetermined contact time, the load was removed, and the time required for the two glass slides to separate was measured using a stopwatch. The test was performed for each formulation with the same number of repetitions. The results were then calculated to obtain the mean adhesion time. A longer separation time indicated stronger adhesion and a greater ability of the preparation to maintain contact with the surface.

Physical Stability Test

The physical stability test was conducted to evaluate the ability of the ointment and cream preparations containing keladi tikus leaf extract to maintain their quality and physical characteristics throughout the storage period. Each formulation was stored in tightly closed containers under the predetermined storage conditions specified in the research design.

The formulations were evaluated periodically, for example, on days 0, 7, 14, and 21, or according to the observation period established in the study. The parameters evaluated included color, odor, appearance or consistency, homogeneity, pH, spreadability, adhesion, and any visible signs of microbial growth. A preparation was considered to have good physical stability when no significant changes in its physical characteristics were observed throughout the storage period and the evaluated parameters remained within acceptable limits. The results were subsequently compared among the formulations to assess changes occurring during storage.

Data Analysis

The data obtained from the evaluation of the physical characteristics and stability of the ointment and cream preparations containing keladi tikus leaf extract were analyzed descriptively. Quantitative data obtained from pH, spreadability, and adhesion measurements were expressed as mean $\pm$ standard deviation. Meanwhile, the results of organoleptic, homogeneity, and physical stability observations were presented descriptively in narrative and tabular forms.

The results from each formulation were then compared to determine differences in the characteristics of the ointment and cream preparations containing 2%, 4%, and 6% keladi tikus leaf extract. The optimal formulation was determined based on the overall organoleptic characteristics, homogeneity, pH, spreadability, adhesion, and physical stability during storage. The formulation demonstrating the most favorable combination of physical characteristics and stability was considered the optimal formulation for further development as a topical preparation containing keladi tikus leaf extract.

RESULTS AND DISCUSSION

Extraction Results of Keladi Tikus Leaf Extract

The extraction of keladi tikus leaves (*Typhonium flagelliforme*) was carried out using the maceration method with 96% ethanol as the extraction solvent. A total of 800 g of powdered keladi tikus leaves was macerated with 1,000 mL of 96% ethanol. Following the extraction process, the mixture was filtered to separate the filtrate from the plant residue. The collected filtrate was subsequently concentrated using a water bath until a thick extract was obtained.

The concentrated keladi tikus leaf extract was then evaluated for its organoleptic characteristics. The extract exhibited a dark brown color, a characteristic odor of keladi tikus, and a thick consistency. From 800 g of powdered crude drug material, 72 g of concentrated extract was obtained. Based on the extraction yield calculation, the resulting yield was 9%. This indicates that approximately 10 g of concentrated extract was obtained from every 100 g of powdered keladi tikus leaves. Extraction Results of Keladi Tikus Leaves show in table 2.

Table 2. Extraction Results of Keladi Tikus Leaves

Parameter	Nilai
Weight (g)	800
Volume ethanol	1000
Weight of concentrated extract (g)	72
Extraction yield (%)	9

Based on the data presented in Table 2, 800 g of powdered keladi tikus leaves produced 72 g of concentrated extract, corresponding to an extraction yield of 9%. The obtained amount of extract was considered sufficient for use in the subsequent formulation process. The concentrated extract was incorporated into ointment and cream preparations at concentrations of 2%, 4%, and 6%. Each formulation was subsequently evaluated to determine its physical characteristics and stability during storage.

Maceration was selected because it is a relatively simple extraction technique that does not involve direct heating during the extraction process. This condition may help reduce the risk of degradation of thermolabile bioactive compounds. The use of 96% ethanol as the solvent also facilitates the extraction of various phytochemical constituents present in keladi tikus leaves. If necessary, re-maceration of the plant residue may be performed to improve the recovery of compounds that remain in the crude drug material after the initial extraction.

