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# FORMULATING AN ALTERNATIVE PAIN-RELIEVING FOOT PAD USING PANDAKAKI (*Tabernaemontana pandacaqui poir*)

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## ABSTRACT

This study formulated an alternative pain-relieving foot pad by utilizing the adopted but modified Ames (2020) protocol. It used the quantitative method, especially the true experimental design. This study was conducted in the academic year 2022-2023. Before the formulation, the researchers performed the collection and washing of the materials. Next, air-drying, dehydration, and soaking Pandakaki leaves. Thereafter followed the rotary evaporation and water bathing. In the formulation of the product, it mixed Epsom Salt *(48.75g)*, Sea Salt *(9.75g)*, Baking Soda *(4.86g)*, and Pandakaki leaf extracts *(2mL)* in a *250*mL beaker using a stirring rod. Finally, after mixing the materials thoroughly, the solution was then put in a filter tea paper and sealed, and now ready to apply with sticky paper. After the formulation, the analgesic properties of treatment, i.e, formulated alternative pain-relieving foot pad using Pandakaki *(tabernaemontana pandacaqui poir)* leaf extracts and positive control, i.e., Diclofenac Sodium were determined using the adopted procedures from Rashid (2017). The results revealed that both the treatment and positive control displayed analgesic properties as evidenced by the reduced number of writhing, i.e., *2, 4, 2* for treatment and *10, 14,* and *12* for positive control among the mice replicates 1, 2, and 3, respectively. Hence, these findings suggest that both the treatment and the positive control manifested pain-relieving properties. Hence, it is suggested that various concentrations of the extracts to compare their tolerability may be formulated, and testing the level of toxicity of the formulations in different ratios may be performed.

***KEYWORDS:*** *Formulation, Alternative Pain-Relieving Foot Pad, Pandakaki (Tabernaemontana pandacaqui poir), Diclofenac Sodium*

## INTRODUCTION

Manufacturers of detoxification foot pads assert that when placed under the feet while sleeping, these alternative medicinal adhesive foot pads or patches can significantly enhance health. Some of these pads might include components like "distilled bamboo vinegar," which is said to draw toxins out of the body, but opponents have demonstrated that the method is not supported by science. Although the skin is one of the body's major organs for detoxification, there is no proof that these goods operate, and no mechanism has been presented as to why these patches might boost the detoxification rate over baseline (Krextzin, 2022). To draw out poisons like heavy metals, foot pads are applied positioned on the soles of a person's feet, and left there all night. The black or discolored appearance of the detox foot pad when it is removed in the morning is said to indicate the toxins that have been eliminated from a person's body (Bauer, 2022).

On the other hand, there have been investigations that revealed Pandakaki *(tabernaemontana pandacaqui poir)* leaf extracts to have antibacterial qualities when it was tested for a variety of ailments. The most recent findings imply that the leaf extracts have an antimicrobial effect on germs that cause wound infections. More research is necessary to determine the crude extracts' antibacterial efficacy against pathogenic microorganisms. Also, studies have shown the presence of analgesic, antiprotozoal, anti-inflammatory, antipyretic, cytotoxic, CNS-depressant, pesticidal, and antimalarial properties of Pandakaki *(tabernaemontana pandacaqui poir)* leaf extracts (Galanta, 2022).

Hence, the researchers found it interesting to explore by conducting experimentation about the analgesic property of Pandakaki *(tabernaemontana pandacaqui poir)* leaf extracts and formulated alternative pain-relieving foot pad using these plant leaf extracts.

### Objectives of the Study

As this study's main goal was to formulate an alternative pain-relieving foot pad using Pandakaki *(tabernaemontana pandacaqui poir)* leaf extracts, these tasks were successfully carried out.

