Asian J Biol Life Sci., 2025; 14(2):386-393.
https://ajbls.com

Research Article

In vitro Anti-Inflammatory Activity of Common Lantana (*Lantana camara*) Leaf and Flower Extract Topical Ointments: Comparative Analysis and Sensory Profile

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ABSTRACT

Aim/Background: *Lantana camara* is an invasive plant species of the family Verbenaceae. It is highly notable for being a nuisance in agriculture and livestock. However, the resurgence of studies with regard to its medical potential would help potentially alleviate the significant health risks brought about by inflammation and reduce side effects brought by NSAIDs. This study aimed to assess the anti-inflammatory activity of *L. camara* leaf and flower extracts *in vitro* through the Egg Albumin Denaturation Assay, formulate a topical ointment with the extracts, and assess its sensory profile based on its fragrance, texture, and appearance. **Materials and Methods:** This study utilized Research and Development (R&D) and quantitative experimental design to determine the percent denaturation inhibition of *L. camara* leaf and flower extract compared to diclofenac. The sensory evaluation utilized questionnaires following the five-point Likert Scale. **Results:** The standard diclofenac exhibited the highest activity peak inhibition of 15.14% at 2000 ppm, followed by the leaf and flower extracts at 5.42% and 4.52%, respectively, indicating that there is a significant difference ($p<0.05$) in the One-Way ANOVA. The sensory evaluation presented the average acceptability of the ointments with a total mean of 3.15 (SD=0.85) for the leaf extract and 3.08 (SD=0.88) for the flower extract. The paired *t*-test concluded with no significant difference ($p>0.05$) in their sensory profile. **Conclusion:** *L. camara* exhibits potential as an anti-inflammatory agent, though future research must focus on refining the extraction process as well as employing more sensory attributes for a much more comprehensive result.

Keywords: Anti-inflammatory, Common Lantana, Ointment, Sensory profile.

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Received: 27-02-2025;
Revised: 08-04-2025;
Accepted: 16-06-2025.

INTRODUCTION

Human settlements are often surrounded by weeds used as herbal medicines. These medicinal plants can cure a wide array of diseases and exhibit drug potential.[1] *Lantana camara*, commonly known as Common Lantana, is an invasive species. It is known to be a threat to agriculture and biodiversity as the plant is toxic to livestock.[2] Additionally, it is ranked among the highest on the list of invasive plant species that are ecologically and economically destructive.[3] However, *L. camara* is known to have properties that make it combat human diseases.[4] It also has properties for other uses, such as its insecticidal and insect-repellent properties, and has been studied for commercialized type products.[5] In particular, *L. camara* species are additionally recognized for their anti-inflammatory properties.[6]

The search is ongoing for ideal anti-inflammatories with effective potency.[7] Diseases associated with inflammatory processes comprise a wide range of communicable or non-communicable things which remain a threat to human health brought about by the rise of introduced pathogens, their increasing drug resistance changes in the environment and the way of life, and the aged population. Additionally, inflammatory diseases affect human wellbeing and chronic inflammation is a major risk factor.[8] Since the Philippines is a country where herbal medicine is widely practiced in tradition and culture due to its diverse flora[9] most particularly *L. camara* with its ability to treat inflammation and pain,[10] its potential to become a mainstream medicinal plant in the Philippines is yet to be delved on, particularly its anti-inflammatory properties. Formulation of a topical ointment would also contribute to further research on the commercialization of medicinal plant products in the country as well as contributing to the emerging studies of *L. camara* commercialized for medicinal uses.

The researchers found significance in conducting the study, especially plants possessing anti-inflammatory properties gaining

DOI: 10.5530/ajbls.20251439

significant resurgence because they address the drawbacks of chemical medications.[11] Medicinal plants in general, showed promising activity in the study of.[12] Additionally, through the utilization of invasive weeds, *L. camara*, in particular, would help diminish their population and redirect them to more helpful fields, such as the field of medicine.[13]

In the study of Baıragı SM, *et al.*,[14] *L. camara* was assessed for its anti-inflammatory activity and concluded with a recommendation to use the plant for medical purposes. A study assessed its activity through different doses and their level of efficacy, also concluding it is suitable for medicinal use.[8,15] Showed the potential of *L. camara* extract to inhibit all enzymes responsible for inflammation and reduce edema. The study of Sore MA, *et al.*, [10] supports the use of *L. camara* as a pharmaceutical component based on the findings.

