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Research Article

Antibacterial Activity and Sensory Profile of Sambong (*Blumea balsamifera*) Leaf Extract as a Liquid Hand Soap

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ABSTRACT

Aim/Background: Medicinal plants have long been integral to traditional healing, particularly in Asia. This study investigates the antibacterial efficacy and sensory attributes of Sambong (*Blumea balsamifera*) liquid hand soap, focusing on its inhibitory effects against *Staphylococcus aureus* (Gram-positive Bacteria) and *Escherichia coli* (Gram-negative Bacteria). Additionally, it assesses user perceptions regarding scent, color, and overall appeal, comparing Sambong soap to commercially available liquid hand soap. **Materials and Methods:** This research employs a Research and Development (R&D) approach with a quantitative experimental design involving 30 participants. Each soap sample was tested in triplicate to ensure reliability. **Results:** The antibacterial assessment revealed that neither Sambong nor the commercial soap exhibited inhibitory effects against *E. coli*. However, Sambong soap demonstrated superior antibacterial activity against *S. aureus*, with an average inhibition zone of 12.43±0.59 mm, compared to the commercial soap's 10.07±1.06 mm. Given the lack of effectiveness against *E. coli*, further improvements are recommended to enhance activity against GNB. Sensory evaluation yielded an average rating of 2.90, categorized as moderate, indicating room for refinement in fragrance and visual appeal. **Conclusion:** Sambong soap consistently inhibited *S. aureus,* with inhibition zones measuring 11.6 mm, 12.9 mm, and 12.8 mm. The commercial soap, by contrast, exhibited inhibition zones ranging from 8.7 mm to 12.8 mm, indicating variable antibacterial efficacy. Neither soap was effective against *E. coli*, with a uniform 0 mm inhibition zone. Sensory evaluation scores averaged 2.90 for Sambong and 2.60 for the commercial soap, with Sambong showing greater consistency (SD=0.50) than its commercial counterpart (SD=0.76). An independent *t*-test found no statistically significant difference in sensory perceptions (t=1.81, p=0.076; p>0.05), suggesting that despite formulation differences, both soaps were perceived similarly regarding sensory attributes.

Keywords: *Blumea balsamifera*, *Escherichia coli* (GNB), Liquid Hand Soap, Sambong, *Staphylococcus aureus* (GPB).

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INTRODUCTION

Poor personal hygiene, particularly inadequate handwashing, significantly contributes to food contamination, often leading to foodborne illnesses.[1] This issue is prevalent in various settings, including restaurants, homes, and schools. Bacterial infections caused by improper hand hygiene pose a substantial public health risk, as pathogens can spread through direct and indirect contact,[2] Hand transmission plays a crucial role in disease spread, so proper hand hygiene is widely recognized as one of the most effective measures for preventing infectious diseases.[3,4] Many commercial soaps contain synthetic chemicals that may cause skin irritation or adverse reactions.[5] The widespread use of these chemical-based hand washes has been linked to skin dryness, rashes, and other dermatological issues.[6] In contrast, natural products derived from medicinal plants offer a safer and more skin-friendly alternative. These plant-based formulations are affordable and readily available and exhibit various beneficial biological properties, including antibacterial, antifungal, antiviral, antioxidant, and anti-inflammatory activities. As concerns over resistance to synthetic antimicrobial agents continue to grow, medicinal plants are gaining recognition as valuable sources of natural antimicrobial compounds, offering a sustainable and practical approach to hygiene and infection control.[7] Sambong, also known as *B. balsamifera*, is a remarkable flowering plant belonging to the genus *Blumea* within the esteemed Asteraceae family. It is a renowned Indigenous medicinal herb and functional tea in multiple Asian countries, such as China, Malaysia, the Philippines, Thailand, and Vietnam.[8]

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Sambong has numerous physiological activities, such as antioxidant, antibacterial, antifungal, anti-inflammatory, and so on.[9] The leaves of this plant are also used in folk medicine to treat fever, lumbago, and skin diseases, to promote appetite, and to heal wounds, including liver cirrhosis.[10] Moreover, sambong has demonstrated multiple significant antibacterial activities against several bacteria, specifically *E. coli* and *S. aureus*.[11]

Touching surfaces, placing your hands in public places, and not having good hygiene can be dangerous. Harmful microorganisms, such as bacteria, can cause infections and diseases when they come into contact with the skin. Many chemical liquid hand soaps on the market can sometimes irritate the skin. *B. balsamifera* is known for its medicinal properties. However, its use as natural antibacterial liquid hand soap is yet to be studied.