The concentrated keladi tikus leaf extract was subsequently used as the active ingredient in the preparation of ointment and cream formulations. Both dosage forms were evaluated based on organoleptic properties, homogeneity, pH, spreadability, adhesion, and physical stability during storage. The evaluation results were used to characterize each formulation and to determine the dosage form and extract concentration that provided the most favorable physical characteristics and stability for topical application.

Organoleptic Evaluation of Ointment and Cream Preparations

Organoleptic evaluation was conducted to assess the physical characteristics of the ointment and cream preparations containing keladi tikus leaf extract (*Typhonium flagelliforme*). The parameters observed included color, odor, appearance or consistency, and the presence or absence of fungal growth. The evaluation was performed on all formulations containing 2%, 4%, and 6% extract.

The observations indicated that variations in extract concentration affected the color intensity and consistency of the preparations. Formulations containing lower concentrations of keladi tikus leaf extract exhibited relatively lighter colors, whereas higher extract concentrations resulted in progressively darker coloration. All formulations demonstrated a characteristic odor of keladi tikus leaf extract and exhibited consistency appropriate to their respective dosage forms. Throughout the observation period, no visible fungal growth was detected in any of the ointment or cream formulations.

Overall, the organoleptic characteristics of all formulations remained relatively consistent during storage, with no substantial changes in color, odor, or consistency.

These findings indicate that the incorporation of keladi tikus leaf extract at concentrations of 2%, 4%, and 6% did not adversely affect the general physical appearance of the ointment and cream preparations. Organoleptic Results of Ointment Preparations and Cream Preparations show in table 3 and table 4.

Table 3. Organoleptic Results of Ointment Preparations

Formula	Color	Odor	Consistency	Fungal Growth
S1 (2%)	Light brown	Characteristic odor of keladi tikus	Soft	None
S2 (4%)	Brown	Characteristic odor of keladi tikus	Moderately thick	None
S3 (6%)	Dark brown	Characteristic odor of keladi tikus	Thick	None

Table 4. Organoleptic Results of Cream Preparations

Formula	Color	Odor	Consistency	Fungal Growth
K1 (2%)	Off-white brownish	Characteristic odor of keladi tikus	Soft	None
K2 (4%)	Brown	Characteristic odor of keladi tikus	Semisolid	None
K3 (6%)	Dark brown	Characteristic odor of keladi tikus	Semisolid	None

Based on the organoleptic observations, all ointment and cream formulations exhibited acceptable physical characteristics throughout the observation period. The formulations containing 2% keladi tikus leaf extract showed relatively lighter coloration, whereas those containing 6% extract exhibited a more intense and darker color. The gradual increase in color intensity was associated with the higher amount of plant extract incorporated into the formulation.

An increase in extract concentration also influenced the consistency of the ointment preparations. The 2% formulation had a softer texture, while the 4% and 6% formulations showed progressively thicker consistencies. This change may be related to the increasing proportion of concentrated extract incorporated into the ointment base.

Similar color changes were observed in the cream formulations, with the color becoming progressively darker as the extract concentration increased. Nevertheless, all cream formulations maintained an appropriate semisolid consistency, and no visible phase separation was observed during the evaluation period. Furthermore, no fungal growth was detected in any of the ointment or cream formulations.

Overall, the incorporation of keladi tikus leaf extract at concentrations of 2%, 4%, and 6% mainly affected the color intensity and consistency of the preparations but did not result in observable physical deterioration. These findings indicate that all formulations maintained acceptable organoleptic characteristics throughout the observation period.

pH Evaluation of Ointment Preparations

The pH evaluation was performed to determine the acidity of the ointment preparations containing keladi tikus leaf extract (*Typhonium flagelliforme*) and to assess their compatibility with the physiological conditions of the skin. The pH was measured

for each formulation containing 2%, 4%, and 6% keladi tikus leaf extract. The results of the pH measurements show in Table 5.