The researchers aimed to determine the anti-inflammatory activity of *L. camara* flower and leaf extracts to determine the extract with the most activity. The study also involved the formulation of two ointments from each extract. Furthermore, the study determined the sensory profile of the ointments, limited to fragrance, texture, and appearance as human testing is prohibited, and several government permits were obtained. Testing the *in vitro* anti-inflammatory activity of the two ointments was done by an expert. The accumulated data was evaluated in comparing the level of efficacy both leaf and flower extract were exhibited to determine the part of the plant with the most potential.

MATERIALS AND METHODS

Research Design

This study employed a Research and Development design, followed by quantitative experimental research, to evaluate the anti-inflammatory properties of *L. camara* leaf and flower extracts and compare the level of activity of both ointments based on given variables. Additionally, the sensory properties of several ointments were evaluated in terms of their fragrance, appearance, and texture.

Locale of the Study

Samples were collected at Purok 6, Casisang, Malaybalay City, Bukidnon. After being collected, the samples were sent to Central Mindanao University in Maramag, Bukidnon, for identification of the *L. camara* species and assessment of the formulated ointments' anti-inflammatory properties. Central Mindanao University provides advanced laboratories and research facilities for carefully analyzing and processing materials. After testing, the ointments were assessed for their sensory profile by the healthcare workers of Bukidnon Provincial Medical Center.

Sampling Procedure

This research utilized controlled quota sampling to determine the respondents for the sensory characterization. The researchers observed a careful selection of respondents to ensure that their evaluation represented the potential inferences of the general population, as highlighted in the study of Simkus J.[16]

Participants of the Study

The researchers selected 24 nurses working in Bukidnon Provincial Medical Center, aged 21-41, as the respondents for the sensory profile. The researchers employed the Central Limit Theorem (CLT) in analyzing the data. Beforehand, informed consent was provided to ensure formality and an ethical approach to the conduct of the study.

Research Instrument

A questionnaire was provided by the researchers based on the sensory characteristics of the respondents. The questions were meticulously curated through internet references and examples from previous related studies. After, the questionnaire was turned in to the adviser for improvements. The data collection was executed through the five-point Likert Scale, similar to the study of Abdon JE, *et al.*,[17] wherein ointments were also assessed for their sensory profile. The scale ranged from five (5) being the highest, indicating the respondents strongly agree, and one and (1) being the lowest data value, indicating dissatisfaction with the product.

Data Gathering Procedure

Extraction Methods

The solvent extraction method highlighted was employed[18] for the preparation of the *L. camara* flower and leaf extracts. Specimens of *L. camara* flowers and leaves were collected and carefully air-dried in a well-ventilated, shaded area for a period of 7 days. After drying, the plant materials were pulverized into a fine powder using a mortar and pestle to increase the surface area for extraction. Following pulverization, the powdered leaf and flower samples were soaked in 70% isopropanol, a solvent capable of extracting high concentrations of bioactive compounds such as triterpenoids, flavonoids, and phenolics, which are the primary anti-inflammatory compounds.[19-21] The isopropanol was added to completely submerge the plant material, ensuring all parts of the powdered specimens were adequately saturated. The mixture was then sealed in airtight containers and underwent 24-hr maceration with occasional shaking due to time restraints. The mixture was filtered using standard filter paper to separate the liquid extract from the coarse plant residues and repeated until the filtrates were entirely separated. Lastly, the extracts underwent a water bath at 40°C to 60°C until the extraction solvent was evaporated and left with water extract in preparation for the anti-inflammatory assay.

Formulation of Topical Ointments

Two (2) ointments were developed, one from the flower extract of *L. camara* and one for the leaf extract, with procedures and

ingredient proportions followed from the study of Abdon JE, *et al.*,[17] with exclusions. 5g of white beeswax was melted in a double boiler setting with water heated at 60 to 70°C, followed by the dilution of 15 g of olive oil, forming an oil-based mixture. Unlike the study, lavender oil was not included since the essential oil itself contains bioactive compounds that hold anti-inflammatory capabilities.[22] The mixture was then removed from the water and let cool down. The *L. camara* flower and leaf extracts were added separately and stirred gradually until a mixture is formed and was added in an airtight container.