B. balsamifera leaf extract has antibacterial activity and can kill or inhibit the growth of these harmful bacteria. Natural ingredients such as Sambong can be safe for everyone to use and environmentally friendly. People could switch from using chemical products to natural ones that are safer. Choosing natural liquid hand soap could help individuals and the public's health.

This study aimed to evaluate the effectiveness of *B. balsamifera* leaf extract as liquid hand soap. This study tested the zone inhibition of formulated liquid hand soaps using *B. balsamifera* leaf extracts. It also assessed the sensory profile of the liquid hand soaps, such as their smell and color.

MATERIALS AND METHODS

Research Design

This study utilized a Research and Development (R&D) framework alongside a quantitative experimental design to evaluate the effectiveness of *B. balsamifera* leaf extract in liquid hand soap. The formulation process involved drying and treating Sambong leaves during the development phase. Quantitative data, including participant sensory evaluations, were collected, statistically analyzed, and compared with commercially available liquid hand soaps. The antibacterial efficacy of the formulated soap was determined using the zone of inhibition test against *S. aureus* and *E. coli*. The inhibition zones were then compared to commercial hand soaps to assess significant differences in antibacterial activity. A sensory evaluation was also performed to gauge consumer perception of the soap's scent, color, texture, and overall skin feel.

Locale of the Study

The research was conducted in Barangay 10 Zone 1, Malaybalay City, Bukidnon, Philippines. Its exact coordinates are 8.1269N+125.1237E, Impalambong 8700 Malaybalay Northern Mindanao. The researchers prepared the liquid hand soaps in the San Isidro College Wet Laboratory with significant assistance.

After preparing the liquid hand soaps, the researchers sent the product to Central Mindanao University (CMU) in Musuan, Maramag, Bukidnon, for antibacterial testing. The researchers were accompanied and arranged suitable transportation. The plant was then sent to the Center for Biodiversity Research and Extension in Mindanao (CEBREM) at Central Mindanao University for plant identification.

Moreover, this study acquired GPB (*S. aureus*) and GNB (*E. coli*) bacteria from the Central Mindanao University Veterinary Medicine Laboratory.

Participants of the Study

This study involved a carefully selected group of 30 participants, including medical professionals and individuals working in various healthcare facilities. Before participating in the research, each participant provided informed consent, ensuring they were fully aware of the study's purpose and procedures. The research was conducted in accordance with strict ethical guidelines, demonstrating a commitment to high standards in medical research. According to,[12] healthcare workers play a vital role in promoting health by providing preventive and curative measures that meet the needs and expectations of individuals and populations. Their expertise in addressing health requirements can lead to improved overall health outcomes. Therefore, including healthcare professionals in the sensory evaluation of liquid hand soap is particularly valuable, as their insights can enhance our understanding of the product's acceptability and effectiveness.

The sensory evaluation aimed to assess both the quality and efficacy of the liquid hand soap. By gathering feedback from individuals with firsthand experience and knowledge of hygiene practices, the study seeks to provide a comprehensive evaluation of the product, ultimately contributing to better health practices in clinical settings.

