

## Effectiveness of veragreens gel with cabbage (*Brassica oleracea*) extract and aloe vera in wound healing and anti-inflammatory activity in vivo

*Efektivitas Gel Veragreens Ekstrak Daun Kubis (*Brassica oleracea*) dan Aloe vera terhadap Penyembuhan Luka dan Aktivitas Antiinflamasi In Vivo*

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### ABSTRACT

**Background:** A common issue faced by breastfeeding mothers is nipple cracks and breast engorgement, which can hinder the breastfeeding process and reduce the frequency of breastfeeding. Traditional remedies, such as direct breast milk application or cabbage leaf compresses, are often considered impractical.

**Objective:** This study aimed to evaluate the effectiveness of Veragreens, a topical gel formulated with a combination of cabbage leaf extract (15%) and aloe vera (25%), in accelerating wound healing and reducing inflammation in vivo using mice (*Mus musculus*).

**Methods:** This experimental study involved three treatment groups: a negative control, a positive control (Flamar/aloe vera gel), and a treatment group using Veragreens. Phytochemical tests showed that cabbage extract contains flavonoids with anti-inflammatory properties, while aloe vera contains mannose-6-phosphate, which supports tissue regeneration.

**Results:** The results demonstrated that Veragreens accelerated wound healing, as indicated by faster wound closure and hair regrowth by day 7. Anti-inflammatory testing revealed a significant reduction in inflammation volume ( $p < 0.001$ ) in the Veragreens groups, although slightly slower than the positive control. No significant differences were observed in overall effectiveness between the Veragreens and positive control groups.

**Conclusion:** Veragreens has the potential to serve as a safe and effective topical solution for simultaneously treating nipple cracks and breast engorgement, making it a promising natural care product for breastfeeding mothers.

**Keywords:** Aloe vera, veragreens, anti-inflammatory activity, cabbage leaf extract (*Brassica oleracea*), in vivo wound healing

### ABSTRAK

**Latar Belakang:** Masalah umum yang sering dialami oleh ibu menyusui adalah lecet pada puting dan pembengkakan payudara, yang dapat menghambat proses menyusui dan menurunkan frekuensi pemberian ASI. Upaya tradisional seperti pemberian ASI langsung pada puting atau kompres daun kubis sering dianggap tidak praktis.

**Tujuan:** Penelitian ini bertujuan untuk mengkaji efektivitas Veragreens, gel topikal berbahan dasar dengan kombinasi daun kubis (15%) dan aloe vera (25%) untuk mempercepat penyembuhan luka serta menurunkan inflamasi secara *in vivo* pada mencit (*Mus musculus*).

**Metode:** Penelitian eksperimental ini menggunakan tiga kelompok perlakuan: kontrol negatif, kontrol positif (gel Flamar/aloe vera), dan perlakuan dengan ekstrak kombinasi. Uji fitokimia menunjukkan ekstrak kubis mengandung flavonoid yang bersifat

antiinflamasi, sementara *aloe vera* mengandung *mannose-6-phosphate* yang mendukung regenerasi jaringan.

**Hasil:** Hasil pengujian menunjukkan bahwa kombinasi ekstrak aloe dan kubis mampu mempercepat penyembuhan luka, ditandai dengan penutupan luka lebih cepat dan pertumbuhan bulu pada hari ke-7. Pengujian antiinflamasi menunjukkan adanya penurunan volume inflamasi yang signifikan ( $p < 0,001$ ) pada kelompok Veragreens, meskipun sedikit lebih lambat dibandingkan kontrol positif. Tidak terdapat perbedaan antara hasil efektivitas antara kelompok perlakuan dengan Veragreens dengan kelompok kontrol positif.

**Kesimpulan:** Veragreens berpotensi menjadi solusi topikal yang aman dan efektif untuk mengatasi lecet puting dan bengkak payudara secara bersamaan, serta layak dikembangkan sebagai produk perawatan alami bagi ibu menyusui.