In vitro Anti-inflammatory Testing

The testing for the anti-inflammatory activity of *L. camara* leaf and flower extract ointment was done *in vitro* since numerous permits will have to be obtained to perform testing with an animal model. The *in vitro* testing utilized the enhanced Egg Albumin Denaturation Assay by, Madhuranga H, *et al.*,[23] wherein anti-inflammatory activity was determined through the capacity of the ointments to denature or break down the protein content in the egg albumin induced by heat through a water bath. Extracts were tested under varying concentrations (2000 ppm, 1000 ppm, 800 ppm, 600 ppm, 400 ppm, and 200 ppm) alongside a positive control/standard (diclofenac sodium) for comparison to the anti-inflammatory activity of the extracts.

Sensory Evaluation

L. camara leaf and flower extract ointments were subject to sensory evaluation in terms of fragrance, texture, and appearance only, also following the approach of study.[17,24] The products physical characteristics were only evaluated as permit from the Food and Drug Administration (FDA) will still have to be obtained for safe human use. Informed consent was collected from the respondents before the survey, and the necessary permission from the head nurse was granted. After data was collected, individual survey results were gathered and compiled, and mean values were quantified.

Statistical Treatment

After testing by an expert, commencing data were analyzed accordingly.

The researchers used quantitative statistics such as the percentage, mean, and standard deviation to present the data concluded. The tools used were the one-way Analysis of Variance (ANOVA) in determining the significant difference between the anti-inflammatory activity of *L. camara* extracts, followed by the *post hoc* Tukey HSD test. The sensory evaluation utilized the paired samples *t*-test to determine any significant difference in the sensory profiles of the ointments.

Ethical Consideration

The researchers prioritized the transparency of the findings obtained, carefully managing it to uphold trust and adhere to ethical standards. Additionally, all data was handled meticulously, ensuring its credibility and integrity, while implementing strict security measures to protect it from mishandling. To further ensure that the research benefits society without causing harm, they focused on the accurate and responsible dissemination of knowledge. Finally, they transparently disclosed and addressed any potential conflicts of interest, thereby maintaining the overall integrity and ethical standards of the research.

RESULTS

In vitro Anti-inflammatory Activity

Table 1 shows the anti-inflammatory activity of *L. camara* leaf and flower extracts as well as the standard NSAID, diclofenac sodium. All samples exhibited protein denaturation capabilities, the diclofenac sodium showing the most activity across all concentrations, with 15.14% at the highest concentration of 2000 ppm and 7.23% at the lowest concentration of 200 ppm. The extracts exhibited activity with peak percent inhibition of 5.42% for the leaf extract and 4.52% for the flower extract, both at 2000 ppm and 0.98% and 1.2%, respectively at the lowest concentration of 200 ppm.

Sensory Evaluation

Table 2 shows only the sensory evaluation of the formulated *L. camara* leaf and flower extract topical ointments by the respondents to focus solely on which ointment is well-accepted. The evaluation was summarized by computing the mean, standard deviation, and the interpretation of the data based on the fragrance, texture, and appearance characteristics of the ointment. *L. camara* leaf and flower extract ointments collected an overall mean of 3.15 (SD=0.85) and 3.08 (SD=0.88), respectively, showing comparable results between the two ointments and varied perceptions amongst the respondents. Furthermore, the sensory evaluation expressed average results, indicating that product acceptability was neutral and well on average overall.

Significant Difference in the Anti-inflammatory Activity

The researchers utilized the one-way Analysis of Variance (ANOVA), as seen in Table 3. Since the F-value between groups (29.22) is higher than the F crit value (3.68), and the *p*-value (0.00) is lesser than the standard significant level (0.05), it can be said that the null hypothesis is rejected; thus all the samples showed significant difference amongst each other. To determine the sample that differed, the *post hoc* Tukey HSD test was calculated as well. Results later identified that the standard diclofenac sodium differed out of the group ($p<0.05$, both extracts) while

both *L. camara* leaf and flower extracts together did not differ significantly among each other ($p>0.05$).

Significant Difference in the Sensory Evaluation

The paired *t*-test was utilized by the researchers to compare the ointments on each sensory characteristic, which was evaluated altogether by the respondents. Table 4 shows that the *t*-statistic (0.75 for appearance and 0.69 for fragrance) was less than that of the t crit value (2.07), meaning that there is no significant difference in the sensory evaluations of the ointment across all given characteristics ($p>0.05$), and that the null hypothesis was accepted. Additionally, both ointments reported no data variance in terms of texture as the means of the evaluations were the same (3.31), implying that the respondents expressed the same observations on both ointments.