Table 5. pH Results of Ointment Preparations

Formula	pH	Remarks
S1 (2%)	4.9	Acceptable
S2 (4%)	5.2	Acceptable
S3 (6%)	5.6	Acceptable

Based on the results presented in Table 5, the pH values of the ointment formulations ranged from 4.9 to 5.6. All formulations demonstrated pH values considered suitable for topical application. Formulation S1 containing 2% extract exhibited the lowest pH value of 4.9, whereas formulation S3 containing 6% extract showed the highest pH value of 5.6. The results indicate a gradual increase in pH with increasing extract concentration, although all values remained within an acceptable range for skin application.

The observed pH variation may be associated with the chemical constituents present in the keladi tikus leaf extract and their interactions with the components of the ointment base. Overall, none of the formulations exhibited excessively acidic or alkaline characteristics. Therefore, all ointment formulations were considered to meet the pH requirements for topical preparations and were expected to be suitable for application to the skin.

pH Evaluation of Cream Preparations

The pH evaluation was conducted on the cream preparations containing keladi tikus leaf extract (*Typhonium flagelliforme*) to determine their acidity and assess their compatibility with the physiological conditions of the skin. The pH was measured for each formulation containing 2%, 4%, and 6% keladi tikus leaf extract. The results show in Table 6.

Table 6. pH Results of Cream Preparations

Formula	pH	Remarks
K1 (2%)	5.1	Acceptable
K2 (4%)	5.5	Acceptable
K3 (6%)	5.8	Acceptable

As shown in Table 6, the pH values of the cream formulations ranged from 5.1 to 5.8. All formulations exhibited pH values within an acceptable range for topical application. Formulation K1 containing 2% extract had the lowest pH value of 5.1, while K2 and K3 showed pH values of 5.5 and 5.8, respectively.

The results demonstrated a gradual increase in pH as the concentration of keladi tikus leaf extract increased. However, the observed variation remained within an acceptable range for topical preparations and did not indicate excessive changes in

acidity. The pH values obtained suggest that all cream formulations were compatible with the physiological condition of the skin and could be considered suitable for topical application.

Differences in pH among the formulations may be attributed to the chemical constituents present in the keladi tikus leaf extract and their interactions with the components of the cream base. Overall, the pH evaluation indicated that increasing the extract concentration from 2% to 6% did not produce an undesirable change in the acidity of the cream preparations.

Spreadability Test of Ointment Preparations

The spreadability test was conducted to evaluate the ability of ointment preparations containing keladi tikus leaf extract (*Typhonium flagelliforme*) to spread over the skin surface. Spreadability is an important parameter in the evaluation of topical preparations because adequate spreading facilitates application and promotes uniform distribution of the active ingredient on the skin. The spreadability was determined by measuring the diameter of the preparation before and after applying loads of 50 g and 100 g. The results show in Table 7.

Table 7. Spreadability Results of Ointment Preparations

Formula	Without Load (cm)	50 g (cm)	100 g (cm)
S1 (2%)	5.1 ± 0.2	5.5 ± 0.2	5.8 ± 0.2
S2 (4%)	4.9 ± 0.2	5.3 ± 0.2	5.6 ± 0.2
S3 (6%)	4.7 ± 0.2	5.1 ± 0.2	5.3 ± 0.2

The results demonstrated that all ointment formulations exhibited an increase in spreading diameter following the application of external loads. Formulation S1 containing 2% keladi tikus leaf extract showed the greatest spreadability, whereas S3 containing 6% extract had the lowest spreading diameter. At a load of 100 g, the spreadability values of the ointment formulations ranged from 5.3 to 5.8 cm.

The differences in spreadability among the formulations suggest that increasing the concentration of keladi tikus leaf extract may alter the consistency and viscosity of the ointment, thereby affecting its ability to spread across the skin surface. Formulations containing higher extract concentrations tended to have a thicker consistency, resulting in a smaller spreading diameter. Conversely, the lower extract concentration produced a softer formulation that spread more readily across the surface.

Overall, S1 demonstrated the highest spreadability among the ointment formulations. Although differences were observed between formulations, all ointments exhibited adequate spreading ability, which may facilitate topical application of keladi tikus leaf extract.

