Indonesian Journal of Pharmaceutical and Clinical Research
Journal homepage: https://idjpcr.usu.ac.id

Body Scrub Salt Formulation from *Cinnamomum burmannii* (C. Ness & T. Ness) Blume Extract as an Antibacterial Against *Staphylococcus aereus*

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ARTICLE INFO

Article history:
Received 07 August 2024
Revised 30 August 2024
Accepted 11 November 2024
Available online 16 November 2024

E-ISSN: 2620-3731
P-ISSN: 2615-6199

How to cite:

Surbakti, C., Nobelia, C. R., & Hanum, T. I. (2024). Body scrub saltformulation from *Cinnamomum burmannii* (C. Ness & T. Ness) Blume extract as an antibacterial against *Staphylococcus aureus*. *Indonesian Journal of Pharmaceutical and Clinical Research*, 7(1), 46-55.

ABSTRACT

Skincare is currently a major focus in the beauty industry with skin exfoliation being an important step. One product used to exfoliate the skin is a body scrub, which contains ingredients such as himalayan salt and cinnamon bark extract. Himalayan salt helps remove dead skin cells and moisturizes the skin, while cinnamon extract has antimicrobial properties that can protect the skin from bacteria. This study aims to formulate and test the effectiveness of body scrub with skin analyzer and antibacterial activity against *Staphylococcus aureus*. This research uses an experimental method with several stages, namely plant material collection, plant identification, powder making, extract making, preparation making, evaluation and stability, effectiveness test with skin analyzer and antibacterial activity against *Staphylococcus aureus*. The 10% body scrub has better effectiveness than 0%; 2.5% and 5% which obtained a percent increase in skin moisture (71.62%), a decrease in the number of blemishes on the skin (70.73%) and a decrease in pore size on the skin (76.38%) for 4 weeks of treatment. In testing antibacterial activity, the 10% concentration was also considered the optimal concentration because it had the greatest inhibition of 14.20 ± 0.59 mm. The results concluded that Himalayan salt and cinnamon bark extract can be formulated into a body scrub dosage form that meets the stability requirements and has the effectiveness in moisturizing, smoothing, and brightening the skin. The formula that has the most effective antibacterial activity is a body scrub containing extracts with a concentration of 10% against *Staphylococcus aureus* bacteria.

Keyword: Body scrub, Cinnamon bark *(Cinnamomum burmannii)*, skin analyzer, *Staphylococcus aureus*

ABSTRAK

Sediaan perawatan kulit kini menjadi fokus utama dalam industri kecantikan dengan eksfoliasi kulit menjadi langkah penting dalam merawat tubuh. Salah satu produk yang digunakan untuk eksfoliasi kulit adalah *body scrub*, yang mengandung bahan seperti garam himalaya dan ekstrak kulit kayu manis. Garam himalaya membantu mengangkat sel kulit mati dan melembabkan kulit, sementara ekstrak kayu manis memiliki sifat antimikroba yang dapat melindungi kulit dari bakteri. Penelitian ini bertujuan untuk memformulasi dan menguji efektivitas sediaan *body scrub* dengan *skin analyzer* serta aktivitas antibakteri terhadap *Staphylococcus aureus*. Penelitian ini menggunakan metode eksperimental dengan beberapa tahapan, yaitu pengambilan bahan tumbuhan, identifikasi tumbuhan, pembuatan serbuk, pembuatan ekstrak, pembuatan sediaan, evaluasi dan stabilitas, uji efektivitas dengan *skin analyzer* dan aktivitas antibakteri terhadap *Staphylococcus aureus*. Sediaan body scrub 10% memiliki efektivitas yang lebih baik dibandingkan 0%; 2,5% dan 5% yang mana diperoleh persen peningkatan kelembapan kulit (71,62%), penurunan jumlah noda pada kulit (70,73%) serta penurunan ukuran pori pada kulit (76,38%) selama 4 minggu