DISCUSSION

In vitro Anti-inflammatory Activity

Several factors may contribute to the lower anti-inflammatory activity of the extracts, including the number of bioactive compounds present in them and the solvent extraction processes. Furthermore, solvent polarity affects the extraction of these compounds despite the used solvent meeting the polarity standards of the compounds.[20,26]

Throughout all tested concentrations, the leaf and flower extracts, along with the standard diclofenac sodium, reported increased denaturation inhibition at higher concentrations and lower inhibition at lower concentrations. The study of[27] reported peak inhibition of plant extract at the highest tested concentration (27.71% at 1000 ppm) and gradually decreases as concentration decreases in addition (13.26% at 0.01 ppm) showing twice and thrice higher anti-inflammatory activity than the standard ibuprofen (9.77% at 1000 ppm and 15.13% at 0.01 ppm) and prednisolone (8.83% at 1000 ppm and 5.43% at 0.01 ppm) respectively in the said assay. However, the plant extracts in the study of Anokwah D, *et al.*,[28] demonstrated higher activity with a peak inhibition of 111.90% compared to diclofenac with a peak inhibition of 74.48%.

The study of Khairan Khairan, *et al.*,[29] reported peak inhibition of *L. camara* extracts at a range of 80%-90% and at a concentration of 500 ppm, also showing a gradual increase in inhibition as concentration increases, which, in comparison to the results of this study, demonstrate significantly higher anti-inflammatory

Table 1: Anti-Inflammatory Activity of *L. camara* Leaf and Flower Extracts and Standard (Diclofenac) through Percent Protein Denaturation Inhibition.

% Denaturation Inhibition (Mean±SD)			
Concentration	**Diclofenac**	**Leaf Extract**	**Flower Extract**
2000 ppm	15.14±0.028	5.42±0.32	4.52±0.41
1000 ppm	12.67±0.24	4.92±0.04	4.09±0.82
800 ppm	11.83±0.07	4.27±0.09	3.52±0.37
600 ppm	10.81±0.19	1.95±0.01	2.55±0.10
400 ppm	8.85±0.10	1.48±0.04	2.23±0.25
200 ppm	7.23±0.13	0.98±0.004	1.24±0.03

Table 2: Sensory Evaluation of *L. camara* Leaf and Flower Extract Ointments by Participants.

Sensory Evaluation	*L. camara* Leaf Ointment		*L. camara* Flower Ointment	
	Mean±SD	Descriptive Rating	Mean±SD	Descriptive Rating
Appearance	3.57±0.75	HA	3.47±0.75	HA
Fragrance	2.58±0.83	LA	2.47±0.88	LA
Texture	3.31±0.69	AA	3.31±0.69	AA
Total Mean	3.15±0.85	AA	3.08±0.88	AA

Scoring Interpretations of Respondent Evaluation.[25]

Mean Range	Descriptors	Qualitative Interpretation
4.21-5.00	Strongly Agree	Very High Acceptability
3.41-4.20	Agree	High Acceptability
2.61-3.40	Neither Agree nor Disagree	Average Acceptability
1.81-2.60	Disagree	Low Acceptability
1.00-1.80	Strongly Disagree	Very Low Acceptability

activity. The same goes for the study of Jalindar V.[30] where *L. camara* aqueous extract exhibited peak inhibition of 62.35% at 500 ppm.

However, the study of Khadija Ben Othman, *et al.*,[31] reported the incapability of *L. camara* leaf and flower extracts to stabilize protein structure, thus incapable of inhibiting denaturation. This is despite the presence of bioactive compounds responsible for anti-inflammatory processes, which were also identified in the same study, and also despite phenolic compounds being stable in thermal stress and, in turn, accumulating more soluble phenolics.[32]

Meanwhile in this study, the standard diclofenac exhibited a relatively high peak inhibition yet lower than usual. The study of Yani D, *et al.*,[33] reported peak inhibition of diclofenac at 84.8% in IC_{50} values and 58.24% in the study of A. Obaleye J, *et al.*,[34] Though diclofenac sodium is well regarded as a standard NSAID, it is attributed with medicinal side effects, including in the gastrointestinal tract; however, efforts in using diclofenac through topical delivery promise to alleviate said side effects.[35] Among all NSAIDs, diclofenac sodium is highly utilized due to its distinctively notable pain reduction, inhibition of inflammation cytokines, and consistent changes in acute inflammation.[36]

Sensory Evaluation

The respondents' perceptions of the formulated ointments may be attributed to the absence of additives, including lavender and vitamin E oil, which may impact the evaluation of ointment fragrance if present. However, the respondents imply high acceptability of the ointment due to the base ingredients beeswax and olive oil, which are favored ingredients in terms of efficient ointment and emollient.[37] Thus, the variety of constituents in the formulation affects the overall perception of the ointment.

