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The Effectiveness of Anti-Inflammatory Cream Galenic Preparations Based on Snail Seromucoid, Durian Peel Extract Polysaccharides and Chitosan in the Wound Healing Process (In Vivo)

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ABSTRACT

Development of galenic preparation formulations that can be used to make anti-inflammatory cream preparations. Snail seromucoid contains glycoproteins, mannose carbohydrates, glucose, N-acetyl muramic acid and the α-1 globulin-oromucoid fraction which functions as a bioimmunostimulator. Durian peel (*Durio zibethinus* L.) contains a polar polysaccharide polymer compound such as D-galacturonic acid which has anti-microbial properties. Chitosan is a polymer compound resulting from derivatization of chitin which has antimicrobial polycationic properties; biodegradable, and biocompatible with animal body tissue. The aim of the research was to examine the effectiveness of a galenic anti-inflammatory cream preparation based on snail seromucoid, durian skin extract, and chitosan for healing acute and chronic wounds in vivo. The research method is experimental research, namely the effectiveness of anti-inflammatory galenic cream preparations made from snail seromucoid, durian peel extract and chitosan on various types of wounds in vivo. Analysis of observation data using the one way anova test. A galenic preparation based on a combination of 2% snail seromucoid, 2% durian peel extract polysaccharide and 2% chitosan ratio 1:1:1 is effective in the healing process based on the formation of granulation tissue thickness in incision injuries, hot objects injuries, second degree burns and ulcers. diabetes. The bioformulation galenic preparation of 2% snail seromucoid, 2% polysaccharide of durian peel extract; 2% chitosan and their combination with ratio 1:1:1 is effective as an anti-inflammatory galenic cream preparation so that it can be applied for healing chronic wounds, acute wounds and diabetic ulcers.

Keywords: chitosan, snail seromucoid, durian peel, in vivo, galenic

1. INTRODUCTION

In general, conventional and modern methods of chronic wounds treatment are based on moist wound healing methods with patent medicines that it only antiseptic so less effective and relatively expensive. Chronic wound therapy is relatively long because it requires repeated wound care procedures and synthetic wound healing products have many limitations, namely the price is relatively expensive, it is only antiseptic, there are side effects or it is relatively only induces angiogenesis less effective for chronic wounds treatment (Pereira and Bártolo, 2016).

Technology in the health sector can contribute to supporting wound care practices. This is supported by the increasing number of new innovations in chronic wound care products. The use of topical galenic cream preparations based on natural ingredients is effective as a method of treating wounds that is often used because it is relatively economical (Yadav, 2014). Galenic preparations in cream form are preferred because of several advantages, namely, they are more comfortable, not sticky to the skin when used and are more easily absorbed by the skin, provide a cool feeling, low

risk of difficulty absorbing the drug with food, avoid risks and are able to stop the effects of the drug quickly if clinical action is needed (Saryanti, D., Setiawan, I., dan Safitri, 2019).

Therefore, it is necessary to consider the selection of the right type of galenic preparation product for wound care, namely effectiveness, economy and product safety through the exploration and development process of bioformulation of wound healing cream preparations that are effective in accelerating the cell regeneration process, safe and economical (Handayani, 2016). Exploration of the potential of natural ingredients and development of pharmaceutical preparation technology based on galenic ingredients need to be optimized to support the effectiveness of chronic wound care therapy. Galenic preparations are preparations based on natural ingredients from herbs or animals that can be used as a source of raw materials for galenic preparations, including snail seromucoid, durian peel extract polysaccharides and chitosan (Harti *et al.*, 2023).

Snail seromucoid has been used by the community as a natural ingredient for healing wounds. Snail seromucoid contains glycoproteins, mannose carbohydrates, glucose, N-acetyl muramic acid and the α-1 globulin – oromucoid fraction. The bioactive compound of snail seromucoid is used in the medical field as a cosmetic ingredient to soften the skin, treat respiratory infections and burns (Harti, Puspawati and Putriningrum, 2019) .

Chitosan has been widely used in the biomedical and pharmaceutical fields because it is polycationic which can suppress the growth rate of pathogenic bacteria. Chitosan as a polymer results from the derivatization of chitin found in Crustaceae skin and is biodegradable, non-toxic, non-immunogenic and biocompatible with animal body tissue. (Harti, Estuningsih, *et al.*, 2016).