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http://doi.org/10.32734/idjpcr.v7i1.17847

perawatan. Pada pengujian aktivitas antibakteri, didapat sediaan konsentrasi 10% dianggap juga sebagai konsentrasi optimal karena memiliki daya hambat terbesar yaitu 14,20±0,59 mm. Hasil penelitian disimpulkan bahwa Garam himalaya dan ekstrak kulit kayu manis dapat diformulasikan ke dalam bentuk sediaan body scrub yang memenuhi syarat kestabilan dan memiliki efektivitas dalam melembapkan, menghaluskan, dan mencerahkan kulit. Sediaan yang memiliki aktivitas antibakteri paling efektif adalah body scrub yang mengandung ekstrak dengan konsentrasi 10% terhadap bakteri *Staphylococcus aureus*.
Keyword: *Body scrub*, kulit kayu manis (*Cinnamomum burmannii*), *skin analyzer, Staphylococcus aureus*

1. Introduction

Skin care preparations have become a major focus in the modern beauty industry, with more and more people realizing the importance of treating their bodies with effective natural products. One of the important skin care steps is skin exfoliation [1]. Body scrubs are included in the commonly used cosmetic preparations to clean and smooth the skin and remove dead skin cells. Salt can be diversified into cosmetics products such as body scrubs [2]. Salt scrub is environmentally friendly because the raw materials use natural ingredients. Body scrubs have coarse particles with an exfoliator-like effect [3].

An exfoliator is an important key in a body scrub to help the process of exfoliating dead skin cells. One ingredient that can be used as an exfoliator is Himalayan salt. Salt can remove dirt and dead skin cells and moisturize the skin. Apart from that, salt is also used for relaxation and improving blood circulation. The results of several studies prove that the minerals in Himalayan salt have many benefits for skin health. Therefore, the mineral content in salt has the potential to be used as a body care product, namely body scrub [1].

Body scrubs can also be used as antibacterials so they can reduce the growth of body odor bacteria with the addition of certain herbs [4]. One of the herbs that can be used is cinnamon (*Cinnamomum burmannii*). Plants have strong antibacterial properties because of their ability to kill microorganisms which can be used to prevent the growth of bad bacteria on the skin. 50% ethanol extract of C. *burmanii* stem bark has antibacterial activity against ten types of bacteria [5].

Cinnamon is often used as a component in herbal medicine. The concentration of alkaloids, flavonoids and tannins in cinnamon bark has antimicrobial properties. The two main antibacterial ingredients are cinnamaldehyde (55%-65%) and eugenol (4%-8%), which have antibacterial properties [6]. Cinnamon bark as an inhibitor of skin-infectious bacteria such as *Staphylococcus aureus* with an inhibition zone diameter of 15.69 mm at a concentration of 40% [7]. According to Djarot et al, stated that *C. burmanii* bark oil shows better antibacterial activity against gram-positive bacteria than gram-negative bacteria because it contains phenolic compounds.

Based on the background above, the author is interested in making a body scrub preparation from Himalayan salt and cinnamon bark extract (*Cinnamomum burmannii*) and testing the antibacterial activity of the body scrub preparation against *Staphylococcus aureus* which causes skin infections.

2. Method

2.1 Tools

The tools used in this research are, extraction tools, glassware, formulation tools, antibacterial test tools and stability test tools.

2.2 Materials

The materials used in this study are cinnamon bark simplisia, extraction materials, formulation materials, and antibacterial test materials.

2.3 Plant material

Sampling was done purposively, that is, without comparing with the same plants from other regions. The sample used was cinnamon bark obtained from Jl. Pusat Pasar, Medan City, North Sumatra.

2.4 Plant Identification

Cinnamon bark plant samples used in this study were determined at Herbarium Medanense, Department of Biology, Faculty of Mathematics and Natural Sciences, University of North Sumatra, Medan.

2.5 Preparation of Cinnamon bark Powder

Powdered simplicia is made from whole simplicia, simplicia that has been dried through the process of making powder with a tool without causing damage or loss of the required chemical content and sieved with a mesh 60 sieve to obtain powder with a fine powder fineness degree [8].