The study of Vergilio MM, *et al.*,[38] conducted a sensory evaluation of formulated sunscreen and commercial sunscreens, limiting evaluation categories by visual, pickup, rub-out, and 1-min after-feel of the sunscreens through a trained panel. The findings of the study highlighted no significant difference across all categories, stating that a soft texture, supple feel, adequate thickness, and fresh look of the sunscreens contributed to their high acceptability among the panel and potential consumers. Additionally, the study's findings stated that silicone, low molecular weight esters, and adsorbents aided in the emollience of the products. This is congruent to the study of Rigou P, *et al.*,[39] wherein several factors and processes help protect the sensory characteristics of fermented wine, particularly the incorporation of yeast-derivative products as a sensory driver and regulator of technological processes as well.

Furthermore, the study utilized nurses as respondents for the evaluation, as among other key health professionals, nurses tend to comply more diligently with hygienic standards and overall cleanliness.[40] It is also noted that the level of performance of workers in the medical field is attributed to their adaptive performance, which includes awareness, hygienic practices, and work ethic.[41] Therefore, in relation to this study, sensory perceptions of the ointment are well-dispersed and varied.

Significant Difference in the Anti-inflammatory Activity

The significant difference between the extracts and the standard can be attributed to many factors including the number of

Table 3: One-way ANOVA Result between the Anti-Inflammatory Activity of *L. camara* Leaf and Flower Extracts and Standard (Diclofenac sodium) In Varied Concentrations.

Source of variation	SS	D_f	MS	F	*p*-value	F crit
Between Groups	255.48	2	127.74	29.22	0.00	3.68
Within Groups	65.58	15	4.37			
Total	321.05	17				

Significant at 0.05 level.

Table 4: Sensory Evaluation of *L. camara* Leaf and Flower Extract Ointments by Participants.

Attribute	Ointment	Mean	σ^2	t- stat	D_f	*p*-value (two-tailed)	t crit	Significant ($p<0.05$)?
Appearance	Leaf Extract Flower Extract	3.57 3.47	0.57 0.56	0.75	23	0.65	2.07	No
Fragrance	Leaf Extract Flower Extract	2.58 2.47	0.69 0.77	0.69	23	0.66	2.07	No
Texture	Leaf Extract Flower Extract	3.31 3.31	0.47 0.47	NaN	23	NaN	NaN	No variance

Significant at 0.05 level.

compounds in the final extracts, as well as the drug potency of diclofenac sodium. *L. camara* contains an array of bioactive compounds responsible for anti-inflammatory processes, including triterpenoids, phenolics, and flavonoids. Though these compounds are potent, standard NSAIDs remain in first line use due to their much-accepted potency, which is reflected in anti-inflammatory activity results.[42,43] However, the study of Samaraweera T, *et al.*,[44] contradicts this statement, as diclofenac sodium exhibited lesser anti-inflammatory activity *in vitro* against natural plant extracts.

The ongoing string of studies that compare the efficacy of natural extracts against synthetic drugs is based on the fact that the extracts deliver lesser side effects than those produced by said synthetic drugs, which brings them extra advantages and helps mitigate drug-induced cytotoxicity as well.[45] Additionally, NSAIDs, outside of their sole purpose, promote pollution in water ecosystems due to their synthetic nature and the presence of various acids that do not lineate with environmental standards.[46]

Another factor that contributes to the membrane stabilization capabilities of plant extracts, which are simulators of anti-inflammatory activity *in vitro*, also includes their concentrations. The study of Samaraweera T, *et al.*,[44] also concluded findings in which extract concentration had a strong correlation to the stability of RBC membranes and egg albumin proteins, more particularly concentrated with nonpolar or lesser polar bioactive compounds, in which isopropanol can also extract highly efficiently, unlike standard solvents like methanol.[47] Polyphenols, also a bioactive compound, were effectively recovered from discarded blueberries through isopropanol extraction, in turn maximizing the use of resources deemed unusable.

Furthermore, ethanol not being used as an extraction solvent in this study due to unavailability is also an impact factor of the variance and diversity of test results of the extracts. Ethanol is a widely used solvent and is the most effective extractor of compounds across all extraction processes and across all extractors as well.[48] Though in contradiction, the study of[49] reported that ethanolic extracts and aqueous extracts exhibited anti-inflammatory activity significantly ($p<0.05$) through paw edema reduction but was relatively lower than the aqueous extract. Lastly, in the study of Pandey AK.[50] *B. monnieri* ethanolic extracts were able to keep up with inhibition percentages of diclofenac sodium, citing that extraction of bioactive compounds was sufficient.

