Journal of Applied Science, Engineering, Technology, and Education *ISSN: 2685-0591 (online)*
Vol. 5 No. 1 (2023)
https://doi.org/10.35877/454RI.asci1139

Effects of Achasin Protein on Snail (*Achatina Fulica*) Mucus on Healing Cuts (*Vulnus Scissum*) in Mice (*Mus Musculus*) Skin

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Abstract

Snail mucus Achasin protein is a protein that has important biological functions, besides being intended to prevent evaporation, and assist smooth movement, it is also needed to protect the body from mechanical injuries. This research is expected to increase knowledge about the effect of achasin protein on snail mucus on wound healing and can provide scientific information to the public about the use and benefits of snail mucus as a traditional medicine for healing cuts on the skin of mice (*Mus Musculus)*. This type of research is a literature review study that aims to examine the effect of achasin protein on snail mucus (*Achatina Fulica)* on the healing of cuts on the skin of mice (*mus musculus)*. Sources of data used in this study used a literature review with relevant sources such as books, official documents, publications, and relevant research results. The results of this study were the achasin protein in snail mucus (*Achatina Fulica*) can accelerate the healing of cuts (*Vulnus Scissum*) on the skin of mice (*mus musculus*). The content of achasin isolate is also useful as an antibacterial and painkiller. So that people can take advantage of snail slime as an alternative to traditional medicine derived from natural ingredients that have been clinically tested for their efficacy.

Keywords: Achasin Protein, Snail Mucus, and Cuts Healing

Received: 24 August 2022 Revised: 23 June 2023 Accepted: 29 June 2023

1. Introduction

Wound healing is critical to restoring skin integrity and is a complex and dynamic process. Healing with snail slime can be an alternative because it has many benefits. In addition, the majority of Indonesian people inherit traditional medicine from generation to generation, natural ingredients that are believed to be efficacious as antimicrobial ingredients, one of which is snail mucus.

Healing with snail mucus can be an alternative because it is easy to use, has good dispersion on the skin, does not clog skin pores, and has an antibacterial effect. Snail slime gave a positive reaction to the test for protein content that plays a role in cell regeneration and growth, including amino acids and enzymes. Protein can function and play a role in growth, defense, body function, and as a protective function, namely replacing damaged tissues and cells. Based on the function of this protein, it is estimated that the animal protein content in snail mucus has a high biological value, namely in healing and inhibiting the inflammatory process (Lestiani, 2022).

The chemical content of snail mucus includes proteoglycans in the form of Achasin, glycosaminoglycans in the form of Acharan sulfate, glycoprotein enzymes, hyaluronic acid, copper peptides, antimicrobial peptides, and metal ions (Ferreira, 2020). Bagaskara explained that snail mucus contains chemicals such as achatin isolate, heparan sulfate, and calcium. The content of achatin isolates is useful as an antibacterial and anti-pain, while calcium plays a role in hemostasis (Mardiyantoro, 2020).

While the content of snail mucus that can be used to help wound healing is due to the content of Achasin and Acharan sulfate (Agustina et al., 2020). Achasin protein in snail mucus is a protein that has important biological functions, besides being intended to prevent evaporation, assisting smooth movement, it is also needed to protect the body from mechanical injuries (Xiong et al., 2021).

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The effect of snail mucus as antibacterial and anti-inflammatory will accelerate the inflammatory phase so that the proliferative phase of wound healing will also accelerate (Gubitosa et al., 2020). The content of snail mucus which is thought to have the most effect on fibroblast proliferation is heparan sulfate which is useful in accelerating the wound healing process by helping the blood clotting process and fibroblast cell proliferation (Brito-Arias, 2022).

Fibroblasts play a role in the production of structural proteins that are used during tissue reconstruction. In particular, fibroblasts are the basic material of collagen fibers that will bind the wound edges (Annisa, 2022). Snail mucus (*Achatina Fulica*) has a significant effect on the number of fibroblasts in wound healing (Ferreira, 2020). So that snail mucus can accelerate the healing of cuts in mice (Harti, 2019). This research is expected to increase knowledge about the effect of achasin protein on snail mucus on wound healing and can provide scientific information to the public about the use and benefits of snail mucus as a traditional medicine for healing cuts on the skin of mice (*Mus Musculus*).

2. Research methods

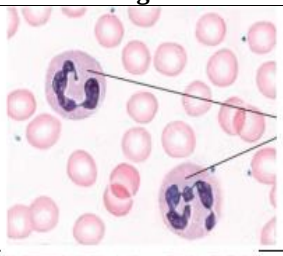
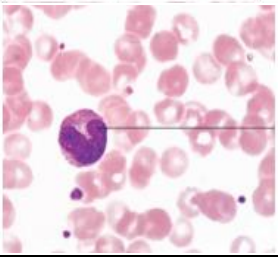
This type of research is a literature review study that aims to examine the effect of achasin protein on snail mucus (*Achatina Fulica*) on the healing of cuts on the skin of mice (*mus musculus*). Sources of data used in this study used a literature review with relevant sources such as books, official documents, publications, and relevant research results. Furthermore, the information obtained is then analyzed and reduced from various relevant information.