Research Instruments

A product appraisal questionnaire was utilized to gather insights from 30 medical participants regarding the antibacterial liquid hand soap made from *B. balsamifera*.[13-15] The questionnaire was adapted from a previous study and employed a five-point Likert scale, with responses ranging from 5 to 1: 5 (Strongly Agree), 4 (Agree), 3 (Neutral), 2 (Disagree), and 1 (Strongly Disagree).[16]

Data Gathering Procedure

Collection of B. balsamifera

For the collection of the samples, *B. balsamifera* plants were picked by the researchers in Purok 2 Maligaya, Malaybalay City, Bukidnon. These plants are known for their medicinal properties and were carefully gathered by the researchers to ensure their characteristics stay intact. The researchers collected 2 kg of *B. balsamifera* and transported the samples to Central Mindanao

University for detailed botanical analysis. This analysis then confirmed the species identity and documented its specific traits, ensuring that the plant material used in the production of the liquid hand soap is accurately identified.

Preparation of *B. balsamifera*

This study followed the methodology outlined by,[17] wherein the process began with collecting 2 kg of *B. balsamifera* leaves, which were then thoroughly washed with clean water to remove dirt and impurities. This initial cleaning step was essential to ensure the leaves were free from contaminants. Following the washing process, the fresh leaves were air-dried for two weeks. This drying phase aimed to significantly reduce the moisture content, which is crucial for preserving the leaves and the subsequent processing steps. Once the leaves were adequately dried, they were finely ground using a blender to produce a uniform powder. This powder form enhances the versatility of the leaves for various applications, including herbal preparations and research purposes.

Preparation of Sambong (*B. balsamifera*) Leaf Extract

In the study, dried and ground leaves of *B. balsamifera* were subjected to extraction using a solvent of 95% ethanol, employing the maceration method. This process involved soaking the plant material in ethanol to allow the solvent to penetrate and dissolve the bioactive compounds present in the leaves. By carefully controlling the extraction conditions, the researchers aimed to maximize the yield of phytochemicals, which are believed to possess various therapeutic properties, thereby laying the groundwork for further investigations into the potential benefits of *B. balsamifera* extracts described in.[18] In this procedure, 100 g of powdered leaves were combined with 1,000 mL of 95% ethanol in a beaker, which was then sealed with a cork. To limit light exposure, the beaker was wrapped in aluminum foil and kept at room temperature for 72 hr to allow for thorough maceration.

After the 72 hr period, the mixture was filtered through filter paper to separate the solid materials from the liquid. To ensure all residual plant material was removed, the liquid was further strained using cheesecloth. The resulting filtrate was then concentrated using rotary evaporation applied under controlled temperature and reduced pressure to remove excess ethanol and obtain a more concentrated extract.

Finally, the concentrated extract was stored in a refrigerator for 3 days until it was ready to be used in the formulation as liquid hand soap.

Preparation of Treatments

The crude extract of *B. balsamifera* leaves was diluted using ethanol and distilled water. To prepare a 5% solution, 1.5 g of crude extract was measured (calculated as 30 mL×0.05). Ethanol was then gradually added in small increments (1 mL at a time) while continuously stirring until the extract was fully dissolved. Once dissolved, distilled water was added to reach a final volume of 30 mL. The diluted extract was then incorporated into the soap base in a clean beaker, with the concentration adjusted as needed for the liquid hand soap formulation. The final mixture consisted of 30 mL of the 5% crude extract solution and 95 mL of the soap base, ensuring thorough mixing for uniform distribution.

Preparation of Liquid Soap Base

For the formulation of liquid hand soap, the hot process method by.[19] The preparation of the soap base began with heating 45.5 mL of coconut oil in a beaker at a controlled temperature of 70 °C for a duration of 15 min to ensure proper liquefaction and integration of essential properties. Simultaneously, 18.2 mL of glycerin was heated using the same conditions, allowing both components to reach optimal blending temperatures.