1.) Adopt but modify protocol from Ames (2020) for the formulation of an alternative pain-relieving foot pad using Pandakaki *(tabernaemontana pandacaqui poir)* leaf extracts.
2.) Test the analgesic properties of the treatment (formulated alternative pain-relieving foot pad using Pandakaki *(tabernaemontana pandacaqui poir)* leaf extracts) and the control (Diclofenac Sodium) through Acetic Acid Writhing Testing on mice.

### Research Questions

Guided by the objectives of the study, the researchers answered these scientific questions:

1.) What is the adopted but modified protocol for the formulation of an alternative pain-relieving foot pad using Pandakaki *(tabernaemontana pandacaqui poir)* leaf extracts?

2.) What are the results of the analgesic properties of the treatment (formulated alternative pain-relieving foot pad using Pandakaki *(tabernaemontana pandacaqui poir)* leaf extracts) and the control (Diclofenac Sodium) after performing Acetic Acid Writhing Testing on mice?

**Scope and Delimitation of the Study**

This research formulated an alternative pain-relieving foot pad using the adopted but modified protocol from Ames (2020). The procedures included the collection of Pandakaki leaves, washing them thoroughly with distilled water, and air-drying them overnight. After the air-drying, dehydration of leaves followed for *16* hours. When the dehydration process was done, grinding of dried leaves followed. Then, the researchers soaked the powdered Pandakaki leaves in a *3*L jar with *2*L ethanol for *4* days and *90* minutes. Thereafter, it was filtrated for *33* minutes, and a rotary evaporation process followed after the filtration. After the rotavap, the extracts were then water bathed for a day and *22* hours and *35* minutes. After water bathing, the researchers began formulating the materials. First, it started with the preparation of all materials such as Pandakaki leaf extracts, Epsom Salt, Sea Salt, and Baking Soda. Second, the researchers ground the Epsom Salt and Sea Salt using the grinder. Third, the researchers measured the amount of each material, i.e., Epsom Salt *(48.75g)*, Sea Salt *(9.75g)*, Baking Soda *(4.86g)*, and Pandakaki leaf extracts *(2mL)*. Fourth, the researchers mixed the solid materials together with the Pandakaki leaf extracts in a *250*mL beaker using a stirring rod. Finally, after mixing the materials thoroughly, the solution was then put in a filter tea paper and sealed, and now ready to apply with sticky paper.

After the Pandakaki leaf extracts were formulated as an alternative pain-relieving foot pad, it was subjected to analgesic property testing along with the positive control (Diclofenac Sodium) by performing the Acetic Acid Writhing Testing on mice adopted from Rashid (2017). This study's formulation of the product was done at Nutraceutical Laboratory of Mindanao State University, General Santos City, and the analgesic property testing was performed at the Chemistry Laboratory of Colon National High School in the academic year 2022-2023.

**Significance of the Study**

**To the Environment Science**, the study formulated an organic pain-relieving foot pad that promotes an environmentally friendly use of traditional medicine.

**To Policy Implications,** the study provides a new discovery of relieving foot pain using Pandakaki *(tabernaemontana pandacaqui poir)* leaf extracts as an organic foot pad. This suggests that the use of plants to treat diseases and other ailments enhances the general health and well-being of people.

**To the Community,** the results of this study provide valuable knowledge on the potential use of Pandakaki as an organic pain-relieving foot pad, which may help the community in using this herbal medicine instead of synthetic medicines that are expensive in the market.