2.6 Plant Characteristics

Analysis of plant characteristics of cinnamon bark includes macroscopical, microscopical, moisture content, ash and acid insoluble content, as well as water soluble and ethanol soluble.

2.7 Phytochemical Screening of Simplicia and Extracts

Phytochemical screening is carried out to determine the class of secondary metabolite compounds contained in plants. Phytochemical screening of cinnamon bark plants includes analysis of alkaloids, flavonoids, saponins, glycosides, tannins, and steroids/triterpenoids [21].

2.8 Preparation of Cinnamon Bark Extract

Cinnamon bark simplicia powder was extracted by maceration using 96% ethanol solvent.

2.9 Sterilisation of Tools and Materials

Glassware was washed and then dried and wrapped in paper. Heat-resistant equipment and other glassware were sterilised using dry heating in an oven. While tools and materials that are not heat-resistant and other tools are sterilised by wet heating using an autoclave [9].

2.10 Media Preparation

The media used in this study were nutrient agar, nutrient broth, and mueller hinton agar. The media was made according to the procedure instructions on the etiquette.

2.11 Preparation of Bacterial Inoculum

A stock culture of test bacteria was taken using a sterile ose needle, then suspended into a test tube containing 10 mL of Nutrient Broth, the transmittance at a wavelength of 580 nm was measured using a UV-Visible spectrophotometer. The transmittance value of approximately 25% at a wavelength of 580 nm will be used to standardize the volume of stock suspension added to the inoculum agar layer [10].

2.12 Preparation of Cinnamon Bark Extract Test Solution

A total of 5 g of cinnamon bark extract was weighed, then DMSO was added to a total volume of 10 mL and stirred until dissolved and obtained an extract concentration of 500 mg/mL, then dilutions were made with a concentration of 400 mg/mL to 0.78 mg/mL.

2.13 Antibacterial Activity Testing of Cinnamon Bark Extracts

Testing the antibacterial activity of cinnamon bark extract was made in various concentrations with the well method and 3 repetitions were carried out. The positive control used was Clindamycin HCl 1% and the negative control was dimethyl sulfoxide (DMSO)[19]. Then incubated in an incubator at 35 ± 2°C for 18-24 hours, after which the diameter of the growth inhibition area (clear zone) around the wells was measured using a caliper [11].

2.14 Body Scrub Preparations

The formula was modified into a basic formula for himalayan salt body scrub preparations and Cinnamon bark extract can be seen in Table 1. The preparation of body scrub consists of mixing the water phase and oil phase to form a creamy mass. Cinnamon bark extract that has been dissolved with some propylene glycol is added and then crushed homogeneously. Then himalayan salt is added and stirred until homogeneous [12].

Table 1. Body Scrub Formula

Material	Formula (%)				
	usage	F0 (Blank)	F1	F2	F3
Cinnamon bark extract	Active substance	-	2,5	5	10
Stearic acid	Emulsifiers	15	15	15	15
Cetyl alcohol	Thickeners	1	1	1	1
Sorbitol	Humectants	5	5	5	5
Propylene glycol	Humectants	3	3	3	3
Triethanolamine	pH regulator	qs	qs	qs	Qs
Methyl paraben	Preservative	0.1	0.1	0.1	0.1
Himalayan salt	Exfoliator	10	10	10	10
Aquadest (ad)	Solvent	100	100	100	100

2.15 Evaluation of the preparation

Evaluation of body scrub preparation includes organoleptic examination, pH measurement, homogeneity and spreadability testing.

2.16 Stability test

The stability of the body scrub preparation was tested at room temperature and cycling test.

2.17 Test on Volunteers

Testing on volunteers includes skin irritation tests and effectiveness tests using a skin analyser. This test involves humans as volunteers so they must obtain ethical approval (ethical clearance) in advance before implementation from the University of North Sumatra Health Research Ethics Committee.