Upon conclusion of the heating phase, the coconut oil and glycerin were combined while maintaining the temperature at 70 °C. The mixture was gently stirred for an additional 15 min, ensuring uniformity and stability as it cooled slightly. During this time, 11.5 g of potassium hydroxide were accurately measured using an analytical balance for precision. In a separate container, 38 mL of distilled water was prepared. Next, the potassium hydroxide was carefully dissolved in distilled water. This was achieved by stirring the mixture until it was clear and homogeneous, resulting in a lye-water solution essential for saponification. Once the lye-water solution reached a clear consistency, it was gradually added to the heated coconut oil. Following the incorporation of the lye mixture, the preheated glycerin was introduced into the blend. The entire solution was maintained at 70 °C and continuously stirred for 50 min, allowing sufficient time for the reaction to occur and the soap base to form effectively. To enhance the final product, 30 mL of Sambong leaf extract was added to the prepared soap base, which amounted to a total of 150 mL. The mixture was thoroughly stirred to ensure even distribution of the extract, ensuring that its beneficial properties were integrated fully into the soap base. This meticulous process resulted in a well-crafted soap base enriched with the natural qualities of coconut oil, glycerin, and Sambong leaf extract.

Antibacterial Zone of Inhibition Test

To assess the antibacterial activity of *B. balsamifera* leaf extract as formulated liquid hand soap, samples were sent to the Central Mindanao University, College of Veterinary Medicine, for a zone of inhibition test. The test conducted underwent a Kirby-Bauer (Disk Diffusion) method against *S. aureus* (GPB) and *E. coli* (GNB) strains with three replicates of each bacterium.

Furthermore, Sambong liquid hand soap's antibacterial effectiveness was then compared to "Cleeny", local Commercial liquid hand soap. The commercial liquid hand soap was also tested

using the Kirby-Bauer (Disk Diffusion) method to determine their inhibitory effects against GPB and GNB.

In contrast, in a similar study,[20] aimed to develop an herbal hand wash by incorporating ginger extract from the plant Zingiber officinale, well-known for its natural antimicrobial properties. The need for effective hand hygiene products has surged, particularly in light of increasing awareness about the spread of pathogens and infectious diseases. Commercial hand washes are readily available, but the integration of herbal extracts could provide an alternative that combines efficacy with natural ingredients.

To assess the antimicrobial activity of the ginger-infused hand wash, the research employed the disc diffusion method. This technique is widely recognized in microbiological studies for its reliability in measuring the effectiveness of antimicrobial agents against various bacterial strains. During the experiments, the ginger-based formulation demonstrated impressive antimicrobial activity against common skin pathogens, which are often responsible for infections and irritations. The results showed that the zones of inhibition areas where microbial growth prevented and were comparable to those observed in commercial antiseptic soaps, indicating that the herbal hand wash could serve as a viable alternative.

In addition to its antimicrobial properties, the study also included a sensory evaluation to assess user acceptability. This aspect is crucial since the overall experience of hand hygiene products can greatly influence their regular use. Participants reported a high level of satisfaction regarding the fragrance and skin feel of the ginger-based hand wash. The pleasant scent and favorable texture suggest that users not only found the product effective but also enjoyable to use.

Overall, the findings of this study highlight the potential of herbal formulations, specifically ginger extract, in creating effective hand hygiene products. The combination of significant antimicrobial efficacy and positive user experience underlines the value of incorporating natural ingredients into everyday hygiene practices. This research contributes to the growing body of evidence advocating for the use of herbal extracts as safe and effective components in personal care products.

Statistical Treatment of Data

This study employed descriptive statistics, including percentages, means, and standard deviations, to outline the sample data. These statistical measures were used to evaluate the hypothesis and analyze the findings. The mean and standard deviation were calculated to present the measured zone of inhibition and sensory perception results. A *t*-test was conducted to compare the antibacterial activity of the liquid hand soaps. Additionally, a *t*-test was used to analyze the sensory perception of *B. balsamifera* liquid hand soap. In this analysis, a *p*-value of less than 0.05 was established as the criterion for determining statistical significance. This means that any result falling below this threshold is considered statistically significant, implying that there is a high likelihood that the observed effect is not due to random chance. To carry out the statistical evaluation, the VassarStats tool was utilized, which provided the necessary computational support for analyzing the data., adapted from.[21]

Ethical Consideration

In ethical consideration, the researchers followed the ethical standards needed to conduct this research. The utmost respect was given to the data and results collected throughout the experimentation and investigation of this study. Additionally, the researchers thoroughly explained the study's purpose to the participants. This information ensured that the participants were fully informed of the goals and considered their involvement in the study.