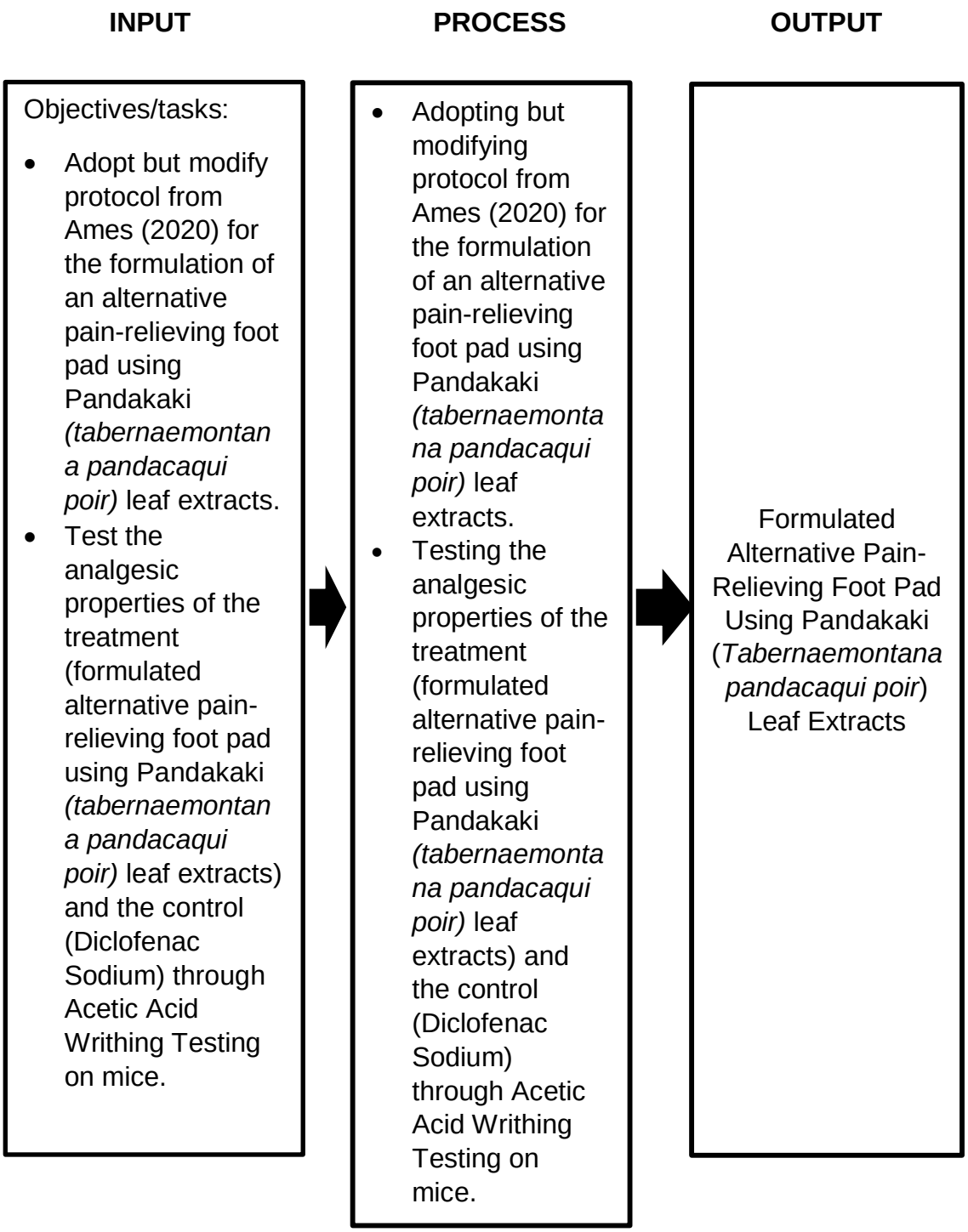
**To the STEM Students,** this study benefits students by providing information on using organic and eco-friendly products, encouraging critical thinking about plant modifications, and improving their learning experience through related scientific questions and problem-solving skills.

**To Future Researchers,** this study suggests that other possible uses of this herbal plant may be explored to further investigate its potential characteristics and properties that may be helpful in other aspects other than its potential of being analgesic.

**Research Gap**

As far as the previous studies are concerned, there have been no studies conducted yet that formulated foot pads using Pandakaki *(tabernaemontana pandacaqui poir)* leaf extracts and evaluated their analgesic property. Hence, this formed the gaps in this present study.

