International Journal Of Health, Engineering And Technology (IJHET) E-ISSN 2829 - 8683
Volume 4, Number 6, March 2026, Page. 2380 - 2390
Email : editorijhess@gmail.com

Antioxidant Body Lotion Formulation From Yakon Leaf Extract (Smallanthus Sonchifolius)

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Abstract

Free radicals due to UV exposure, pollution, and the environment damage the skin and accelerate premature aging, so natural antioxidants are needed. This study aims to formulate and evaluate antioxidant body lotion from ethanol extract of yacon leaves (Smallanthus sonchifolius). Semi-quantitative laboratory experimental research used old yacon leaves from Wonosobo as a purposive sample (1,897 g of dried simplicia). Instruments include a UV-Vis spectrophotometer for DPPH (515 nm) test, a Brookfield viscometer, and a pH meter. Data analysis used IC_{50} regression and physical quality standards (SNI). The results showed that the IC_{50} of the extract was 28.08 ppm (very strong, <50 ppm), positive phytochemical screening (phenolics, flavonoids), and all lotion formulas (F0-F3: 0-10% extract) met physical standards (pH 4.6-6.2, viscosity 2,187-9,230 cps, O/W emulsion). Formula F1 (2.5%) was optimal overall. The conclusion is that yacon leaf extract has strong potential for the development of a stable body lotion.

Keywords: Antioxidant Activity, Body Lotion, DPPH Method, Smallanthus Sonchifolius, Yakon Leaves.

INTRODUCTION

The skin is the largest organ in the human body and serves as the primary barrier against external environmental influences, such as exposure to ultraviolet light, air pollution, and various free radical-inducing factors. This exposure often produces free radicals that damage skin tissue and accelerate the aging process through oxidative stress. (Suryani Wahyuni, 2025; Rawal et al., 2025)

Free radicals can also disrupt skin cell integrity by triggering collagen and elastin degradation, leading to signs of aging such as wrinkles and loss of elasticity. This phenomenon is increasingly relevant in the modern era, where exposure to pollutants is increasing, demanding more effective skin protection through natural ingredients. (Suryani Wahyuni, 2025; Simanjuntak, 2025)

However, the use of synthetic antioxidants in skin care products often carries the risk of long-term side effects, necessitating safer and more sustainable alternatives from natural sources. Many conventional chemicals fail to provide optimal protection without disrupting the skin's physiological balance. (Nurheni et al., 2023; Wardana et al., 2025)

Plants such as yacon leaves (Smallanthus sonchifolius) offer high potential due to their richness in phenolic and flavonoid compounds. However, their use in topical preparations such as body lotions remains limited despite their proven antioxidant activity. Previous research has shown a low IC50 for yacon leaf extract, but stable formulations for skin application have not been widely explored. (Elawati Yuanita, 2021; Nugraha, 2017)

Therefore, the main problem is the lack of yacon leaf extract-based body lotion preparations that have been comprehensively evaluated for antioxidant activity and physical stability. This hampers the development of practical and effective natural skin care products against free radicals. (Saputri, 2024; Nagalievska et al., 2025)

This study aims to formulate a body lotion from yacon leaf ethanol extract with varying concentrations and evaluate its physical quality and antioxidant activity using the DPPH method. The urgency of the research lies in the need for natural solutions to prevent skin damage caused by free radicals amidst increasing environmental exposure, while the novelty of the study is the development of an optimal formula with the lowest IC50 (28.08 ppm) from a 40 mg extract and a complete evaluation that supports commercial applications. (Kusumawati et al., 2023; Rawal et al., 2025)

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THEORETICAL STUDY

Yakon Leaves and Their Antioxidant Activity

The yacon plant (Smallanthus sonchifolius) is a plant from the Asteraceae family which has the potential as a source of natural antioxidants due to its secondary metabolite compound content, especially phenolics and flavonoids.(Elawati & Yuanita, 2021)Yacon leaves are known to contain compounds such as chlorogenic acid, caffeic acid, and quercetin which contribute to its biological activity.(Puentes & Amador, 2020)These compounds play a role in counteracting free radicals that can cause cell damage. Furthermore, yacon leaves are also reported to have antioxidant activity and protective effects against oxidative stress.(Wijayanti et al., 2023). With these bioactive ingredients, yakon leaves have the potential to be developed as an active ingredient in skin care products.