RESULTS

Zone of Inhibition of *B. balsamifera* and Commercial Liquid Hand Soap

Each sample underwent three replicate tests to ensure accuracy. The Sambong liquid hand soap exhibited vigorous antibacterial activity (Table 1) for *S. aureus*, with inhibition zones of 11.6 mm, 12.9 mm, and 12.8 mm across trials. The commercial liquid soap also showed antibacterial effects, with inhibition zones ranging from 8.7 mm to 12.8 mm. While Sambong soap consistently demonstrated decisive antibacterial action, the commercial soap's efficacy varied from moderate to strong.

Table 1: Zone of Inhibition of the B. balsamifera and Commercial liquid hand soap against GPB and GNB (*S.aureus* and *E. coli*)

		Bacterial/Isolate Zone of Inhibition (mm)	
		Gram-positive Bacteria	Gram-negative Bacteria
		S. aureus	***E. coli***
	1	11.16	*0*
Sambong	2	12.90	0
	3	12.80	0
	1	8.70	0
Commercial	2	10.20	0
	3	12.80	0

Conversely, neither the Sambong nor the commercial soap exhibited antibacterial effects against *E. coli*, as indicated by a consistent 0 mm inhibition zone in all trials. This suggests that both formulations are effective against Gram-positive bacteria like *S. aureus* but ineffective against Gram-negative bacteria *like E. coli*. The results indicate that Sambong soap performs comparably to commercial soap against *S. aureus* but lacks efficacy against *E. coli*. Further testing of *B. balsamifera* (Sambong) leaf extracts against *S. aureus* using different solvents revealed variations in antibacterial activity. The ethanolic extract produced a weak inhibition zone of 2.4 mm, while the ethyl acetate extract demonstrated moderate activity with a 9.2 mm inhibition zone. The n-hexane extract had similar weak activity, with an inhibition zone of 2.3 mm. The positive control (a known antibacterial agent) showed a more potent inhibition zone of 14 mm. In contrast, the negative control exhibited no inhibition (0 mm), confirming that inactive components had no antibacterial effect.

Particularly, in a study conducted by,[22] the antibacterial properties of leaf extracts from *B. balsamifera* using various solvents. A key focus was to determine how the solvent choice influenced the antibacterial efficacy of the extracts. The results showed that the ethyl acetate extract was the most effective, exhibiting a remarkable zone of inhibition of 9.2 mm against the bacterial strain *S. aureus*. This suggests that ethyl acetate is a suitable solvent for extracting the active antibacterial compounds present in the leaves of *B. balsamifera*. In comparison, the ethanol and n-hexane extracts were significantly less effective, yielding inhibition zones of 2.4 mm and 2.3 mm, respectively. These findings highlight a notable difference in the antibacterial activity of *B. balsamifera* leaf extracts depending on the solvent used for extraction.

Furthermore, it is important to note that no significant inhibitory effects were observed against *E. coli* in any of the extracts tested. This indicates that while *B. balsamifera* may possess antibacterial properties, its effectiveness varies across bacterial strains. Overall, this study's results underscore the importance of solvent selection in the extraction process. Solvent selection plays a crucial role in determining the antibacterial efficacy of the extracts derived from *B. balsamifera* leaves. This could have implications for the development of natural antibacterial agents derived from plant sources. Moreover, numerous soap ingredients contributed to antibacterial properties, including Potassium Hydroxide (KOH), Virgin Coconut Oil (VCO), and glycerin. Studies indicate that KOH alone can reduce microbial presence and enhance

Table 2: Product Evaluation of the Medical Professional Participants for the Sambong (*B. balsamifera*) Liquid Hand Soap.