2.18 Testing Antibacterial Activity of Body Scrub Preparations

Testing the antibacterial activity of cinnamon bark extract body scrub preparations was made in various concentrations with the well method and 3 repetitions were carried out. The positive control used is a body scrub preparation on the market and the negative control is a body scrub base without extract. Then incubated in an incubator at a temperature of 35 ± 2°C for 18-24 hours, after which the diameter of the inhibition area (clear zone) of growth around the wells was measured using a caliper [11].

2.19 Statistical analysis

The values of bacterial inhibition zone were analyzed using Kruskal-Wallis method with Statistical Product and Service Solution (SPSS) version 22 program to determine differences in antibacterial activity on the different concentrations of cinnamon bark extract (*Cinnamomum burmannii*). In addition, the volunteer's moisture, pores, and skin blemishes were analyzed using Kruskal-Wallis and Anova method to determine differences in effectiveness between body scrub preparations on the different concentrations of cinnamon bark extract.

3. Result and Discussion

3.1. Plant identification

Plant identification conducted at Herbarium Medan, Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Sumatera Utara, Medan stated that the plant parts used in this study were cinnamon (*Cinnamomum burmannii*), *Lauraceae* family.

3.2. Plant characteristic

The results of macroscopic analysis of cinnamon bark are stem bark, curled, longitudinal, thick, flat, yellowish brown or brown to reddish brown outer surface, pale wavy longitudinal or slightly grooved stripes, dark reddish brown to blackish brown inner surface, uneven fracture marks; characteristic odor; slightly sweet taste. The results of macroscopic examination can be seen in **Figure 1.** The results of microscopic analysis of cinnamon bark simplicia powder showed the presence of oil cells, sclereides, and sclerenchyma. The results of microscopic examination of cinnamon bark simplicia powder can be seen in **Figure 2.** Which these results have met the requirements of the Indonesian herbal pharmacopoeia 2nd edition. The results of cinnamon bark characteristics showed that all parameters meet the requirements of the 2nd edition of the Indonesian herbal pharmacopoeia. The results of cinnamon bark characteristics can be seen in **Table 2.**

Figure 1. Macroscopic analysis of Cinnamon bark

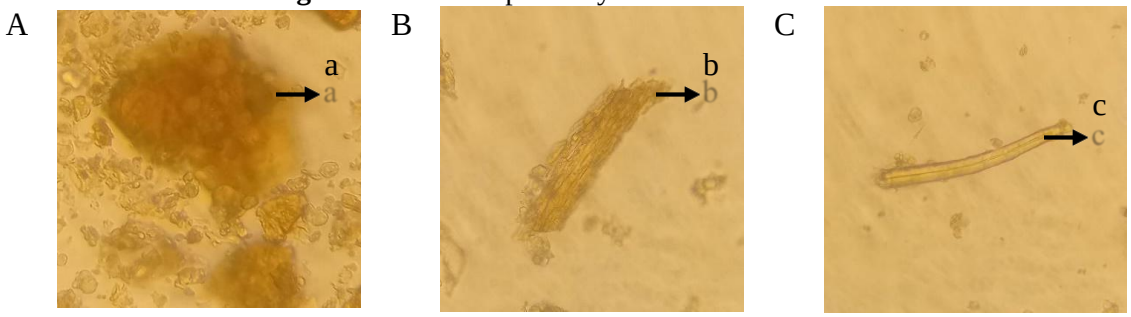

Figure 2. Microscopic analysis of Cinnamon bark (40x10) (A) Oil Cell; (B) Sklereida; (C) Skelerenkim

Table 2. Simplicia characteristic and extract Cinnamon bark

Parameter	Simplicia (%)	Extract simplicia (%)
Moisture content	6,65	2,65
Water soluble	16,85	-
Ethanol soluble	28,14	-
Total ash	1,87	0,14
Acid insoluble ash	0,3	0,09

3.3. Phytochemical screening

Table 3. Phytochemical screening of cinnamon bark

Chemical compound	Identification	
	Simplicia	Extract
Alkaloid	+	+
Flavonoid	+	+
Glikosida	+	+
Saponin	+	+
Triterpenoid	+	+
Tanin	+	+

Note:
(+): contains a class of secondary metabolite compounds
Identification of chemical compound groups in simplicia and cinnamon bark extracts show the content of secondary metabolite compounds, namely alkaloids, flavonoids, glycosides, saponins, triterpenoids, and tannins which are compounds that function as antibacterials, can be seen in **Table 3**.