**Kata kunci:** aktivitas antiinflamasi, aloe vera, ekstrak daun kubis (*Brassica olearacea*), penyembuhan luka in vivo, veragreens

## INTRODUCTION

Breast milk (ASI) contains various essential nutrients essential for supporting a baby's growth, development, and immune system, which are obtained through the breastfeeding process. The process of breastfeeding to meet a baby's nutritional needs does not always run smoothly for every breastfeeding mother. A common problem during breastfeeding is sore nipples. Sore nipples cause pain that makes mothers reluctant to breastfeed, potentially reducing the frequency of breastfeeding, which can trigger milk ducts and breast engorgement. If not addressed promptly, these problems can lead to failure in exclusive breastfeeding.

According to the United Nations Children's Fund (UNICEF), the breastfeeding process can be accompanied by various obstacles, including breast engorgement, sore nipples, and mastitis.<sup>1</sup> Based on a systematic review by Safitriana et al., the prevalence of breast and nipple problems in breastfeeding mothers includes breast engorgement of 65%, breast pain of 52.5%, blocked milk ducts of 45.9%, nipple pain of 15.5%, nipple abrasions of 9.7%, and breast abscess of 0.6%.<sup>2</sup> Based on data from the 2017 Indonesian Demographic and Health Survey (SDKI), it was recorded that 35,985 postpartum mothers or around 15.60% experienced breast milk stasis.<sup>3</sup> Previous research by Apriyanti & Syahda estimated that 80-90% of mothers experience sore nipples, 58% of whom experience nipple damage.<sup>4</sup> Sore nipples and breast engorgement are two problems that often occur together in breastfeeding mothers. Sore nipples often occur alongside mastitis, as both are caused by improper attachment by the baby during breastfeeding. This improper attachment can injure the nipple, which can become a source of infection, which then leads to breast engorgement.<sup>5</sup>

One method that breastfeeding mothers use to prevent sore nipples is to apply breast milk before breastfeeding.<sup>6</sup> Breast milk is the recommended treatment for sore nipples because of its emollient, anti-inflammatory, and antibacterial properties, which make it effective in healing and preventing sore and cracked nipples.<sup>7</sup> However, research has shown that aloe vera is more effective than breast milk in treating sore nipples.<sup>8</sup> Meanwhile, to overcome breast swelling, the traditional method that has been used is compressing using cabbage leaves.<sup>9</sup> Cabbage leaves have been shown to reduce breast swelling. Research by Utami et al. found a reduction in breast swelling after applying cabbage leaf compresses.<sup>10</sup> The effectiveness of aloe vera in treating sore nipples and cabbage leaves in reducing breast swelling prompted the author to develop a natural-based product that combines both to address breast problems, considering that there are no products available that can address both problems simultaneously.

Cabbage is known for its anti-inflammatory properties that can help reduce swelling, while aloe vera has a soothing effect, moisturizing the skin and accelerating the healing of wounds such as cracked nipples. Aloe vera contains active substances such as glucomannan, mucopolysaccharides, amino acids, vitamins C and E, zinc, as well as enzymes and saponins that play a role in stimulating collagen production, maintaining skin moisture, reducing inflammation, and preventing infection. This combination of ingredients helps accelerate wound healing and improve skin elasticity and integrity.<sup>11</sup> Cabbage contains phytonutrients and various vitamins, such as vitamins A, C, and E, and glucosinolates, which have anti-cancer properties. Furthermore, cabbage contains sulfur, which is beneficial for reducing inflammation and swelling in the breasts.<sup>12</sup> According to research conducted by A'yun et al., gel with 5% cabbage extract was effective in reducing swelling in mice.<sup>13</sup> Research by Sabin et al. showed that cabbage extract (*Brassica oleracea* var. *Capitata*) had significant anti-inflammatory effects in mouse models of acute and subacute inflammation. Topical administration of cabbage extract was shown to reduce inflammation levels with effectiveness comparable to nonsteroidal anti-inflammatory drugs (NSAIDs). Furthermore, the phenolic compounds in cabbage extract exhibited strong antioxidant activity.<sup>14</sup>