Significant Difference in the Sensory Evaluation

The driving factors contributing to the similarity of the ointments' sensory characteristics can be attributed to their formulation and the implementation of sensory evaluation. Both *L. camara* ointments used the exact ingredient measurements, with the only difference being the type of extract serving as the active ingredient on each ointment.

The study of Sipos L, *et al.*,[51] states that ideal sensory results are obtained when between-product variability is present, and products are clearly differentiated by the respondents. Since the goal of this study is to determine which ointment would be deemed acceptable compared to the other, this indicates that there was low between-product variability. The respondents preferred either one of the ointments. Due to time restraints, sensory profiling was only done in one health center, implying that there is a less diverse set of respondents, incongruent with the same study that also stated that a sensory panel should ensure a more variated set of respondents. Additionally, more employed attributes during the sensory evaluation will provide a more comprehensive sensory profile of a product as well as characteristics that are more defined,[52] therefore in the context of this study, though attributes are adequately defined and evaluated through a set of questions each sensory characteristics, there is only a limited set of factors to be assessed (appearance, fragrance, texture).

CONCLUSION

The study successfully demonstrated the potential of *L. camara* leaf and flower extracts as natural anti-inflammatory agents, though their activity was notably lower than that of the standard NSAID, diclofenac sodium. The extracts showed dose-dependent inhibition of protein denaturation, with peak activity of 5.42% and 4.52% for the leaf and flower extracts, respectively, compared to diclofenac sodium (15.14%). Statistical analysis confirmed significant differences between the extracts and the standard, but no significant difference was found between the leaf and flower extracts themselves. These results suggest that while the extracts possess some anti-inflammatory properties, further optimization in extraction methods and formulation may be necessary to enhance their efficacy.

The sensory evaluation of the topical ointments formulated from the extracts indicated that both were generally accepted by respondents, particularly in terms of appearance and texture. However, fragrance received lower acceptability, with mean scores of 2.58 for the leaf ointment and 2.48 for the flower ointment. Overall, the paired t-test revealed no statistically significant difference between the two in terms of sensory characteristics. The results imply that the formulation of the ointments was consistent, and respondents found both acceptable for potential use.

Limitations highlighted in the study include the anti-inflammatory efficacy of the extracts compared to synthetic standards and the relatively neutral sensory ratings. These issues were attributed to the extraction methods, which, although effective at isolating non-polar bioactive compounds, influenced the potency of the

final extracts. Additionally, the lack of additives in the ointments was a driving factor in their sensory evaluation.

The study emphasizes the potential of utilizing *L. camara* as a source of natural remedies, aligning with growing interest in plant-based alternatives to synthetic drugs. While the extracts exhibited some degree of anti-inflammatory activity and the ointments showed acceptable sensory characteristics, the findings suggest improvement and recalibration. Optimizing the extraction process, incorporating fragrance-enhancing additives, and expanding sensory evaluation to a more diverse group of respondents could strengthen the results in future research.

ACKNOWLEDGEMENT

The authors would like to thank their institution, San Isidro College, for allowing the study to be conducted. Additionally, they also express their gratitude to Central Mindanao University and Bukidnon Provincial Medical Center for assisting with the data and the findings of the study.

Most importantly, the panel of examiners for the insights, and the parents of the authors: Ms. Abulag, Mr. and Mrs. Ban, and Ms. Cabigon, for their immense support.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ABBREVIATIONS

HSD: Honestly Significant Difference; **NSAID:** Non-Steroidal Anti-Inflammatory Drug; **ppm:** Parts per million.

SUMMARY

The study's findings show that *L. camara* leaf and flower extracts successfully demonstrated anti-inflammatory activity in the form of protein structure stabilization, though lower than the standard diclofenac, indicating a significant difference ($p<0.05$) in the test samples. The sensory evaluation for both leaf and flower extract ointments were accepted, and no significant difference was found ($p>0.05$).

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Cite this article: Robosa JCA, Ban QLD, Cabigon KO, Saldo IJP. *In vitro* Anti-Inflammatory Activity of Common Lantana (*Lantana camara*) Leaf and Flower Extract Topical Ointments: Comparative Analysis and Sensory Profile. Asian J Biol Life Sci. 2025;14(2):386-93.