The chemical substance of durian peel (*Durio zibethinus* L.) contains pectin which is multifunctional and can be used in the pharmaceutical field. Chemically, pectin is a polysaccharide polymer of D-galacturonic acid linked by ß-1,4 glycosidic bonds which can dissolve in water to form a colloidal solution or gel and is antimicrobial non *Mycobacterium tuberculosis* (Hokputsa *et al.*, 2004), (Sutanto *et al.*, 2020).

Snail seromucoid, durian peel extract polysaccharide, chitosan and their combination can be developed as an innovative creative health product for wound care based on the principles of product safety and product hygiene based on a knowledge based economy because they contain natural bioactive compounds that are effective, safe, halal and economical so that they can be downstream and commercialized. professionally; independent and sustainable.

The aim of the research was to examine the effectiveness of a galenic anti-inflammatory cream preparation based on snail seromucoid, durian skin extract, and chitosan for healing acute and chronic wounds in vivo.

2. METHODS

1. Materials

Types of research include laboratory experimental research in vitro and in vivo. The research was conducted at the Pharmacy Laboratory of Muhammadiyah University, Surakarta, Microbiology and Pharmacology Laboratory of Setia Budi University, Surakarta; and Histology laboratory at Faculty of Medicine Sebelas Maret University, Surakarta. Implementation time is July – December 2023. The pharmaceutical industry partner is PT. Wijaya Wismaya Teratai, Sukoharjo and An Naffi Home Care, Gondangrejo Village, Karanganyar. The tools used were sterile surgical instruments (Smicss), micropipette tubes (Gibco), Eppendorf tubes (Extragen), 10 mL injection syringes (Terumo), centrifuges (Sorvall,), vortex (Bio-Rad), pasture pipettes (Brand), white tip, yellow tip, blue tip (Brand), sterile petridishes (Costar), laminar air flow (Nuaire), microscope (Olympus), The materials used are chitosan of medical grade, a product of Chimultiguna Manufacture & Supplier Cirebon, snails from snail craftsmen from Maribaya Village, Kramat subdistrict, Tegal Regency, while durian peel comes from the durian peel collecting center in Kaligayam Village, Talang subdistrict, Tegal Regency. Culture media as Vogel Johnson Agar media, Brain Heart Infusion media, Gram stain, sterile physiological NaCl, *Staphylococcus aureus* from diabetic ulcer patients at An Naffi Home Care.

2. Methods.

The research stages are handling of examination materials, bioformulation of anti-inflammatory cream preparations; isolation and identification of microbes from chronic wounds, analysis and testing of the effectiveness of anti-inflammatory galenic cream preparations from snail seromucoid, durian peel extract and chitosan in vivo. Letter of ethical approval for this research by the Health Research Ethics Committee of RSUP Dr. Moewardi Surakarta with letter number No. : 1223/VII/HREC/2023.

a. Handling of Inspection Materials

Snail seromucoid as many as 10-50 snails from local snails (*Achantina fulica*) with average weight 19 g and height/width 25/43 mm, taken by opening the end of the shell and the liquid. The hemolymph fluid is collected in bottle container then centrifuged at 3000 rpm for 30 minutes as hemolymph fluid. Next, filtration was carried out using a microfilter membrane and a freeze drying process was carried out (Harti *et al.*, 2022). The 2% chitosan preparation uses medical grade chitosan produced by Chimultiguna Manufacture & Supplier Cirebon Indonesia. The dosage of 2% chitosan used was based on the results of previous research (Harti, *et al.*, 2016). Durian peel polysaccharide extraction is a modification of research by (Hokputsa *et al.*, 2004), (Sato *et al.*, 2011), (Sutanto *et al.*, 2022).

b. Bioformulation of galenic preparations from snail seromucoid cream, chitosan and durian peel extract. The formulation used as a galenic preparation for snail seromucoid cream, durian peel polysaccharide and chitosan is a modification of the formulation from previous research (Harti *et al.*, 2018, 2023)as listed in table 1.