Research by Lestari et al. on the use of aloe vera gel to improve the healing time of sore nipples in breastfeeding mothers showed that the gel accelerated the wound healing process, which typically takes 7-14 days. This effect is due to the amino acids and enzymes in aloe vera, which stimulate new cell growth and help remove dead skin cells.<sup>15</sup> Another study by Arma et al. also showed that aloe vera gel significantly accelerated the healing of sore nipples in breastfeeding mothers.<sup>16</sup> These two natural ingredients complement each other in alleviating common complaints often experienced by breastfeeding mothers. Veragreens is a gel formulated to address breast problems such as engorgement and sore nipples. It contains 15% cabbage extract and 25% aloe vera gel as supporting ingredients.

Based on the ability of cabbage leaves to reduce swelling and aloe vera to accelerate wound healing, the authors were interested in investigating the effectiveness of combining these two ingredients in the form of Veragreens gel. This study aimed to assess the effectiveness of cabbage leaf and aloe vera extracts in reducing breast swelling and healing nipple wounds *in vivo* using animal models.

## METHODS

### Study design

This research used an experimental laboratory study to test the anti-inflammatory activity of Veragreens topical gel in male white mice (*Mus musculus*). The study was conducted in May 2025 at the Pharmacology Laboratory, Faculty of Pharmacy, Institut Kesehatan Rajawali Bandung, Indonesia.

### Data sources and sampling procedures

The data for this study were obtained from observations of anti-inflammatory activity and wound healing in healthy Balb/c mice weighing 20–30 grams after administering topical Veragreens gel, aloe vera gel, and Flamar gel or diclofenac sodium. The data collected included observations of wound healing and measurements of anti-inflammatory activity in the experimental animals.

The experimental animals used in this study were healthy Balb/c mice weighing between 20–30 grams. For testing wound healing and anti-inflammatory activity, mice were divided into three groups, each consisting of five mice. In the wound healing test, group I was a negative control that was wounded on the back along  $\pm 2$  cm and allowed to heal without treatment, group II was a positive control that was wounded on the back

along  $\pm 2$  cm and given aloe vera gel, while group III was a treatment group that was wounded on the back along  $\pm 2$  cm and given Veragreens gel.

In the anti-inflammatory test, group I was a negative control that was induced by carrageenan on the feet and left untreated, group II was a positive control that was induced by carrageenan on the feet and given aloe vera gel, Flamar gel, or sodium diclofenac, while group III was a treatment group that was induced by carrageenan on the feet and given Veragreens gel.

**Measurement and instruments**

The tools and materials used in this study were cages, mouse food and drink containers, rice husks (bedding), cleaning equipment, alcohol swabs, scissors, razors, scalpels, 1 cc syringes, beakers, measuring cups, test tubes, hot plates, stirring rods, watch glasses, labels, and markers. The materials used included Veragreens topical gel and Flamar gel, cabbage (*Brassica oleracea*), aloe vera gel, 96% ethanol, 2N HCl, magnesium powder, Fehling's solution A and B, carbopol, triethanolamine (TEA), sodium metabisulfite, propylene glycol, essential lemon, distilled water, and carrageenan.

Measurements were made through evaluation of the gel preparation using organoleptic observations, pH tests, irritation tests, and homogeneity tests. Wound healing activity was observed for seven days, with specific observations on days 5 and 7, while anti-inflammatory activity was monitored every 60 minutes until the 300th minute.

**Data collection**

This research began with the preparation of simplicia from cabbage (*Brassica oleracea*) obtained from farmers in the Cihanjuang area, West Bandung Regency, West Java. The cabbage was thoroughly washed, cut into small pieces, and dried using a stovetop oven at a controlled temperature of 160–180°C until a dry texture and brownish color were obtained. The drying process lasted for 5–6 hours for 110 grams of cabbage.