**Conceptual Framework of the Study**



## METHODOLOGY

The completion of this study's objectives was attained using a quantitative method, specifically a true experimental design. The study focuses on scientific experimentation and employs statistical analysis in its execution (Pubrica-Academy, 2020).

### Materials Used

This study used these materials: Pandakaki leaves, Epsom Salt, Sea Salt, Baking Soda, Acetic Acid, Diclofenac Sodium, Ethyl Alcohol, and Distilled Water.

### Tools Used

The tools used were the beaker, container jar, mortar & pestle, syringe, laboratory tray, graduated cylinder, dehydration rack, evaporating dish, filter paper, sticky patch, filter tea paper, Buchner funnel, cling wrap, stainless basin, and weighing boat.

### Equipment Used

The sets of equipment used were the top loading balance, dehydrator, grinder, rotary evaporator, and water bath.

### Paraphernalia Used

To protect the researchers from any harm, they used these sets of paraphernalia: laboratory gown, laboratory footwear, face mask, gloves, and hairnet.

### Formulation Protocol

This research formulated an alternative pain-relieving foot pad using the adopted but modified protocol from Ames (2020). The procedures included the collection of Pandakaki leaves, washing them thoroughly with distilled water, and air-drying them overnight. After the air-drying, dehydration of leaves followed for *16* hours. When the dehydration process was done, grinding of dried leaves followed. Then, the researchers soaked the powdered Pandakaki leaves in a *3*L jar with *2*L ethanol for *4* days and *90* minutes. Thereafter, it was filtrated for *33* minutes, and a rotary evaporation process followed after the filtration. After the rotavap, the extracts were then water bathed for a day and *22* hours and *35* minutes. After water bathing, the researchers began formulating the materials. First, it started with the preparation of all materials such as Pandakaki leaf extracts, Epsom Salt, Sea Salt, and Baking Soda. Second, the researchers ground the Epsom Salt and Sea Salt using the grinder. Third, the researchers measured the amount of each material, i.e., Epsom Salt *(48.75g)*, Sea Salt *(9.75g)*, Baking Soda *(4.86g)*, and Pandakaki leaf extracts *(2mL)*. Fourth, the researchers mixed the solid materials together with the Pandakaki leaf extracts in a *250*mL beaker using a stirring rod. Finally, after mixing the materials thoroughly, the solution was then put in a filter tea paper and sealed, and now ready to apply with sticky paper.

### Variables of the Study

The study's independent variable was the formulated alternative pain-relieving foot pad using Pandakaki *(tabernaemontana pandacaqui poir)* leaf extracts, while the dependent variable was the analgesic property. The positive control was the Diclofenac Sodium as the commercial pain reliever.

## RESULTS AND DISCUSSIONS

### Formulation Protocol for an Alternative Pain-Relieving Foot Pad

The formulated alternative pain-relieving foot pad using the adopted but modified protocol from Ames (2020) was successfully accomplished by following the procedures. These procedures included the collection of Pandakaki leaves, washing them thoroughly with distilled water, and air-drying them overnight. After the air-drying, dehydration of leaves followed for *16* hours. When the dehydration process was done, grinding of dried leaves followed. Then, the researchers soaked the powdered Pandakaki leaves in a *3*L jar with *2*L ethanol for *4* days and *90* minutes. Thereafter, it was filtrated for *33* minutes, and a rotary evaporation process followed after the filtration. After the rotavap, the extracts were then water bathed for a day and *22* hours and *35* minutes. After water bathing, the researchers began formulating the materials. First, it started with the preparation of all materials such as Pandakaki leaf extracts, Epsom Salt, Sea Salt, and Baking Soda. Second, the researchers ground the Epsom Salt and Sea Salt using the grinder. Third, the researchers measured the amount of each material, i.e., Epsom Salt *(48.75g)*, Sea Salt *(9.75g)*, Baking Soda *(4.86g)*, and Pandakaki leaf extracts *(2mL)*. Fourth, the researchers mixed the solid materials together with the Pandakaki leaf extracts in a *250*mL beaker using a stirring rod. Finally, after mixing the materials thoroughly, the solution was then put in a filter tea paper and sealed, and now ready to apply with sticky paper.