After the data is collected from various sources, then the data identification is carried out by selecting the information that has been collected. Furthermore, the author tries to study and understand various data relevant to the problems in this article. According to Creswell, this kind of data collection and analysis technique is called triangulation, which means combining a collection of data taken from various existing data sources (Sarosa, 2021).

3. Results and Discussion

The results of the observation, Microscopy of the Excision Wound using magnification of 1000 times showed that histological preparations were made on days 3, 7, and 14. Histological analysis was used to see the number of fibroblasts, the number of neutrophil inflammatory cells (neutrophils), and the number of phagocytes (macrophages). The characteristics can be described in the Table 1.

Table 1. Features of neutrophils, macrophages, fibroblasts and collagen fibers

No	Cell Type	Characteristics	Figure
1	Neutrophils	Has a cell nucleus, is a group of granular leukocytes, has a blue-black color, has a size of approximately 8 µm, is around the wound tissue in large numbers.	
2	Macrophages	Has a round nucleus, has a larger size than neutrophils, and has purplish-red in HE staining, and has an irregular shape.	

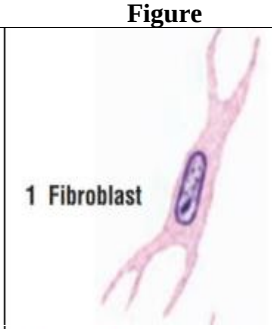
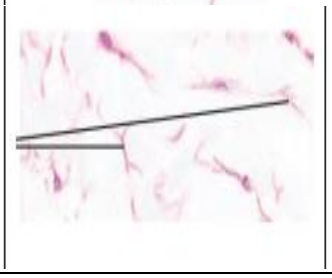
No	Cell Type	Characteristics	Figure
3	Fibroblasts	Fibroblast cells have more than 3 cytoplasmic or fibronexus projections, the most numerous, elongated and filled in shape, round to oval nuclei, close to collagen fibers, and dark in HE staining	
4	Collagen fibers	Collagen fibers can be identified by their characteristics, which are pink in color and elongated in shape	

Table 2. Analysis of the journal Achasin Protein in Snail Mucus (*Achatina Fulica*) for Healing Slices (*Vulnus Scissum*)

No	Author	Title	Years	Result
1	Ertati Suarni, Putri Rizki Amalia Badri	Effectiveness Test of Snail Mucus (*Achatina Fulica*) Compared with Povidone Iodine 10% on Slice Healing (*Vulnus Scissum*) in Mice (Mus musculus)	2016	The results showed that snail mucus at various concentrations was effective in accelerating wound healing compared to aquadest ($p<0.05$) but not significantly different when compared to 10% povidone iodine. In conclusion, snail mucus can accelerate the healing of cuts in mice.
2	Abd Rachman Usman, Nur Asmar Salikunna	The Effect of Snail Mucus (*Achatina Fulica*) on Closing Time of Slices (*Vulnus Scissum*) in Mice (*Musmusculus*)	2015	The results showed that the treatment group that was given snail mucus (*Achatina Fulica*) had an average time of closing wounds with an average time of 6.75 days, while the control group without snail mucus (*Achatina Fulica*) had an average wound closure time of 8.1 days.
3	Ferreira, Angela Dos Santos	The Effectiveness of Snail Mucus (*Achatina Fulica*) on the Speed of Healing of the Inflammatory Phase of Second Degree Burns in White Mice (Rattus Norvegicus)	2020	Statistical test results showed lower erythema values using snail mucus compared to NaCl which means that there was a significant difference between snail mucus and NaCl ($\rho=0.001$). There was a decrease in diameter in the snail mucus group compared to the control group. Granulation tissue was obtained and there was no necrosis in the snail mucus group, while there was tissue granulation and necrosis in the NaCl group
4	Wa Ode Harlis, Dwi Arinto Adi, Ni Made Maitri Saraswati, Jamili Jamili, Suriana Suriana, Resman Resman.	Effectiveness of snail mucus gel (*Achatina Fulica* Ferr) on mice (Mus musculus L.) burns	2023	The results showed that snail mucus gel (*A.fulica*) with a gel concentration of 5% was more effective in accelerating burns healing with an average healing time of 14 days, and positive controls healed within 14.In 25 days, 4% of the gel recovered in 14.5 days, 3% in 15 days, and negative controls recovered in 16 days. The fastest closure of burn diameter was in gel with a

No	Author	Title	Years	Result
				concentration of 5% with a mean of burn diameter of 0.33mm and an average percentage of burn healing of 98.35%, followed by the Bioplacenton treatment group of 10%, gel with a concentration of 4%,3%, and the longest burning closure was in the ointment base gel group.