Subsequently, cabbage extract was prepared from the simplicia using the maceration method with 96% ethanol as the solvent. A total of 45 grams of cabbage simplicia was weighed and soaked in 450 mL of solvent for three days, with stirring performed every eight hours. Re-maceration was carried out every 24 hours using the same volume of solvent. All macerates were then combined and concentrated using a water bath to obtain a thick extract.

The next step was phytochemical screening of cabbage extract and aloe vera gel. Phytochemical testing of cabbage extract aimed to identify flavonoid compounds. Flavonoid identification was performed using the Shinoda test, which involved adding 0.5 grams of magnesium powder and 2 mL of 2N HCl solution to 2 grams of cabbage leaf extract. The presence of flavonoids was indicated by a color change from orange to red.<sup>17</sup> Phytochemical testing of tongue gel was performed to identify mannose-6-phosphate content. Mannose-6-phosphate identification was performed using the Fehling test. Fehling's solutions A and B were mixed in equal proportions, then 1 gram of the sample was added. The mixture was heated in a water bath, and the presence of glucose was indicated by the formation of a brick-red precipitate.<sup>18</sup>

**Table 1. Veragreens Preparation Formulation**

Material	Concentration
Aloe Vera Extract	25%
Cabbage extract	15%
Lemon essential oil	3%
Carbopol	3%
Triethanolamine (TEA)	3%
Sodium metabisulfite	0.5%
Propylene glycol	0.15%
Aquades	Add 100%

Next, a combination gel was made with the formulation in Table 1. Preparation of the preparation began with the creation of a gel phase by dispersing Carbopol into distilled water, then neutralized by adding TEA until a clear gel was formed. After that, a liquid phase was made by mixing aloe vera gel, propylene glycol, and sodium metabisulfite until homogeneously mixed. Cabbage extract was then added to the liquid phase mixture, and this mixture was added to the carbopol gel by stirring using a low-speed mixer until evenly distributed. The final stage included the addition of essential ingredients such as lemon and adjustment of consistency and pH (pH 6–7).

The formulated Veragreens gel was then evaluated through organoleptic tests, pH tests, irritation tests, and homogeneity tests. Following these tests, the study continued with wound healing and anti-inflammatory activity tests using experimental animals. Wound healing activity was observed for seven days, with specific observations on days 5 and 7. Anti-inflammatory activity was also observed every 60 minutes until the 300th minute.

#### **Ethical consideration**

This research has obtained ethical approval from the Research Ethics Committee of Dian Nuswantoto University with the number: 001684/UNIVERSITAS DIAN NUSWANTORO/2025.

#### **Data analysis**

Wound healing testing will be conducted through observation and descriptive data processing. Meanwhile, anti-inflammatory activity testing will be analyzed statistically using SPSS 27 for Windows. Prior to the main analysis, the data were first tested for normality using the Shapiro-Wilk test. Data are considered normally distributed if the p-value is greater than 0.05 ( $p > 0.05$ ). Next, homogeneity testing will be performed using the Levene Test. Data are considered homogeneous if the p-value is also greater than 0.05 ( $p > 0.05$ ).

Inflammation volume testing before and after carrageenan induction, as well as at 0 and 300 minutes, was analyzed using a parametric statistical test in the form of a paired sample t-test if the data met the assumptions of normality and homogeneity. However, if the results of the normality or homogeneity test showed a p-value of less than 0.05 ( $p < 0.05$ ), a nonparametric statistical test, namely the Wilcoxon test, was used.

Furthermore, to analyze the difference in inflammation volume between the 300th and 0th minutes, if the data were normally distributed and homogeneous, parametric statistical analysis was used in the form of Analysis of Variance (ANOVA) with a 95% confidence level, followed by a Bonferroni post hoc test. If the data were not normally distributed, the nonparametric Kruskal-Wallis statistical test was used, followed by a Mann-Whitney post hoc test.