Antioxidants DPPH Method and UV-Vis Spectrophotometry

Phenolic and flavonoid compounds contained in yacon leaves are known to have a role as natural antioxidants due to their ability to donate electrons or hydrogen atoms to stabilize free radicals.(Elawati & Yuanita, 2021; Maulida, 2020)The antioxidant activity of these compounds can be analyzed using the DPPH method which is based on the reduction capacity of synthetic free radicals.(Kusumawati et al., 2023)The hydroxyl groups in phenolic compounds contribute to the free radical scavenging process, while the conjugated aromatic structure of flavonoids supports radical stabilization (Kurniati, 2022). The interaction between antioxidants and DPPH radicals is characterized by a change in the color of the solution, reflecting free radical scavenging activity. These changes are then measured using UV-Vis spectrophotometry to determine the IC_{50} value as an indicator of the strength of antioxidant activity.(Kusumawati et al., 2023). Thus, the spectrophotometric-based DPPH method can be used to evaluate the contribution of phenolic and flavonoid compounds to the antioxidant activity of yacon leaves.

Body Lotion Preparation

*Body lotion*is a topical preparation used to maintain skin moisture and prevent water loss from the skin's surface.(Telaumbanua et al., 2024). In addition to functioning as a moisturizer, body lotion can also serve as a delivery medium for active ingredients from natural ingredients. This preparation is widely used because it is easy to apply and provides comfort during use. The use of plant extracts in body lotion is an alternative for developing natural skin care products. Therefore, body lotion is a suitable dosage form for the application of yakon leaf extract as an antioxidant.

RESEARCH METHODS

Types and Methods of Research

This study is a semi-quantitative laboratory experimental study designed to test the formulation and evaluation of body lotion based on ethanol extract of yacon leaves (Smallanthus sonchifolius) on antioxidant activity using the DPPH method. The experimental approach was chosen because it allows for causality testing through variations in extract concentration (2.5%, 5%, and 10%) and controlled measurement of physical and biological parameters, in accordance with the principles of quantitative research methodology that emphasize replication and objective measurement. (Sugiyono, 2021; Faruki, 2021) The study was conducted at the Health Laboratory of the Pharmacy Study Program, Duta Bangsa University, Surakarta, and the Indonusa Polytechnic Laboratory, Surakarta, from November 2025 to January 2026, with samples of old yacon leaves from Wonosobo, Central Java, which had been determined at the UPF Laboratory, Dr. Sardjito General Hospital (number TL.02.04D.XI.6344/84.9/2025). This semi-quantitative approach integrates qualitative observations, such as organoleptic measurements, with numerical data such as IC50, resulting in a comprehensive and statistically testable analysis. (Emzir, 2022; Sudaryono, 2021)

Data Analysis Instruments and Techniques

The main instruments include laboratory equipment such as a rotary evaporator for extract concentration, a UV-Vis spectrophotometer for DPPH assay at 515 nm, a Brookfield viscometer for viscosity measurement, a pH meter for acidity, and a dispersive and adhesive force apparatus for physical evaluation. Data analysis techniques involve calculating the percent inhibition using the formula [(control Abs - sample Abs)/control Abs] × 100% and IC50 through linear regression of the concentration-inhibition curve, with activity categories based on IC50 <50 ppm (very strong). Physical data are evaluated quantitatively descriptively against SNI standards, while phytochemical screening uses specific reagents such as Mayer, FeCl3, and Liebermann-Burchard for compound identification. (Creswell & Creswell, 2023; Kusumawati et al., 2023) This analysis is supported by software such as Excel for regression and processing of triplicate averages, ensuring the validity and reliability of the results according to the mixed methods paradigm in pharmaceutical research. (Sugiyono, 2021; Mufidah et al., 2025)