Based on several previous research articles, Achasin Protein in snail mucus (*Achatina Fulica*) has been shown to have a positive effect in accelerating the healing of cuts. Research shows that snail mucus at various concentrations is effective in accelerating the healing of cuts compared to sterile water (aquadest), although it is not significantly different when compared to 10% povidone iodine. In this study, the group given snail mucus experienced faster wound closure than the control group without snail mucus. In addition, the use of snail mucus also resulted in lower erythema values compared to the use of NaCl, indicating a significant difference between snail mucus and NaCl. The group using snail mucus also experienced a decrease in the diameter of the incision wound and had good granulation tissue, while the group using NaCl had necrosis and had poor granulation tissue. In another study, snail mucus gel with a concentration of 5% proved to be more effective in accelerating burn wound healing compared to positive and negative controls. Gels with concentrations of 4% and 3% also showed good results, while the group that used the ointment base gel required the longest time to cover the burns. Thus, Achasin Protein in snail mucus can be a promising option in accelerating the healing process of cuts and burns.

Therefore, healing with snail slime can be an alternative because it is easy to use, has good dispersion on the skin, does not clog skin pores, and has an antibacterial effect. Snail slime gave a positive reaction to the test for protein content that plays a role in cell regeneration and growth, including amino acids and enzymes. Protein can function and play a role in growth, defense, body function, and as a protective function, namely replacing damaged tissues and cells (Harti, 2021).

Snail slime contains chemicals such as achatin isolate, heparan sulfate, and calcium. The content of achatin isolates is useful as an antibacterial and anti-pain, while calcium plays a role in hemostasis (Mardiyantoro, 2020). In addition, the snail mucus component is mostly water, water is the key to humidity which can increase epithelialization, causing wounds to heal faster (Song et al., 2021).

In snail slime there is a glycoprotein called Achasin, the achasin peptide bond is stably stored at 40-80˚C or is not damaged at room temperature and is not damaged at a pH of 8-9.5. Achasin has a molecular weight of 56 kDa, works bacteriostatically with a very broad antimicrobial spectrum, both Gram-positive and Gram-negative bacteria, and is even effective against parasites, viruses, and other pathogenic organisms (Hetland et al., 2021). Meanwhile, Achasin isolated from the slime of the *Achatina Fulica* Ferussac snail, the Java strain, is a protein molecule with a molecular weight of 71.3 kDa which is active as an antibacterial with reaction conditions at the pH of the solution: 7.98-8.0 (Jacub, 2019).

Meanwhile, the results of the inhibition test of snail slime against MRSA with a concentration of 100% and a protein content of 262 g showed that snail slime was able to inhibit the growth of MRSA. Snail slime can inhibit the growth of MRSA because snail mucus contains antibacterial components such as Achasin protein (Anggraini et al., 2018). Achasin will attack or inhibit the formation of common parts of bacterial strains such as peptidoglycan and cytoplasmic membranes (Lima et al., 2020). The peptidoglycan layer is an important part of bacteria because the peptidoglycan layer forms the cell wall, where the cell wall in bacteria plays a very important role in protecting cell contents, resisting external pressure and playing a role in cell division (Harti, 2019).

Achasin in snail mucus is also a protein that has an important biological function to heal skin from wounds, achasin protein also functions as an antibacterial factor that works by attacking or inhibiting the formation of common parts of bacterial strains, namely the peptidoglycan layer and cytoplasmic membrane (Jacub, 2019), besides that, the protein achasin in snails (*Achatina fullica*) is also a protein binding receptor (enzyme) in bacteria (Harti, 2019).

This achasin works by attacking or inhibiting the formation of common parts of bacterial strains such as the peptidoglycan layer and the cytoplasmic membrane. The peptidoglycan layer is the layer that forms the cell wall, where the cell wall in bacteria plays a very important role in resisting osmotic pressure from the outside (Lestiani, 2022). The achasin protein in snail mucus has important biological functions, including as a protein binding receptor (enzyme) for bacteria. The achasin protein will bind to the protein (enzyme) present in the bacteria and will interfere

with the activity of the enzyme so that when an infection occurs, the bacteria that will carry out the replication process will fail to separate because it is prevented by the achasin protein, the septum is not formed and separates into daughter cells. (Harti, 2021)

Achasin protein in snail mucus is a protein that has important biological functions, besides being intended to prevent evaporation, and assist smooth movement, it is also needed to protect the body from mechanical injuries (Lestiani, 2022). The administration of snail mucus (Achtina fulica) has the effect of accelerating the closure of a cut wound (*Vulnus Scissum*) which can be seen by the linking of the two edges of the wound. Administration by applying snail mucus (*Achatina Fulica*) to cuts in mice has a faster effect on wound closure time compared to incisions that are not smeared with snail mucus (Suarni, 2016).