### Acetic Acid Writhing Test (Analgesic Property Testing)

This study involved analgesic property testing of the treatment (formulated alternative pain-relieving foot pad using Pandakaki *(tabernaemontana pandacaqui poir)* leaf extracts) and control (Diclofenac Sodium as commercial pain-reliever) by performing the Acetic Acid Writhing Test adopted from Rashid (2017). Table 1-2 shows the complete results of the testing.

**Table 1. Analgesic Property of Treatment**

| Mice no. | Body Weight (g) | Acetic Acid/ Negative Control (mL) | No. of Writhing | Treatment/ Pandakaki Solution (mL) | No. of Writhing |
|---|---|---|---|---|---|
| 1 | 22.65g | 0.1133mL | 14 | 0.1133mL | 2 |
| 2 | 26.24g | 0.1312mL | 15 | 0.1312mL | 4 |
| 3 | 25.55g | 0.1278mL | 13 | 0.1278mL | 2 |

The table shows the results of the analgesic property performed with the treatment (formulated alternative pain-relieving foot pad using Pandakaki *(tabernaemontana pandacaqui poir)* leaf extracts) among the three mice replicates. It can be construed that when the negative control, i.e., Acetic Acid was injected into the replicates, the number of writhing 14, 15, and 13 of mice replicates 1, 2, and 3, respectively were higher compared with the treatment when injected into the same replicates, it exhibited a remarkable reduction in number of writhing to 2, 4, 2, for mice replicates 1, 2, and 3, respectively.

These results imply that since the treatment obtained a lesser number of writhing among the mice replicates, it is understood that the treatment, i.e., formulated alternative pain-relieving foot pad using Pandakaki *(tabernaemontana pandacaqui poir)* leaf extracts demonstrated analgesic properties as compared with the negative control. Hence, the treatment manifested effective pain relief.

The writhing test is a chemical method that causes mice to experience pain of peripheral origin using irritants like phenyl quinone and acetic acid. Analgesic activity of the test compound is inferred from the decrease in the frequency of writhings. The effectiveness of the test substance as an analgesic can be inferred from a drop in writhing frequency (Gawade, 2012). During the injection of acetic acid, the mice reacted with characteristics of stretching, scratching, and twirling behavior called writhing. Irritant is injected into the mouse peritoneal cavity to cause pain. Any writhing is considered a positive reaction. Thus, the number of writhing implies the effect of the acetic acid (negative control) on the mice when injected (Bighetti, 1999).

**Table 2. Analgesic Property of Control**

| Mice no. | Body Weight (g) | Acetic Acid/ Negative Control (mL) | No. Of Writhing | Diclofenac Sodium/ Positive Control (mL) | No. Of Writhing |
|---|---|---|---|---|---|
| 1 | 26.28g | 0.2628 ml | 30 | 0.2628 ml | 10 |
| 2 | 26.56g | 0.2656 ml | 33 | 0.2656 ml | 14 |
| 3 | 25.74g | 0.2574 ml | 25 | 0.2574 ml | 12 |

The findings of the analgesic property performed with the positive control (Diclofenac Sodium) among the three mouse replicates are shown in the table. When the negative control, i.e., Acetic Acid, was injected into the replicates, the number of writhing *30, 33,* and *25* of mice replicates *1, 2,* and *3*, respectively, were higher. When the positive control was injected into the same replicates, the number of writhing was reduced to *10, 14, and 12,* for mice replicates *1, 2,* and *3*, respectively.