Population and Sample

The study population consisted of mature yacon leaves (Smallanthus sonchifolius) from the Wonosobo area, Central Java, as the main source of active antioxidant ingredients, with the characteristics of dry simplicia after sorting and indirect sunlight drying. Samples were taken purposively as much as 11,840 grams of wet simplicia which were sorted into 1,897 grams of dry, then ground through a 40 mesh for extraction, producing a thick extract after 70% ethanol maceration (ratio 1:5). Variations in extract samples (10 mg, 20 mg, 40 mg) were used for DPPH tests and lotion formulations (F0 as a control, F1-F3), ensuring the representativeness of the plant population by standardizing water content <10% and total ash. (Elawati Yuanita, 2021; Narulita et al., 2025) This sample selection follows the principle of non-probability purposive sampling for natural materials, which is effective in experimental pharmaceutical research to optimize the extraction of phenolic and flavonoid compounds. (Sudaryono, 2021; Emzir, 2022)

Research Procedures

The procedure begins with the collection and standardization of yacon leaf simplicia through wet/dry sorting, washing, chopping, covered sun drying, 40 mesh refinement, and quality testing (organoleptic, drying loss 8.03%, water content 8.2%, ash 8.16%). Maceration extraction was carried out with 1,000 grams of simplicia powder in 70% ethanol for 3-24 hours with two remacerations, concentrated with a rotary evaporator (40-60°C), followed by standardization of the extract (shrinkage 5.33%, water 6.92%, ash 5.50%) and positive phytochemical screening for alkaloids, tannins, flavonoids, etc. The DPPH test involved a stock solution of the extract (100-400 ppm), 100 ppm DPPH, 20 minutes dark incubation, 515 nm measurement, and IC50 calculation. (Fatwami Royani, 2023; Riwanti et al., 2020) O/W lotion formulation was made with a water phase (carbopol 940, TEA, propylene glycol, tween 80, preservative), oil phase (VCO, span 80), and extract, stirred with a magnetic stirrer at 400 rpm at 55°C; evaluated for organoleptic, homogeneity, pH, emulsion, viscosity, adhesion (>4 seconds), spread (5-7 cm). All steps followed an iterative experimental protocol for validation. (Telaumbanua et al., 2024; Manoj et al., 2025)

Table 1. Dosage FormulationYacon Leaf Ethanol Extract Body Lotion

Material	Formula				Function
	F0	F1	23	F3	
Ethanol extract of yacon leaves	0	2.5	5	10	Active ingredient
VCO	5	5	5	5	Oil phase
Tween 80	5	5	5	5	Surfactant
Propylene glycol	0.05	0.05	0.05	0.05	Co surfactant
TEA	0.5	0.5	0.5	0.5	Alkalizing agent
Carbopol 940	0.6	0.6	0.6	0.6	Thickener
Methyl Paraben	0.1	0.1	0.1	0.1	Preservative
Propyl Paraben	0.05	0.05	0.05	0.05	Preservative
Span 80	5	5	5	5	Surfactant
Aquadest	Ad 50	Ad 50	Ad 50	Ad 50	Water phase

In the process of making body lotion, it is done by weighing all the necessary ingredients, namely yacon leaf extract, tween 80, propylene glycol, Triethanolamine (TEA) and distilled water for the water phase then for span 80 and vco as the oil phase, carbopol 940 as the gel phase, methyl paraben and propyl paraben as preservatives. Then carbopol 940 is developed using hot water for 30 minutes. After the carbopol has developed, it is crushed in a mortar until homogeneous, then TEA, propylene glycol, tween 80, and 2 types of preservatives are added gradually, slowly crushed until homogeneous, then distilled water is added little by little until a gel phase is formed. After the gel phase is formed, put it into a glass beaker then stirred and heated using a magnetic stirrer at 400 rpm with heating at a temperature of 550C until mixed. The mixed oil phase is also heated until combined and then the extract is added until homogeneous. After that, add it to the water phase little by little while heating it while stirring it manually until it is mixed to form a body lotion preparation.

The finished yacon leaf ethanol extract body lotion preparation was then subjected to physical evaluation including organoleptic testing, homogeneity, pH, emulsion type, viscosity, adhesive power, and spreading power.