## **RESULTS**

### **Phytochemical screening results**

The results of phytochemical screening of cabbage extract showed that the extract contained secondary metabolite compounds in the form of flavonoids, which have an important role as antioxidants.<sup>19</sup> Meanwhile, the results of phytochemical screening of aloe vera extract showed that the extract contained mannose-6-phosphate, which plays an important role in the wound healing process.<sup>20</sup>

### **Results of physical quality testing of gel**

Veragreens gel has undergone organoleptic testing, showing a thick texture, brownish color, and a lemony aroma. A pH test showed a pH of 6. The irritation test showed no irritation. Furthermore, the gel is homogeneous, with no coarse grains present.

Results of wound healing activity testing on experimental animals

Table 2. Wound Healing Activity Process in Experimental Animals Until the 7th Day

Group	Day			
	0	1	5	7
I	1 cm red wound	The wound is still red and open.	The wound is still open, still a little red.	The wound is still open, and there is no redness.
II	1 cm red wound	The wound is still red and open.	The wound is still open, but not too red.	The wound is improving but has not closed yet.
III	1 cm red wound	The wound is still red and open.	The wound begins to close and heal.	The wound heals, and hair begins to grow.

Based on the observations in Table 2, in group I, which received no treatment, the incision wounds in the mice showed a very slow healing process. The wounds remained open from day 1 to day 5, and only began to show slight signs of closure on day 7.

In group II, which received aloe vera gel, it was observed that on day 1, the gel helped reduce inflammation. On day 5, the wounds were still open, but the redness appeared to have reduced. On day 7, the wounds showed improvement, although they had not yet completely closed.

In group III, which was given Veragreens gel, the redness began to subside on day 1. On day 5, the wound showed signs of closing, and on day 7, the wound improved significantly and hair began to grow in the wound area.

Results of anti-inflammatory activity testing on experimental animals

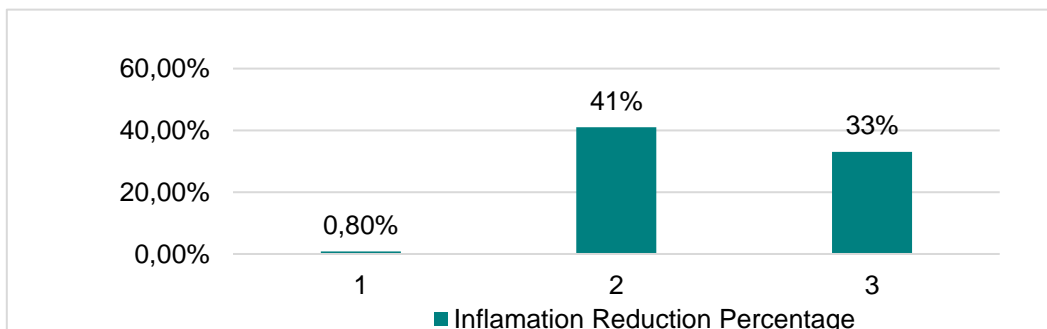


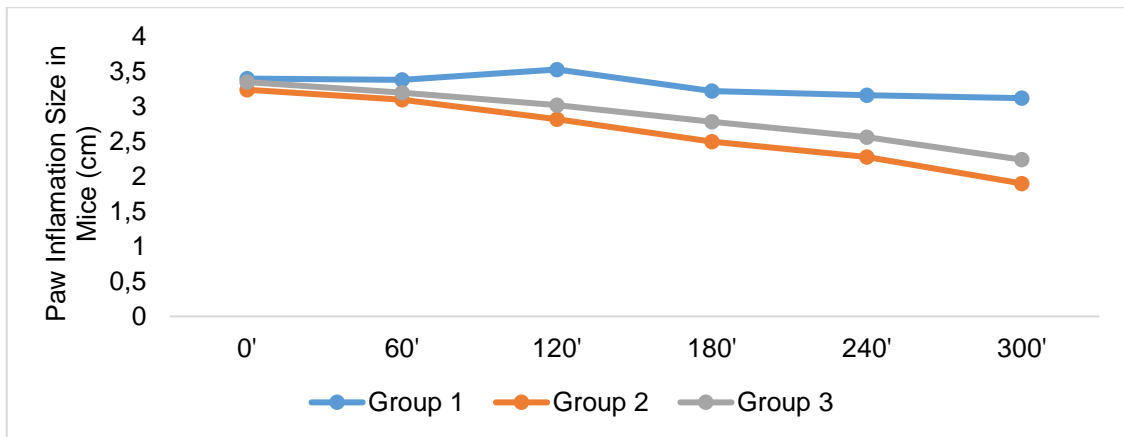
Figure 1. Percentage of Inflammation Reduction