3.4. Result of extraction

The results of cinnamon bark extraction using maceration method with 96% ethanol solvent, then evaporated the ethanol solvent from the extract with a rotary evaporator at 50°C, then the liquid extract obtained was concentrated with an oven temperature at 45-50°C to form a thick extract. The results of the extraction process from 500g of cinnamon bark simplicia powder using 96% ethanol are 142g with a yield of 28.40%.

3.5. Antibacterial activity

The results of the antibacterial activity analysis using the agar well diffusion method showed in the **Table 4** that cinnamon bark extract has the ability to inhibit the growth of *Staphylococcus aureus* bacteria as indicated by the clear zone around the wells containing the extract.

Based on the results of antibacterial activity testing that has been carried out, it was found that cinnamon bark extract has a minimum inhibitory concentration (KHM) of 1.56 mg/ml (0.156%) in inhibiting the growth of *Staphylococcus aureus* bacteria. This is indicated by the presence of an inhibition zone with a diameter of 7.98 ± 0.32 mm on *Staphylococcus aureus*. In the negative control used, namely DMSO, there is no area of inhibition of bacterial growth, so it can be confirmed that the inhibition zone shown is purely from the antibacterial activity of cinnamon bark extract [18].

Table 4. Extract antibacterial activity of cinnamon bark

Concentration (mg/ml)	Inhibition zone diameter of *Staphylococcus aureus bacteria* ($\bar{x}$ mm ± SD; n=3)
K+	29,87 ± 0,05
500	18,75 ± 1,56
400	17,40 ± 1,25
300	16,77 ± 0,98
200	16,37 ± 0,85
100	15,73 ± 0,57
75	15,18 ± 0,73
50	14,90 ± 0,68
25	14,60 ±0,74
12,5	14,33 ± 0,67
6,25	10,48 ± 0,26
3,125	9,33 ± 0,48
1,56	7,98 ± 0,32
0,78	-
Blank	-

Note: (-) no barrier; (K+) clindamycin HCl 1%; (Blank) DMSO

Meanwhile, Clindamycin HCl 1% was used as a positive control because it has been proven to have antibacterial activity. By using a positive control that has been proven to have antibacterial activity, to ensure the validity of the antibacterial activity test procedure [13].

3.6. Body scrub evaluation

Body scrub preparations were made using a standard body scrub formula [12] with modifications using Himalayan salt exfoliators. The selection of the extract concentration used was based on consideration of the diameter of the extract inhibition against *Staphylococcus aureus*, so three concentrations were selected, namely 2.5; 5, and 10% based on the inhibition zone obtained which was included in the strong inhibition zone category. In this case, the highest concentration of the preparation chosen was 10%, because higher extract concentrations can result in a decrease in pH which is increasingly acidic. So it is expected that the resulting preparation meets the range of pH requirements for the skin, which is 4.5-6.5 [14].

Figure 3. Himalayan Salt and Cinnamon Bark Extract Body Scrub Preparation

The results of organoleptic examination of body scrub preparations are purplish red to brownish red in colour, distinctive aroma, and semi-solid dosage form. The organoleptic of the body scrub preparation obtained is influenced by the amount of concentration of cinnamon bark extract used. The results of organoleptic examination can be seen in **Figure 3.**

The pH of the body scrub preparation was checked for 12 weeks at room temperature (25℃) and observed every 2 weeks. Data on the results of the pH examination of the preparation can be seen in **Figure 4(A)**. The preparation is expected to have a pH that is the same or as close as possible to the physiological pH of the skin, which is 4.5-6.5 because if the more alkaline or more acidic a material that hits the skin, the more difficult it will be to neutralise it, as a result the skin becomes dry, cracked, sensitive and prone to infection [15].