RESULTS AND DISCUSSION

Standardization of Simplicia and Ethanol Extract of Yakon Leaves

The results of the simplicia test showed organoleptic characteristics in the form of green color, distinctive aroma, and powder form. The drying loss value (8.03%), water content (8.2%), and ash content (8.16%) were below the <10% limit, thus meeting the simplicia quality requirements.(Ramdhini, 2023)Yakon leaf extract has a blackish-green color, a distinctive herbal aroma, and a thick texture. The drying loss (5.33%), moisture content (6.92%), and ash content (5.50%) also meet extract quality standards as they are below 10%.(Handayani et al., 2024; Wandira et al., 2023). In addition, the ethanol-free test showed a negative result, indicating the absence of residual solvent in the extract.(Tivani et al., 2021).

Phytochemical Screening

The results of phytochemical screening can be seen in table 1.

Table 1. Phytochemical Screening Results of Yakon Leaf Ethanol Extract

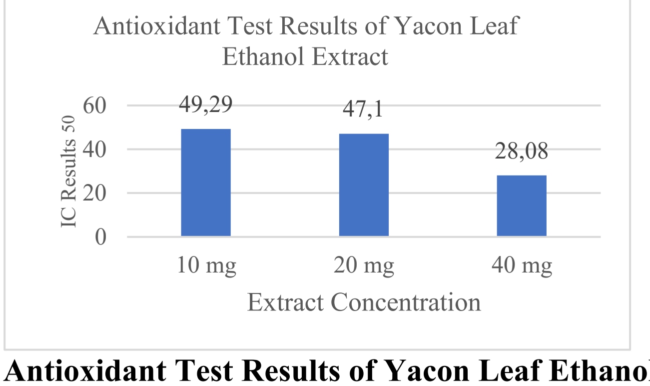
Compound	Reagent	Conclusion
Alkaloids	Mayer	-
	Wagner	+
	Dragendorff	+
Tannin	10 ml hot water + $FeCl_3$	+
Flavonoid	Mg powder + concentrated HCl	+
Saponin	Aquadest + HCl	+
Steroids + Terpenoids	Acetic acid + concentrated sulfuric acid	+
Phenolic	Hot water + $FeCl_3$	+

Phytochemical screening results showed that yacon leaf extract contains several secondary metabolites, including alkaloids, tannins, flavonoids, saponins, steroids/terpenoids, and phenolics. Alkaloid tests using Mayer, Wagner, and Dragendorff reagents showed the presence of alkaloids characterized by the formation of ionic complexes due to the reaction of metal ions with free nitrogen groups (Dewi & Putri, 2023). Tannin and phenolic tests using $FeCl_3$ produced color changes due to the formation of complexes with aromatic hydroxyl groups, which play a role in antioxidant activity (Wijayanti & Kurnia, 2024; Lestari & Sari, 2024). Flavonoids were detected through a reduction reaction with Mg powder and concentrated HCl, which demonstrated the ability to stabilize free radicals (Nugroho et al., 2025). Saponins were identified through the formation of stable foam, while steroids and terpenoids were detected through the Liebermann-Burchard reaction, which showed a characteristic color change (Sari & Yuliana, 2023; Handayani & Sutrisno, 2024). The presence of these compounds supports the biological potential of the extract, particularly as a source of natural antioxidants.

Antioxidant Activity Test of Yacon Leaf Ethanol Extract Using DPPH Method

The antioxidant activity of yacon leaf ethanol extract was tested by preparing a stock solution at three concentrations: 10 mg, 20 mg, and 40 mg. These variations were used to determine the extract concentration with the best antioxidant activity, which could be used as a reference in the formulation of the preparation. Each extract was dissolved in methanol to obtain concentrations of 100 ppm, 200 ppm, and 400 ppm, then a series of dilutions of 2, 4, 6, 8, and 10 ppm were made. Each solution was reacted with DPPH and incubated for 20 minutes before its absorbance was measured using UV-Vis spectrophotometry at its maximum wavelength.

The absorbance data obtained were then processed by calculating the average of three replications to increase the accuracy of the results. The percent inhibition value was calculated for each concentration, then a curve was created to determine the relationship between concentration and antioxidant activity. This curve produced a linear regression equation for each extract variation. The regression results were used as the basis for calculating the IC_{50} value. The IC_{50} value indicates the extract concentration required to reduce 50% of DPPH free radicals. The results of the antioxidant test of the yacon leaf ethanol extract can be seen in Figure 1.