The results of the normality test on the average data of the mouse paw volume before and after carrageenan injection showed a p-value > 0.05, which means the data was normally distributed. The homogeneity test also showed a p-value > 0.05, so the data met the requirements for further analysis using the Paired Sample T-Test. This test was conducted to compare the average inflammation volume before and after carrageenan injection. The results of data processing showed a p-value < 0.05, which indicated that there was a statistically significant difference between the volume of the mouse paw before and after injection. This shows that carrageenan injection affects the formation of inflammation in the mouse paw.

Table 2. Difference in Inflammation Volume of Mice Before and After Treatment

Group	Average hour 0	Average 5th hour	p
I	3.40	3.12	0.002
II	3.24	1.90	<0.001
III	3.30	2.24	<0.001

Comparison of inflammation volume before treatment and at 5 hours was performed using a paired sample t-test, which showed a significant decrease in inflammation volume in all groups. This decrease was then further analyzed using the Kruskal-Wallis and post hoc tests to evaluate differences in the ability of the groups to reduce inflammation. There was a significant difference between the groups in terms of their ability to reduce inflammation, with a p-value of <0.05. The comparison of inflammation volume before and after treatment at 5 hours is shown in Table 2, while the percentage decrease in inflammation following treatment is presented in Figure 1.



**Figure 2. Reduction in Inflammation Size in Mice's Feet**

Figure 2 shows that the reduction in edema in the paws of mice in group I, which were not given any treatment, was slow. This indicates that the natural inflammatory process takes longer to subside. In group II, which was given Flamar gel (sodium diclofenac), edema reduction was very rapid and effective. This is consistent with the characteristics of sodium diclofenac as a nonsteroidal anti-inflammatory drug (NSAID) that works by inhibiting the production of prostaglandins, mediators in the inflammatory process. Sodium diclofenac is a chemical compound, so its anti-inflammatory effects work quickly.

Group III demonstrated good anti-inflammatory effects, although not as rapid as Flamar gel. These findings indicate that Veragreens has potential as a natural anti-inflammatory agent. Despite its slower rate compared to Flamar gel, Veragreens' natural-based gel is considered safer for long-term use.

**DISCUSSION**

Veragreens is a topical gel for treating breast swelling and sore nipples in breastfeeding mothers. It is made from cabbage (*Brassica oleracea*) and aloe vera extracts. Both ingredients are known to help reduce swelling and accelerate wound healing. A literature study by Purawati et al. showed that cabbage leaf compresses were effective in reducing breast swelling in postpartum mothers.<sup>21</sup> Research by Juwita et al. also showed that aloe vera gel affected the healing time of sore nipples in breastfeeding mothers.<sup>22</sup> Therefore, developing a natural alternative treatment based on these two plants in the form of Veragreens gel is considered crucial. In this study, the authors aimed to test the effectiveness of Veragreens gel on wound healing and reducing inflammation in vivo.

Phytochemical screening results revealed that cabbage extract contains flavonoids, which have antioxidant and anti-inflammatory effects. Flavonoids play a key role in reducing oxidative stress and inflammation by targeting various pro-inflammatory molecular pathways and enzymes, as well as enhancing antioxidant activity and cell regeneration.<sup>23</sup> Meanwhile, phytochemical screening results for aloe vera gel, a

supporting ingredient in this gel, revealed the presence of mannose-6-phosphate. Aloe vera gel accelerates wound healing and reduces swelling through its glucomannan and mannose-6-phosphate content, which plays a role in promoting skin cell growth, blood vessel formation, collagen production, and providing anti-inflammatory effects.<sup>24</sup>