Table 1. Galenic Preparation Formulation of Durian peel Extract Cream and Chitosan

Formula	FA	FB	FC	FD
Cream base				
Stearic acid	12,00	12,00	12,00	12,00
Cera alba	2,00	2,00	2,00	2,00
Vaselin alba	9,20	9,20	9,20	9,20
Nipagin	0,02	0,02	0,02	0,02
Triethanolamine	1,60	1,60	1,60	1,60
Propilen glycol	7,20	7,20	7,20	7,20
Nipasole	0,02	0,02	0,02	0,02
Akuadest ad	100,00 g	100,00 g	100,00 g	100,00 g
Active ingredients				
Freeze dried snail snail seromucoid 2%	2,00 g	-		1,00 g
Durian peel extract polysaccharides 2%		2.000 g		1,00 g
Chitosan 2% in acetic acid 1%	-		2,000 g	1,000 g

c. Isolation and Identification of Microorganisms in Diabetic Ulcers

Samples of isolation and identification of microorganism from diabetic ulcer patients at An Naffie Home Care were swab cultured aseptically on liquid BHI media, then isolated on Vogel Johnson Agar selective media and identification of *Staphylococcus aureus* isolates.

d. Analysis the effectiveness of galenic anti-inflammatory cream preparations based on snail seromucoid, durian peel extract and chitosan (in vivo).

Laboratory experimental design was carried out on an experimental animal model of 40 male *Rattus norvegicus* strain Wistar aged 2 months divided into 8 groups:
K 1 = healthy control (without treatment)
K 2 = negative control (normal saline or no preparation)
K 3 = induction with a cream base without bioactive compounds
K 4 = positive control (herbal preparation for standardized wound care)
K 5 = cut wounds with anti-inflammatory cream preparations
K 6 = blisters with anti-inflammatory cream
K 7 = burns with anti-inflammatory cream preparations
K 8 = diabetic ulcer wounds with anti-inflammatory cream preparations

Adaptation of the mice was carried out for 7 days, then the mice had their hair shaved on their backs and left for 24 hours. Next, anesthesia was carried out using 0.5-0.6 ml ketamine intramucularly per animal. Test animals were treated according to the research design. Types of treatment are: 1) treat incision injuries by making a 1 cm incision using a sterile scalpel; 2) treat object hot injuries by applying hot water to the back of the test animal; 3) treatment of type 2 degree burns involves placing hot metal on it for a few seconds until inflammation appears; 4) in diabetic ulcer wounds, test animals are subjected to hyperglycemia induced by alloxan.

Before being given alloxan, test mice were fasted for 12 hours and then injected alloxan monohydrate intraperitoneally at a dose of 150 mg/kgBW. Next, the test mice were given to drink a 5% glucose solution after 1 hour of intraperitoneal induction for 24 hours. After 7 days, using a glucometer to determine whether the mice had experienced permanent hyperglycemia or not for the blood glucose levels of the test mice. Hyperglycemia parameters are mice with blood glucose levels of more than 140 mg/dL. Topical preparations are given once a day for 10 days.

Observation of results includes: 1) the degree of visual wound healing based on indicators of whether or not there is still an ulcer on the scar. If there is no ulcer, it is declared a healed wound and validated by microbiological culture testing with an aseptic swab using a sterile cotton swab on the scar, and further identified for the presence or absence of *Staphylococcus aureus* bacteria on Vogel Johnson Agar media incubated at 37ºC for 24 -48 hours; 2) microscopic histochemical staining of wound tissue. The mice were euthanized by cervical dislocation and the treated skin was taken starting from the edge of the wound and as deep as the subcutaneous tissue, on the 14th day. The tissue processing for staining is fixation, dehydration, clearing and paraffin infiltration then Hematoxylin Eosin staining is carried out. Histological preparations were examined using a light microscope with a 4x magnification objective lens and a 40x photo magnification attached to the eyepiece of the light microscope, then measurements of the oral mucosal epithelium were carried out using a micrometer unit. Intake is done by taking the average of the two points and then analyzing the data (Indraswary, Amalina and Firmansyah, 2022).

Data analysis used the One Way Anova test. The results of the data normality test with Shapiro-Wilk because the number of samples was less than 50 showed a normal distribution and continued with the paired T test. If the data distribution is not normal, the Wilcoxon test is continued.