Product Evaluation of Sambong Liquid Hand Soap			
	Mean	SD	Interpretation
The product is pleasing to the eyes.	2.83	0.53	Moderate
The soap conveys a sense of cleanliness or freshness.	3.70	0.44	High
The product possesses a very pleasant smell.	2.33	0.61	Low
My overall impression of the product is very positive.	2.96	0.31	Moderate
I would recommend the product to others.	2.70	0.61	Moderate
Overall Mean and Standard Deviation.	2.90	0.50	Moderate

Table 3: Product Evaluation of the Medical Professional Participants for the Commercial Liquid Hand Soap.

Product Evaluation of Commercial Liquid Hand Soap			
	Mean	SD	Interpretation
The product is pleasing to the eyes.	2.17	0.87	Low
The soap conveys a sense of cleanliness or freshness.	2.67	0.76	Moderate
The product possesses a very pleasant smell.	2.77	0.77	Moderate
My overall impression of the product is very positive.	2.60	0.62	Moderate
I would recommend the product to others.	2.77	0.77	Moderate
Overall Mean and Standard Deviation.	2.60	0.76	Moderate
Mean Range	**Descriptor**	**Scale**	**Interpretation**
4.20-5.00	Strongly Agree	5	Very High
3.40-4.19	Agree	4	High
2.60-3.39	Neutral	3	Moderate
1.80-2.49	Disagree	2	Low
1.00-1.79	Strongly Disagree	1	Very Low

antimicrobial activity when combined with lauric acid from coconut oil.[23]

Similarly, glycerin has been reported to exhibit antibacterial effects against various microorganisms.[24] However, despite these contributions, the soap formulation was not strong enough to inhibit the growth of Gram-negative bacteria. Additionally, previous research on *B. balsamifera* suggests antimicrobial activity against several microorganisms. However, studies using methanolic, chloroform, and other plant extracts consistently reported no inhibition against *E. coli*, aligning with this study's findings.

Participants' sensory perception of *B. balsamifera* and Commercial Liquid Hand Soap

The Sambong liquid hand soap received a mean appearance score of 2.83, interpreted as moderately pleasant, indicating that while visually acceptable, it was not particularly outstanding. Its ability to provide a sense of cleanliness or freshness was rated the highest, with a mean score of 3.7, which is considered high, suggesting that users strongly felt it gave a fresh and clean sensation. However, the scent received a lower mean score of 2.33, which is interpreted as low, meaning many users did not find the fragrance appealing. The overall impression of the product was 2.96, which is categorized as moderate, reflecting a generally positive but not exceptional perception. Lastly, the willingness to recommend the product had a mean score of 2.7, also moderate, indicating that some users would recommend it while others were hesitant. Overall, the soap achieved a mean score of 2.90, which is interpreted as moderate, signifying an acceptable performance but with room for improvement, particularly in scent. On the other hand, the commercial liquid hand soap had a lower appearance score of 2.17, which was interpreted as unpleasant; suggesting that its visual appeal was not well-received. Its ability to convey cleanliness and freshness was rated at 2.67, considered moderate, showing that users expected it to provide a clean feeling but not as strongly as the Sambong soap. The scent was rated the highest among its attributes, with a mean score of 2.77, indicating a neutral or everyday fragrance. The overall impression received a mean score of 2.6, also moderate Tables 2 and 3. Lastly, the willingness to recommend the commercial soap scored 2.77, among its highest ratings, suggesting a moderate level of user agreement in recommending it to others. The commercial soap attained an overall mean score of 2.60, indicating acceptable performance but highlighting the need for improvements in visual appeal. Their appearance and smell influence products' general acceptability, both significant factors.[25] Moreover, healthcare workers contributed to this study by providing insights into hygiene and product acceptability, which ensures cleanliness. Additionally, a lack of knowledge about hygiene may lead to misunderstandings regarding cleanliness.[26,27]

Table 4: Zone of Inhibition (Significant Difference) between *B. balsamifera* Liquid hand soap and Commercial Liquid hand soap.