The results of the physical quality test of Veragreens gel show that the gel has a thick texture, is brownish in color, has a lemon scent, is homogeneous without any coarse grains, does not cause irritation, and has a pH of 6. This pH value is in accordance with the pH of the skin, which is between 4.5–6.5, thus allowing the gel to diffuse into the skin without causing dryness or irritation.<sup>25</sup>

The results of the wound healing activity test on mice showed that group III experienced a faster wound healing process compared to the control group (group I) and the group that was only given Aloe vera gel (group II). By the 5th day, the wounds in group III had begun to close and showed significant improvement, while in group I, the wounds were still open and showed only slight improvement.

The combination of cabbage leaf extract and aloe vera in Veragreens gel is proven effective because it combines the anti-inflammatory effects of flavonoids in cabbage with the regenerative and moisturizing effects of glucomannan and mannose-6-phosphate in aloe vera. These synergistic properties support faster tissue repair by stimulating collagen production, increasing fibroblast proliferation, and reducing local inflammation.

These results align with research by Juwita et al. (2021), which found that applying aloe vera gel can speed up the healing time of sore nipples in breastfeeding mothers.<sup>22</sup> However, in this study, wound healing was more optimal with the addition of cabbage extract, which shows that the combination of these two natural ingredients provides a superior effect compared to using Aloe vera alone.

Statistical analysis showed a significant decrease in inflammation volume in the group given Veragreens gel (group III) with a p-value <0.001. This decrease indicates that Veragreens has a significant anti-inflammatory effect. When compared to the Flamar group (group II) as a positive control, Veragreens gel did show a slightly slower effect, but its effectiveness approached that of nonsteroidal anti-inflammatory drugs (NSAIDs) such as diclofenac sodium.

This is an added value, considering that Veragreens is made from natural ingredients and is considered safer for long-term use, especially for breastfeeding mothers who require alternative topical therapy without systemic risks. Cabbage has been shown to have anti-inflammatory activity due to its content of glucosinates, a dominant secondary metabolite that can be an alternative to NSAIDs.<sup>26</sup> The Kruskal-Wallis test and the Mann-Whitney follow-up test showed no significant difference between the positive control group and the Veragreens treatment group. These findings suggest that Veragreens, as a natural topical gel, has inflammation-reducing properties comparable to nonsteroidal anti-inflammatory drugs (NSAIDs).

Veragreens offers advantages as a natural alternative breast care product due to its combination of natural ingredients, such as cabbage leaf extract and aloe vera, providing a multifunctional effect, acting as an anti-inflammatory agent and accelerating wound healing. Furthermore, because it is naturally based, Veragreens is safer for long-term use and minimizes the risk of systemic side effects, which is especially important for breastfeeding mothers. However, Veragreens has limitations in terms of its reaction speed, which tends to be slower than chemical substances like diclofenac sodium. Its effectiveness in this trial showed good results, but further human studies are needed to confirm its safety, clinical efficacy, and long-term storage stability.

The results of this study can be applied to address common problems in breastfeeding mothers, such as sore nipples and breast engorgement. Veragreens has the potential to

be an efficient and practical topical treatment solution because it can address both breast engorgement and sore nipples simultaneously with a single product. This can certainly improve maternal comfort and compliance in continuing breastfeeding. Based on natural ingredients and with initial evidence of effectiveness through in vivo studies, Veragreens has the potential to be developed as a safe, evidence-based alternative, particularly to support successful breastfeeding without the added burden of side effects or difficulty with administration.

## CONCLUSION

Veragreens is a topical gel preparation made from cabbage leaf extract and aloe vera that has been proven effective in vivo in accelerating wound healing and reducing inflammation. Its effectiveness is close to the positive control (sodium diclofenac), but it is safer for long-term use due to its natural ingredients. The multifunctional benefits of Veragreens make this gel a potential, practical, and evidence-based alternative topical therapy for breastfeeding mothers. Further human studies are still needed to support its clinical application, but before that, further research is needed on long-term safety aspects and product stability testing.

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