Spreadability Test of Cream Preparations

The spreadability test was also performed on cream preparations containing keladi tikus leaf extract (*Typhonium flagelliforme*) at concentrations of 2%, 4%, and 6%. The measurement was conducted before and after the application of 50 g and 100 g loads. The results show in Table 8.

Table 8. Spreadability Results of Cream Preparations

Formula	Without Load (cm)	50 g (cm)	100 g (cm)
K1 (2%)	5.8 ± 0.2	6.2 ± 0.2	6.5 ± 0.2
K2 (4%)	6.0 ± 0.2	6.5 ± 0.2	6.8 ± 0.2
K3 (6%)	5.9 ± 0.2	6.4 ± 0.2	6.6 ± 0.2

All cream formulations showed an increase in spreading diameter following the application of the external loads. At a load of 100 g, the spreadability values ranged from 6.5 to 6.8 cm. Formulation K2 containing 4% extract demonstrated the highest spreadability, with a value of 6.8 ± 0.2 cm, while K1 showed a value of 6.5 ± 0.2 cm. Variations in spreadability may be influenced by the concentration of the extract and its interaction with the components of the cream base. Good spreadability indicates that the preparation can be distributed relatively easily over the skin surface, thereby supporting convenient application. The progressive increase in spreading diameter following the application of greater loads also indicates that external pressure affects the spreading behavior of the preparations.

Overall, the cream formulations demonstrated better spreadability than the ointment formulations. This finding is consistent with the generally lighter texture of creams, which allows them to be spread more easily over the skin. Based on the spreadability evaluation, K2 containing 4% keladi tikus leaf extract showed the most favorable result, with a spreading diameter of 6.8 ± 0.2 cm at a 100 g load. This result can be considered together with pH, adhesion, homogeneity, and stability parameters to determine the optimal cream formulation.

Adhesion Test of Ointment Preparations

Adhesion is an important parameter in the evaluation of topical preparations because it indicates the ability of a formulation to maintain contact with the skin surface. A preparation with adequate adhesion may remain at the application site for a longer period, thereby allowing the active ingredients to maintain contact with the skin. The adhesion results of the ointment preparations containing keladi tikus leaf extract (*Typhonium flagelliforme*) show in Table 9.

Table 9. Adhesion Results of Ointment Preparations

Formula	Adhesion Time (s)
S1 (2%)	6.8 ± 0.2
S2 (4%)	6.5 ± 0.3
S3 (6%)	6.2 ± 0.2

Based on the results, S1 containing 2% keladi tikus leaf extract exhibited the longest adhesion time, at 6.8 ± 0.2 s, whereas S3 containing 6% extract showed the lowest value, at 6.2 ± 0.2 s. Formulation S2 containing 4% extract demonstrated an adhesion time of 6.5 ± 0.3 s.

The results indicate differences in adhesion among the ointment formulations. The gradual decrease in adhesion with increasing extract concentration may be associated with changes in the consistency and physical properties of the preparations resulting from the incorporation of a greater amount of keladi tikus leaf extract. In addition to extract concentration, adhesion may also be affected by the composition and physicochemical properties of the ointment base.

Overall, all ointment formulations demonstrated good adhesion to the test surface, with adhesion times ranging from 6.2 to 6.8 s. S1 exhibited the highest adhesion value, indicating that the ointment could maintain contact with the application surface for a relatively longer period and potentially support prolonged contact of the active constituents with the skin.

Adhesion Test of Cream Preparations

The adhesion test of the cream formulations was performed to determine their ability to maintain contact with the skin surface after application. This parameter is important in the evaluation of topical preparations because it is related to the ability of the formulation to remain at the application site for a certain period. Adequate adhesion may help maintain contact between the active ingredients and the skin surface. The adhesion results of the cream formulations containing keladi tikus leaf extract (*Typhonium flagelliforme*) show in Table 10.