	Bacteria/Isolate Zone of Inhibition (mm)	
	Gram-positive bacteria	Gram-negative bacteria
	S. aureus	*E. coli*
Sambong	12.43±0.59	0±0
Commercial	10.07±1.06	0±0
t-test Summary (p)	p<0.108	

Based on the data (Table 4), the average zone of inhibition for Sambong liquid hand soap against *S. aureus* was 12.43±0.59 mm, more significant than the commercial product's 10.07±1.06 mm. This suggests that Sambong soap was effective and demonstrated more consistent antibacterial activity against *S. aureus*. Although Sambong showed higher antibacterial activity than the commercial soap, the *p*-value ($p<0.108$) indicates that the difference was not statistically significant. Additionally, for *E. coli*, neither Sambong nor the commercial soap exhibited any inhibitory effect (0±0 mm), confirming that both products had no significant antibacterial activity against *E. coli*.

DISCUSSION

These results (Table 5) suggest that the Sambong liquid hand soap received a slightly higher mean sensory score (2.90) than the commercial soap (2.60), but the difference was not statistically significant. Additionally, the lower standard deviation (SD=0.50) for Sambong indicates that evaluators had more consistent perceptions of its sensory qualities than the commercial soap (SD=0.76). The independent sample *t*-test ($t=1.81$, $p=0.076$)

Table 5: Sensory perceptions of *B. balsamifera* liquid hand soap compared to Commercial liquid hand soap.

		Sensory Evaluation Score of the Sambong Liquid Hand Soap and Commercial Liquid Hand Soap			
	n	Mean	SD	*t*-cal	*p*-value
Sambong Liquid Hand Soap	30	2.90	0.50	1.81	0.076
Commercial Liquid Hand Soap	30	2.60	0.76		

confirmed that there was no significant difference between the sensory evaluation scores (p>0.05), meaning both soaps were generally perceived similarly despite their differences in formulation.

Hence, in a study conducted by,[28] the authors aimed to evaluate consumer preferences between herbal and commercial hand soaps by analyzing their sensory characteristics. The findings revealed that the herbal soap achieved an average sensory score of 3.00 with a standard deviation of 0.48. In contrast, the commercial soap scored 2.75 and a standard deviation 0.70. Although the herbal soap had a higher score, the difference between the two was not statistically significant, with p-values of 0.08 for the herbal soap and 0.076 for the commercial option.

Participants noted that the herbal soap offered a more consistent texture and a natural fragrance, contributing to its higher overall preference. In contrast, the commercial soap was favored for its superior foam quality, indicating a distinct aspect of performance that consumers appreciate. These findings suggest important considerations for manufacturers and marketers in the hand soap industry, particularly regarding consumer perceptions of sensory attributes and overall product performance.

CONCLUSION

Sambong soap consistently showed antibacterial activity against *S. aureus*, with inhibition zones varying from medium to firm. In contrast, both soaps did not affect *E. coli*, proving effective only against GPB.

For sensory evaluation, Sambong soap's appearance was moderately pleasant; cleanliness scored highest, but the scent was less appealing. The overall impression and willingness to recommend were moderate, suggesting scent improvement. The commercial soap had poor visual appeal but a higher scent score, with moderate overall performance.

Sambong showed more substantial and consistent antibacterial activity against *S. aureus* than commercial soap, but the difference was insignificant. Neither soap inhibited *E. coli*.

Sambong had a slightly higher sensory score and more consistent ratings, but the independent t-test showed no significant difference, indicating that both soaps were perceived similarly.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ABBREVIATIONS

B.b: *Blumea Balsamifera;* **C:** Commercial; **GPB:** Gram-positive Bacteria; **GNB:** Gram-negative Bacteria.

SUMMARY

The Sambong liquid hand soap demonstrated strong antibacterial activity against *S. aureus*, with an average inhibition zone of 12.43 mm, outperforming the commercial soap's 10.07 mm. However, both soaps showed no antibacterial effects against *E. coli*. In sensory evaluation, Sambong received a mean score of 2.90, indicating moderately pleasant characteristics, particularly in providing a clean feeling, while the commercial soap scored 2.60 and was perceived as less visually appealing. The difference in antibacterial efficacy and sensory scores between the two was not statistically significant. Overall, both soaps have room for improvement, particularly in scent and visual appeal.

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