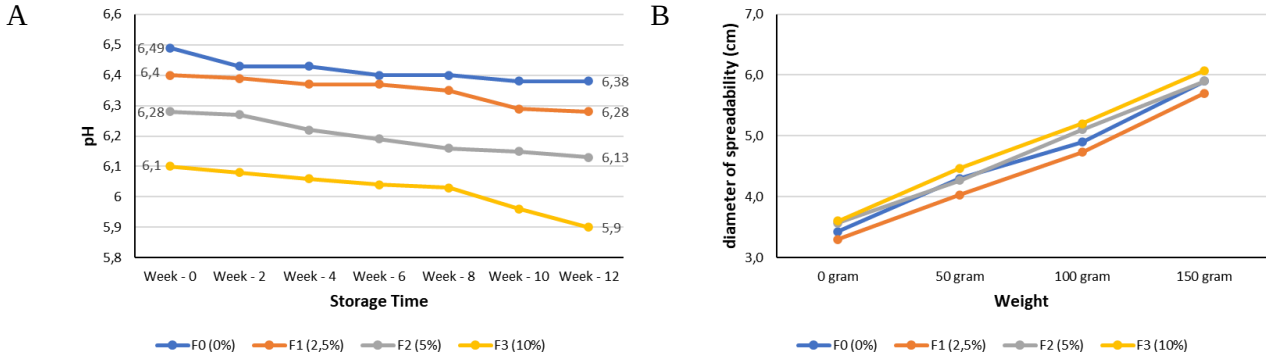

Figure 4. (A) 12 Weeks of Storage; (B) Scattering Power

The examination of the spreadability of body scrub preparations was carried out on F0, F1, F2, and F3. The results of the spreadability of body scrub preparations can be seen in **Figure 4(B)**. Body scrub preparations with various concentrations fulfil the requirement of spread diameter measured after 1 minute. The results show that good spreadability occurs in the range of 5-7 cm, which signifies a consistency that is very suitable for good use [22]. The greater the spreadability of the preparation, the better it is because it will provide wider contact between the body scrub and the skin [16].

The preparation is said to be homogeneous if there are no visible coarse grains [17]. In formulas F0, F1, F2 and F3, homogeneous preparations were obtained where salt and cinnamon bark extract were evenly distributed in the body scrub base. The homogeneity results can be seen in Figure 5.

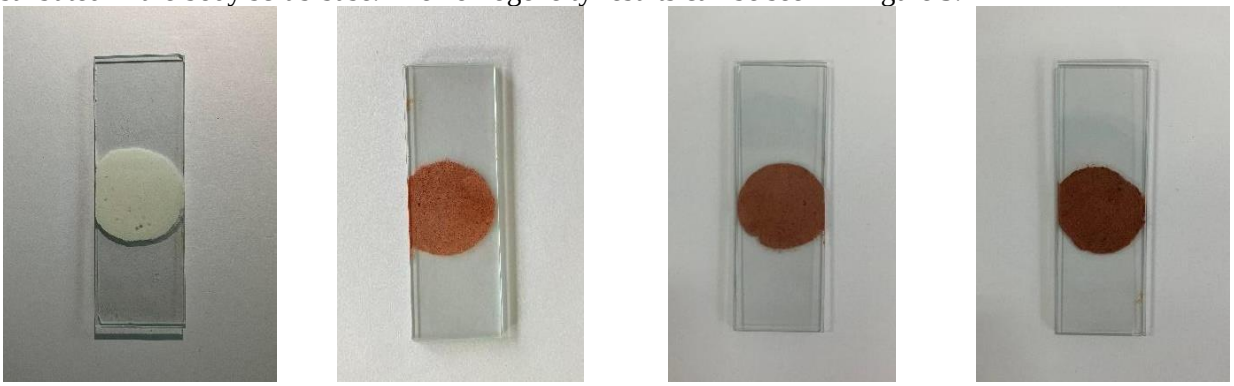

Figure 5. Homogeneity check of preparations

3.7. Result of physical stability

Body scrub preparations in formulations F0, F1, F2, and F3 showed stable results in terms of organoleptic. During the storage period of 12 weeks at room temperature and 6 cycles in the cycling test, there were no significant changes in colour, odour and shape of the body scrub preparations. This states that the body scrub

preparations with formulations F0, F1, F2, and F3 have good stability.