Picture 1. Antioxidant Test Results of Yacon Leaf Ethanol Extract

The calculation results showed that the IC_{50} value for the 10 mg extract was 49.29 ppm, the 20 mg extract was 47.1 ppm, and the 40 mg extract was 28.08 ppm. These values indicate that all extracts have very strong antioxidant activity because they are below 50 ppm. A lower IC_{50} value indicates a higher ability to ward off free radicals. Thus, yacon leaf extract has good antioxidant potential.

Of the three concentration variations, the 40 mg extract showed the highest antioxidant activity with an IC_{50} value of 28.08 ppm. This activity is thought to be related to the polyphenolic compounds present in yacon leaves, such as phenolics and flavonoids. These compounds act as primary antioxidants, capable of donating hydrogen atoms or electrons to stabilize free radicals.(Widiasriani et al., 2024)Therefore, ethanol extract of yacon leaves has the potential to be a source of natural antioxidants.

Physical Test of Yakon Leaf Ethanol Extract Body Lotion Preparation

After preparing the yakon leaf ethanol extract body lotion, physical testing can be carried out. The yakon leaf ethanol extract body lotion preparation can be seen in Figure 2.

Picture 2. Body Lotion Preparation with Yacon Leaf Ethanol Extract

Organoleptic Test

Organoleptic testing was conducted to assess the physical characteristics of body lotion preparations based on texture, aroma, and color (Maula et al., 2025). Testing was conducted by visual observation using all human senses to the texture, aroma, and color of the preparation when applied to the skin. The results showed that all formulas had a semi-solid texture, but differed in aroma and color. Formula F0 was white with a distinctive aroma of VCO, while FI, FII, and FIII exhibited a herbal aroma with increasing intensity as the extract concentration increased. The color change from light cream to dark green was caused by the content of secondary metabolites such as chlorophyll and phenolics in the yacon leaf extract. The higher the extract concentration, the more intense the color of the preparation. The results of the organoleptic test can be seen in Table 2.

Table 2. Organoleptic Test Results of Body Lotion Preparations

Formula	Texture	Aroma	Color
F0	semi-solid	typical VCO	white
FI	semi-solid	distinctive herbal aroma	youth cream
FII	semi-solid	distinctive herbal aroma	brownish green
FIII	semi-solid	distinctive herbal aroma	dark green

FI has a light cream color with a light herbal scent, FII is brownish green with a stronger scent, and FIII is dark green with the most intense scent. Despite the color and scent changes, all formulas maintain a semi-solid texture due to the influence of the lotion base.(Fatmawati et al., 2023)The addition of high amounts of extract can affect viscosity due to the presence of polar compounds that disrupt the thickening network (Apriani et al., 2023). Based on visual and aroma comfort considerations, FI was selected as the best formulation. This formula was considered the most balanced because it had a color and aroma that were not too strong but still reflected the character of the extract.

Homogeneity Test

A homogeneity test was performed to ensure the absence of coarse particles, lumps, or foreign objects in the body lotion preparation. The test was performed by applying 0.5 grams of the preparation to a watch glass and observing visually (Aljanah et al., 2022). This parameter is important for assessing the uniformity of material distribution in the emulsion system. A homogeneous preparation indicates that the mixing process is proceeding smoothly. The results of the homogeneity test can be seen in Table 3.

Table 3. Results of the Homogeneity Test of Body Lotion Preparations

Formula	Homogeneity
F0	homogeneous
FI	homogeneous
FII	homogeneous
FIII	homogeneous

The test results showed that all formulas had a uniform appearance without any coarse particles. Specifically, formulas F0, FI, FII, and FIII all showed homogeneous results. This indicates that increasing the extract concentration did not affect the uniformity of the emulsion system. The distribution of the active ingredients remained even despite changes in viscosity in some formulas. This condition indicates that the physical stability of the preparation was maintained. Thus, all formulas were deemed to meet homogeneity requirements (Aljanah et al., 2022).

pH test

A pH test is performed to determine the acidity level of a body lotion preparation, ensuring its safety for use on the skin. Measurements are made using a calibrated pH meter, with the preparation sample first dissolved in distilled water (Widyastuti & Suryanti, 2023). This parameter is important because pH affects the preparation's stability and comfort during use. A safe pH value for skin is generally in the range of 4.5–8 (Maula et al., 2025). The pH test results can be seen in Table 4.