In addition, snail slime gave a positive reaction to the test for protein content that plays a role in cell regeneration and growth, such as amino acids and enzymes. Protein can play a role in growth, defense, body function, and as a protective function, namely replacing damaged tissues and cells. Based on this protein function, it is estimated that the animal protein content found in snail slime has a high level of biological value in healing and inhibiting the inflammatory process (Lestiani, 2022).

Therefore, although the body is very fragile and the condition of the skin tissue is very wet, these animals have resistance to microorganisms. The presence of antibacterial factors appears to be present in the mucus. According to Karnwal et al., (2023) this antibacterial factor can work by attacking or inhibiting the formation of common parts of bacterial strains such as the peptidoglycan layer and the cytoplasmic membrane.

Elongation and septation are said to require Penicillin Binding Proteins (PBPs), which are transpeptidases that play a role in catalyzing the final phase of peptidoglycan biosynthesis. This antibacterial activity also causes an elongation of the Escherichia coli body three to seven times compared to normal size and prevents the formation of a separating septum. As a result, even though many nuclei are produced in the process of cell replication, cells will still fail to separate because the septum is not formed (Koentjoro, 2020). The target of achasin in Staphylococcus aureus is its cytoplasmic membrane by attacking the cytoplasmic membrane and causing the cell wall to peel off and sink into the cytoplasm.

Furthermore, the content of snail mucus which is thought to have the most influence on fibroblast proliferation is heparan sulfate which is useful in accelerating the wound healing process by helping the blood clotting process and fibroblast cell proliferation (Riyani, 2021). While the content of snail mucus that can be used to help wound healing is due to the content of Achasin and Acharan sulfate (Sutanto et al., 2021). The effect of snail mucus as antibacterial and anti-inflammatory will accelerate the inflammatory phase so that the proliferative phase of wound healing will also accelerate (Harti, 2021).

Tissue healing can be carried out by several types of cells, one of which is fibroblast cells. During the healing process, fibroblasts migrate to the damaged tissue and repair the tissue. Healing tissue with snail mucus (*Achatina Fulica*) can be an alternative because it contains ingredients as anti-inflammatory agents that accelerate the inflammatory phase and accelerate the tissue healing phase. Snail slime (*Achatina Fulica*) with a concentration of 1.25% showed better cell migration compared to exposure to mucus at a concentration of 2.5% and 5%. Snail slime (*Achatina Fulica*) at a concentration of 1.25% has the effect of supporting the growth of fibroblast cells, especially in migrating cells (Perpelek et al., 2021).

Therefore, the protein content of achasin in snail mucus plays a role in healing cuts on the skin of mice (mus musculus). Snail slime has Achasin Protein which is an antibacterial factor that works by attacking or inhibiting the formation of common parts of bacterial strains such as the peptidoglycan layer and cytoplasmic membrane. The use of snail mucus topically on wounds can help the wound healing process (Kesumaningrum, 2021).

The concentration of snail slime (*Achatina Fulica*) did not affect the physical quality of the snail slime gel preparation. Snail mucus gel formulation (*Achatina Fulica*) can be used to accelerate the wound healing process with the best formula being Formula I at 10% snail mucus concentration (Song et al., 2021). Based on the results of previous studies related to snail mucus, what distinguishes this research was the focus on the mucus content in the presence of protein which turns out not only to have a biological function, but there are several other benefits, namely helping facilitate movement, healing wounds naturally, and preventing evaporation, and also in this study the object was more on the skin of the mice, not other parts. In addition, it is important to know that the achasin content in snail mucus acts as an antibacterial in healing wounds on the rat's skin. This is probably what most people don't know about, so this research can be used as an insight or new knowledge in finding natural remedies for wound healing in particular.

4. Conclusion

Protein content Achasin in snail slime is a protein that has important biological functions, in addition to preventing evaporation and helping the smooth movement. The utilization of achasin protein in snail mucus (*Achatina Fulica*) can accelerate the healing of cuts (*Vulnus Scissum*) on the skin of mice (mus musculus). Snail mucus also contains achatin isolate which is useful as an antibacterial and painkiller. So that people can take advantage of snail slime as an alternative to traditional medicine derived from natural ingredients that have been clinically tested for their efficacy. In addition, natural antibiotics are much better and more natural for the body, do not contain chemicals, and are more economical.

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