3.8. Testing result on volunteers

Irritation testing was carried out by applying the body scrub preparation to the inner forearm skin. Then the parameters observed were redness, itching or swelling of the treated skin. The results of the irritation test on the volunteer's skin were no irritation.

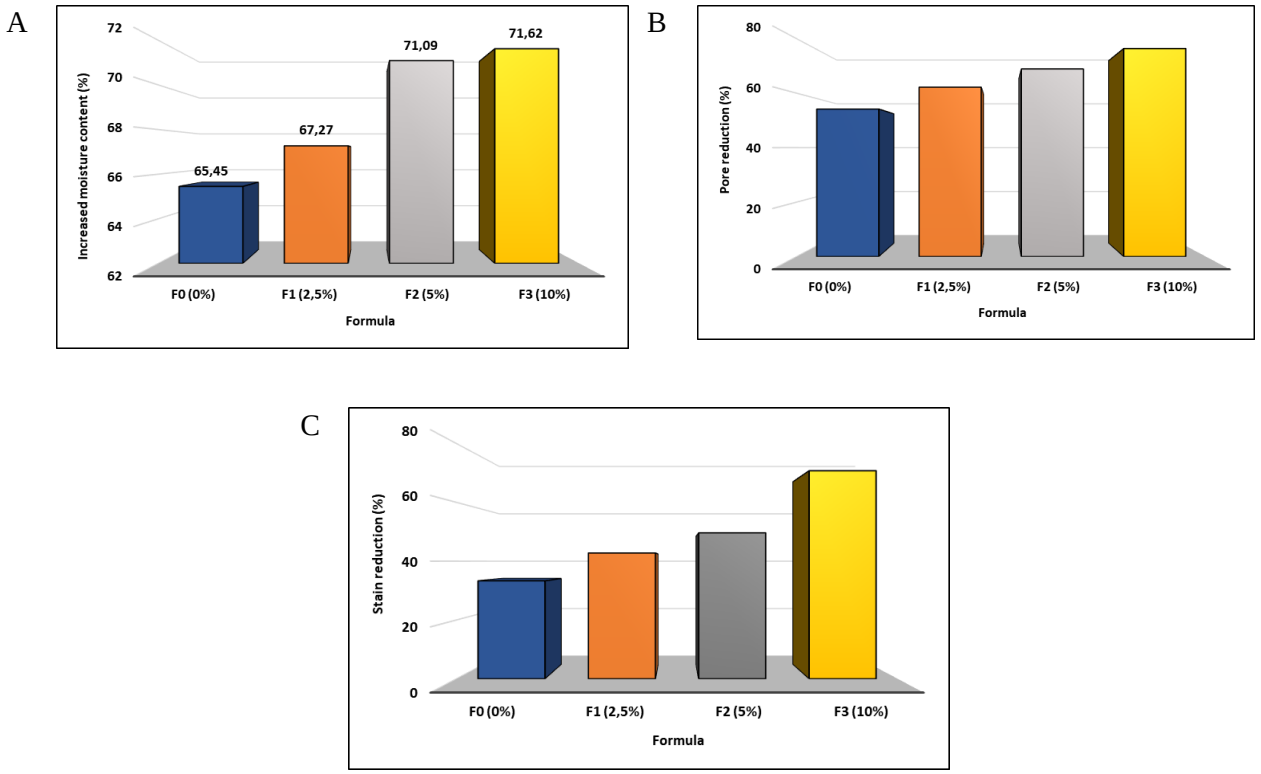

Figure 5. (A) Moisture content; (B) Pore reduction; (C) Stain reduction

Measurement of moisture on the skin using a moisture checker tool found on the Aramo skin analyzer device. Testing was carried out for 4 weeks with the use of body scrub cream preparations 2 times a week. Seen figure 5A. In Figure 5A, it can be seen that the percent increase in moisture in the skin is getting bigger as the concentration of cinnamon bark extract increases in the preparation formula. The initial condition of the volunteer's skin on average is in the dehydrated-normal range, after the use of the preparation there is an increase in moisture to normal-hydrated. The average percentage recovery in each formula is for F0 (blank) of 65.45%, F1 of 67.27%, F2 of 71.09% and F3 of 71.62%. The results of statistical analysis showed that there was no significant difference ($p>0.05$) in the increase in skin moisture content between formulas during the use of the 4-week [20].