Table 4. Results of pH Test of Body Lotion Preparations

Formula	Average
F0	6.2
FI	5.2
FII	4.6
FIII	4.6

The test results showed that all formulas had a pH within safe limits for topical use. Specifically, the pH values obtained were F0 of 6.2, FI of 5.2, FII of 4.6, and FIII of 4.6. Although all formulas were still within the safe range, FII and FIII were near the lower limit, while F0 was in the neutral skin range. FI was chosen as the best formulation because it has a pH of 5.2, which is in the middle of the skin's physiological range, making it more compatible and potentially reducing the risk of irritation (Widyastuti & Suryanti, 2023). The decrease in pH with increasing extract concentration is thought to be caused by the content of weak acidic compounds such as phenolics and flavonoids. This condition can also affect system stability, including the performance of thickening agents in lotion formulations.

Emulsion Type Test

Emulsion type testing is carried out to determine the emulsion system formed, namely oil in water (O/W) or water in oil (W/O). The test is carried out using a coloring method using methylene blue as a water-soluble dye (Tambunan & Julianty, 2025). In the O/W type emulsion, the oil phase is dispersed in the water phase so that the dye will spread evenly and produce a homogeneous color. Conversely, in the W/O type emulsion, the dye will not be distributed uniformly. The results of the emulsion type test can be seen in table 5.

Table 5. Results of Emulsion Type Test for Body Lotion Preparations

Formula	Emulsion Type
F0	O/W
FI	O/W
FII	O/W
FIII	O/W

The test results showed that all formulas (F0–FIII) had an O/W emulsion type. The O/W emulsion type was chosen because it suits the characteristics of body lotion, which is light, easily absorbed, and does not leave a greasy feeling on the skin (Widyastuti & Suryanti, 2023). This system also showed that the composition of the oil phase, water phase, and emulsifier has formed a stable emulsion structure. O/W emulsions support comfortable use and help distribute active ingredients on the skin surface. In addition, this type is commonly used in topical cosmetic formulations because it provides a non-sticky sensation and is easy to apply (Maula et al., 2025). Thus, all formulas are considered to have an emulsion type suitable for body lotion preparations.

Viscosity Test

Viscosity testing is carried out to determine the level of viscosity of the preparation and its resistance to flow, because viscosity affects the ability of the preparation to stick to and spread on the skin.(Chandra & Rahmah, 2022). Measurements were made using a Brookfield viscometer with spindle number 4 at a speed of 60 rpm for 1 minute.(Zulfa, E. et al., 2019)This parameter is important because viscosity affects the stability, spreadability, and comfort of topical preparations. Based on SNI standards, the viscosity of a good body lotion preparation is in the range of 2,000–50,000 cps.(Tambunan & Julianty, 2025). The results of the viscosity test can be seen in table 6.

Table 6. Viscosity Test Results of Body Lotion Preparations

Formula	Average (cps)
F0	9230
FI	2866
FII	2518
FIII	2187

The test results showed that all formulas met the viscosity range. Formula F0 had a viscosity of 9,230 cps, FI 2,866 cps, FII 2,518 cps, and FIII 2,187 cps. These values indicate that viscosity decreases with increasing extract concentration. The decrease in viscosity is thought to be caused by the content of polar compounds in the extract, which can disrupt the thickening network and reduce the density of the emulsion system (Widyastuti & Suryanti, 2023). Although F0 had the highest viscosity, FI showed a more balanced consistency compared to FII and FIII, which tended to be thinner. Therefore, FI was chosen as the best formulation because it has optimal viscosity for stability and comfort of use (Zulfa et al., 2019; Tambunan & Julianty, 2025).