These findings suggest that the positive control, Diclofenac Sodium, demonstrated analgesic properties when compared to the negative control because it exhibited a lower number of writhing among the mice replicates. As a result, the positive control provided better pain alleviation.

The writhing test is a chemical approach that uses irritants such as phenyl quinone and acetic acid to cause peripheral discomfort in mice. The decrease in the frequency of writhings indicates that the test chemical has analgesic efficacy. A decrease in writhing frequency indicates that the test chemical is effective as an analgesic (Gawade, 2012). The mice reacted to the acetic acid injection by stretching, clawing, and twisting, a behavior known as writhing. To generate pain, an irritant is injected into the mouse peritoneal cavity. Any writhing is regarded as a favorable response. Thus, the number of writhing mice indicates the influence of acetic acid (negative control) when injected (Bighetti, 1999).

**Summary of Findings**

By following the steps, the formulated alternative pain-relieving foot pad was created utilizing the adopted but modified Ames (2020) protocol. These steps included gathering the Pandakaki leaves, giving them a thorough wash with distilled water, and letting them air dry overnight. Dehydration of the leaves occurred for *16* hours after air-drying. The dried leaves were then ground after the dehydration process was complete. The researchers soaked the Pandakaki leaves for *4* days and *90* minutes in a *3*L jar with *2*L ethanol. It then underwent a *33*-minute filtration procedure, which was followed by rotary evaporation. The extracts were then water bathed for a day, *22* hours, and *35* minutes following the rotavap. After the water bathing was done, the researchers then started formulating the materials.

First, it started with the preparation of all materials such as Pandakaki leaf extracts, Epsom Salt, Sea Salt, and Baking Soda. Second, the researchers ground the Epsom Salt and Sea Salt using the grinder. Third, the researchers measured the amount of each material, i.e., Epsom Salt *(48.75g)*, Sea Salt *(9.75g)*, Baking Soda *(4.86g)*, and Pandakaki leaf extracts *(2mL)*. Fourth, the researchers mixed the solid materials together with the Pandakaki leaf extracts in a *250*mL beaker using a stirring rod. Finally, after mixing the materials thoroughly, the solution was then put in a filter tea paper and sealed, and now ready to apply with sticky paper.

After the formulation, the analgesic properties of treatment, i.e, formulated alternative pain-relieving foot pad using Pandakaki *(tabernaemontana pandacaqui poir)* leaf extracts and positive control, i.e., Diclofenac Sodium were determined using the adopted procedures from Rashid (2017). The results revealed that both the treatment and positive control displayed analgesic properties as evidenced by the reduced number of writhing, i.e., *2, 4, 2* for treatment and *10, 14,* and *12* for positive control among the mice replicates 1, 2, and 3, respectively. Hence, these findings suggest that both the treatment and the positive control exemplified analgesic properties when compared to the negative control because they exhibited a lower number of writhing among the mice replicates. As a result, the treatment and positive control manifested pain-relieving properties.

## Conclusions

This study was conducted to formulate an alternative pain-relieving foot pad using organic materials, including plant-based extracts of Pandakaki using the adopted but modified protocol for the formulation. Using the analgesic property testing procedures, it was revealed that the formulated alternative pain-relieving foot pad using Pandakaki leaf extracts (treatment) and Diclofenac Sodium (positive control) demonstrated pain-relieving properties as evidenced by the reduced number of writhing among mice replicates during the Acetic Acid Writhing Test. This indicates the potential of the formulated Pandakaki leaf extracts as a pain-relieving agent. Overall, the study supports the use of natural materials in the development of organic analgesic medicines.

## Recommendations

Considering the summary of findings and the conclusions, the researchers suggest the following:

1. Future researchers may formulate various concentrations of the extracts to compare its tolerability.
2. Future researchers may test the level of toxicity of the formulation in different ratios.
3. Another potential benefit of Pandakaki may be explored apart from being a pain-reliever for further studies and investigations adding to new discoveries.

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