Table 10. Adhesion Results of Cream Preparations

Formula	Adhesion Time (s)
K1 (2%)	5.0 ± 0.2
K2 (4%)	5.3 ± 0.3
K3 (6%)	5.7 ± 0.2

The results showed that K1 containing 2% extract had an adhesion time of 5.0 ± 0.2 s, while K2 and K3 demonstrated adhesion times of 5.3 ± 0.3 s and 5.7 ± 0.2 s, respectively. Among the cream formulations, K3 exhibited the highest adhesion value. The increase in adhesion with increasing extract concentration may be related to changes in formulation consistency and interactions between the extract and the components of the cream base.

The adhesion times of the cream formulations ranged from 5.0 to 5.7 s. Compared with the ointment preparations, all cream formulations exhibited lower adhesion values. This difference may be attributed to the characteristics of the ointment base, which is generally more viscous and occlusive, allowing it to maintain contact with the skin surface for a longer period. In contrast, creams generally have a lighter texture and are

easier to spread, resulting in comparatively lower adhesion.

Although K3 exhibited the highest adhesion among the cream formulations, K2, containing 4% keladi tikus leaf extract, was considered the most favorable cream formulation overall, as it provided a balanced combination of pH, spreadability, adhesion, homogeneity, and physical stability. This selection was based on the balance of its physical characteristics, including a pH of 5.5, spreadability of 6.8 ± 0.2 cm, and adhesion time of 5.3 ± 0.3 s.

The novelty of this study lies in the comparative evaluation of ointment and cream formulations containing different concentrations of *Typhonium flagelliforme* extract. Although previous research has explored the phytochemical composition and pharmacological potential of *T. flagelliforme*, further research on the development of topical preparations containing this extract remains necessary (Maha et al., 2023). Previous formulation studies involving other medicinal plant extracts have demonstrated that extract concentration and formulation composition can influence important physical properties, including viscosity, spreadability, and adhesiveness (Kurnianingrum & Zulkarnain, 2023; Usman et al., 2024). In contrast, the present study examines these formulation characteristics across two different semisolid dosage forms and multiple extract concentrations. The finding that K2 demonstrated a favorable combination of ease of application and sufficient adhesion to the skin surface provides a basis for identifying a promising formulation among those investigated. Thus, this study contributes comparative formulation data that may support the further development of *T. flagelliforme* extract as a topical preparation.

The findings of this study have practical implications for the development of plant-based topical preparations by providing preliminary information on the relationship between extract concentration, dosage form, and physical formulation characteristics. The favorable spreadability and adhesiveness observed in K2 suggest that this formulation may offer a suitable balance between ease of application and retention on the skin surface. Similar formulation studies have demonstrated the importance of evaluating physical properties and stability when selecting suitable herbal semisolid preparations (Kurnianingrum & Zulkarnain, 2023; Usman et al., 2024). Accordingly, the results of the present study may serve as a basis for selecting formulations for further optimization and development. However, favorable physical characteristics alone do not establish therapeutic efficacy or clinical safety. Further investigations, including long-term stability testing, skin irritation assessment, active compound release, skin permeation, and relevant pharmacological studies, are needed before the formulation can be recommended for therapeutic use.

CONCLUSION

Based on the evaluation results, the ointment and cream preparations containing keladi tikus leaf extract (*Typhonium flagelliforme*) demonstrated suitable physical characteristics for topical application. The ointment formulations exhibited pH values ranging from 4.9 to 5.6, spreadability values of 5.3–5.8 cm, and adhesion times of 6.2–

6.8 s. Meanwhile, the cream formulations showed pH values of 5.1–5.8, spreadability values of 6.5–6.8 cm, and adhesion times of 5.0–5.7 s. All formulations demonstrated good homogeneity and relatively stable physical characteristics throughout the storage period. Among the cream formulations, K2 containing 4% keladi tikus leaf extract was considered the most optimal formulation, with a pH of 5.5, spreadability of 6.8 ± 0.2 cm, and adhesion time of 5.3 ± 0.3 s. Further studies are recommended to investigate the pharmacological efficacy and topical safety of keladi tikus leaf extract.

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