Adhesion Test

The adhesion test was conducted to evaluate the body lotion's ability to adhere to the skin surface after application. This parameter is important because it is related to the duration of contact between the preparation and the skin, thus affecting the effectiveness of the active ingredient (Maula et al., 2025). The test was conducted by placing 0.1 g of the preparation between two glass objects, then applying a 50 g load for 5 minutes before being tested using an adhesion tester (Aljanah et al., 2022). The time required for the two glass objects to separate was recorded as the adhesion value. The preparation was considered to have good adhesion if the adhesion time was more than 4 seconds (Maula et al., 2025). The results of the adhesion test can be seen in Table 7.

Table 7. Results of the Adhesion Test of Body Lotion Preparations

Formula	Average (seconds)
F0	6.45
FI	5.52
FII	4.34
FIII	4.27

The test results showed that all formulas had adhesive strength above the minimum limit, with the highest value at F0 (6.45 seconds), followed by FI (5.52 seconds), FII (4.34 seconds), and FIII (4.27 seconds). The decrease in adhesive strength with increasing extract concentration is thought to be related to the decrease in viscosity of the preparation. Body lotions with a thinner consistency generally have a lower adhesive force (Widyastuti & Suryanti, 2023). Although F0 showed the highest adhesive strength value, FI was considered more optimal because it was still within a good range and provided a balance between adhesive strength and comfort of use. Thus, FI was selected as the best formula overall.

Spread Power Test

The spreadability test was conducted by weighing 0.5 g of body lotion preparation placed in the center of a graduated circular glass, then covered with a cover glass and left for 1 minute. Next, the load was added gradually starting from 50 g to 200 g, and the spread diameter was measured at each additional load.(Aljanah et al., 2022)This test aims to determine how easily the lotion spreads over the skin's surface when applied. A good formulation generally has a spreadability in the range of 5–7 cm.(Maula et al., 2025). The test results showed that all formulas (F0–FIII) met the range, although there was an increase in spreadability as the extract concentration increased. The results of the spreadability test can be seen in Table 8.

Table 8. Results of the Spreadability Test of Body Lotion Preparations

Formula	50 gr	100 gr	150 gr	200 gr
F0	5.2	5.8	6.4	6.6
FI	5.3	5.5	5.7	5.9
FII	5.6	5.7	6.5	6.6
FII	6.6	6.6	6.6	6.7

From the comparison between the formulas, FIII showed the widest spreadability, while F0 had the lowest. However, excessively high spreadability can indicate low viscosity and poor adhesion.(Widyastuti & Suryanti, 2023)FII also has relatively high spreadability, but has the potential to experience reduced stability. Conversely, FI exhibits a balance between spreadability and consistency. Therefore, FI was chosen as the best formula because it has optimal spreadability without compromising the stability and adhesion of the body lotion.

CONCLUSION

This study successfully formulated an antioxidant body lotion from ethanol extract of yacon leaves (Smallanthus sonchifolius) with concentration variations of 2.5%, 5%, and 10%, where all formulas met physical quality standards such as homogeneity, pH 4.6-6.2, viscosity 2,187-9,230 cps, O/W emulsion type, adhesiveness >4 seconds, and spreadability 5-6.7 cm. Formula F1 (2.5%) was selected as the optimal one due to the best balance in organoleptic, stability, and comfort of use. The antioxidant activity of the extract reached a peak at IC50 28.08 ppm for the 40 mg variant, categorized as very strong (<50 ppm), supported by positive phytochemical screening for phenolics, flavonoids, and other compounds that are effective in counteracting free radicals. These findings confirm the potential of yacon leaves as a natural ingredient for skin care, with practical implications in the form of developing environmentally friendly cosmetic products that protect against premature aging due to pollution and UV.

Despite promising results, limitations of the study include a focus on in vitro physical and DPPH evaluations without skin irritation testing, long-term stability, or hedonic panel analysis for consumer preferences. Suggestions for further research include in vivo testing, nanoemulsion formulation for better absorption, and economic analysis of industrial-scale production. Practically, this research encourages the pharmaceutical and cosmetic industries to utilize local plants such as yacon for antioxidant product innovation. natural, supporting public skin health amidst urban environmental threats.

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