Pore measurement using a skin analyser device. Seen figure 5B. In that figure can be seen that the use of body scrub has the effect of reducing the size of pores on the skin of volunteers where the average initial condition of volunteer skin pores ranges from several large conditions, after the use of the preparation there is a decrease in the size of skin pores to small conditions. The average percentage recovery in each formula is for F0 (blank) of 54.16%, F1 of 62.21%, F2 of 68.89% and F3 of 76.38%. The results of statistical analysis showed that there was a significant difference ($p<0.05$) in the decrease of pores on the skin between formulas during the use of the preparation for 4 weeks.

Stain (melanin) measurement using the skin analysis device. Seen figure 5C. In that figure can be seen that the use of body scrub has the effect of reducing blemishes on the skin of volunteers where the average initial condition of volunteer skin blemishes ranges from the condition of many blemishes, after the use of the preparation there is a decrease in the size of skin pores to a condition of few and some blemishes. The average percentage recovery in each formula is for F0 (blank) of 33.30%, F1 of 42.78%, F2 of 49.62% and F3 of 70.73%. The results of statistical analysis showed that there was a significant difference ($p<0.05$) in the decrease in skin blemishes between formulas during the use of the 4-week preparation.

3.9. Result of antibacterial activity of preparation

Concentrate (mg/ml)	Inhibition zone diameter of *Staphylococcus aureus* bacteria ($\bar{x}$ mm ± SD; n=3)
F0	-
F1	13,28 ± 0,60
F2	13,57 ± 0,63
F3	14,20 ± 0,59
K+	15,10 ± 0,46

Note: (F0) Salt body scrub dosage formula without cinnamon bark extract (blank); (F1) Body scrub dosage formula of salt and cinnamon bark extract 2.5%; (F2) Body scrub dosage formula of salt and cinnamon bark extract 5%; (F3) Body scrub dosage formula of salt and cinnamon bark extract 10%; (K+) Body scrub preparations on the market

Based on the results of the antibacterial activity test of salt body scrub preparations and cinnamon bark extract, it shows that in F1 (2.5%) a strong inhibition zone is obtained against *Staphylococcus aureus*, namely 13.28 ± 0.60 mm; in F2 (5%), namely 13.57 ± 0.63 mm; and F3 (10%), namely 14.20 ± 0.59 mm. F0 (blank) has no inhibition zone against *Staphylococcus aureus* bacteria, this indicates that only the active ingredients, namely extracts, provide antibacterial activity against these bacteria.

The results of the statistical test show a significance value of $p<0.05$, which means that there is a significant difference between the treatment results on the antibacterial activity of *Staphylococcus aureus* at each concentration of the preparation extract. Furthermore, the Mann-Whitney test was conducted to analyse the results further.

4. Conclusion

Based on the results of the study, it is concluded that cinnamon bark extract has antibacterial activity against *Staphylococcus aureus* bacteria. Himalayan salt and cinnamon bark extract (*Cinnamomum burmannii*) can be formulated into body scrub preparations that meet physical quality requirements, are non-irritating and stable (color, odor, and shape) at room temperature; high and low during 12 weeks storage and effective as body scrub preparations. Himalayan salt and cinnamon bark extract 2.5; 5; and 10% body scrub preparations had antibacterial activity against *Staphylococcus aureus* and gave a significant antibacterial response to F0 (blank) which showed no resistance to bacterial growth. From the three concentrations, the 10% concentration is considered the optimal concentration because it has the greatest inhibition and is effective as a body scrub preparation.

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