3. RESULTS AND DISCUSSION

1. Bioformulation of galenic preparations of snail seromucoid cream, chitosan and polysaccharide durian peel extract

The formulation of snail seromucoid cream, durian peel extract polysaccharides; chitosan and their combination with ratio 1:1:1 (FA, FB, FC, FD) was made based on the differences in the composition. The results of quality tests on galenic preparations of snail seromucoid cream, durian peel extract polysaccharides and chitosan which were carried out by Harti et al, 2023 including organoleptic tests, physicochemical and microbiological tests showed that the galenic cream preparations were based on snail seromucoid, durian peel extract polysaccharides and chitosan (FA, FB, FC, FD) fulfill the requirements as cream preparations regarding safety and quality requirements for finished products in the category of external medicines as semi-solid preparations in the form of ointments, creams, gels based on BPOM Regulation Number 32 of 2019. The results of the research

show that the galenic preparations of snail seromucoid cream, durian peel extract polysaccharides and chitosan meet the physical and chemical quality test requirements. microbiology (Harti *et al.*, 2023), (Marchianti *et al.*, 2021).

The composition of the ingredients in the cream formulation can influence the quality test of the cream preparation (Lumentut, Edi and Rumondor, 2020). Cream is defined as a semi-solid preparation in the form of a thick emulsion and homogenous containing no less than 60% water intended for external use and there is an even uniform color overall and there are no particles in the cream (Rahman, Astuti and Dhiani, no date). Cream that meets organoleptic requirements is that it has a color like the active substance, a distinctive aroma of the extract and is homogeneous as a cream mass (Roosevelt, H. Ambo Lau and Syawal, 2019).The criteria commonly used to assess organoleptic products include taste, smell, color and texture (Nonci, Tahar and Aini, 2017).

The composition of raw materials, packaging materials, facilities, equipment, production processes, quality control and the workforce involved in production influenced the safety and stability of the quality of topical cream products. A stable cosmetic preparation is characterized by the preparation not changing color and remaining within acceptable limits during the storage and use period, where its properties and characteristics do not change to the same as when it was originally made (Sugiharta and Ningsih, 2021).

2. Effectiveness of galenic anti-inflammatory cream preparations based on snail seromucoid, durian peel extract and chitosan in vivo.

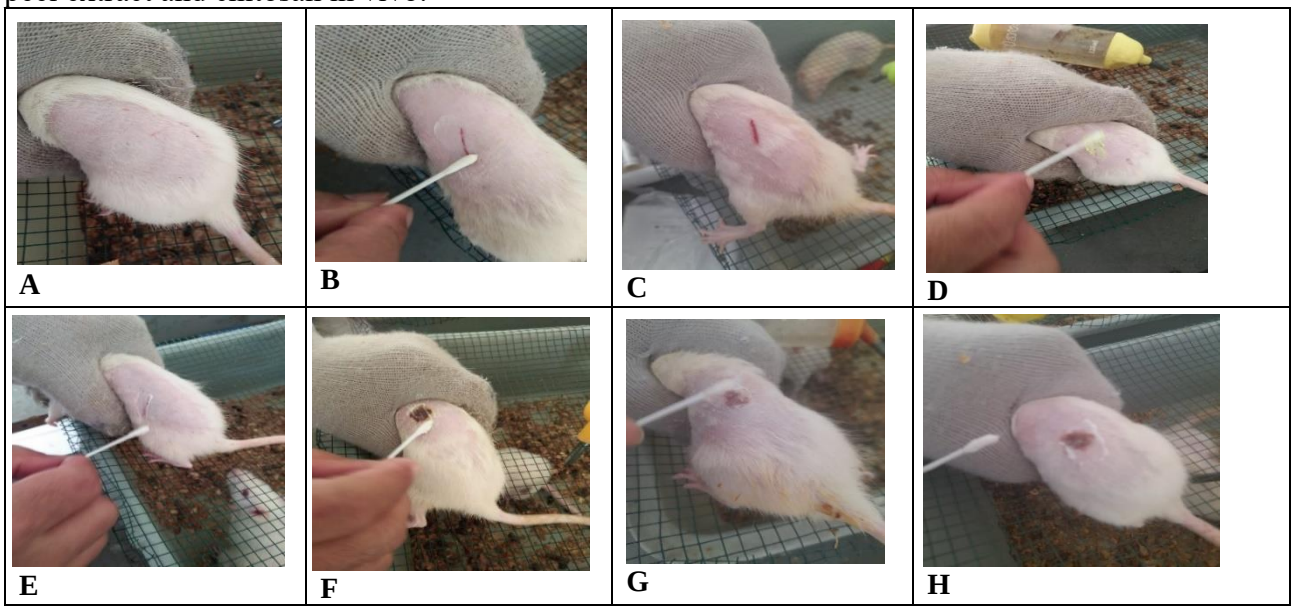
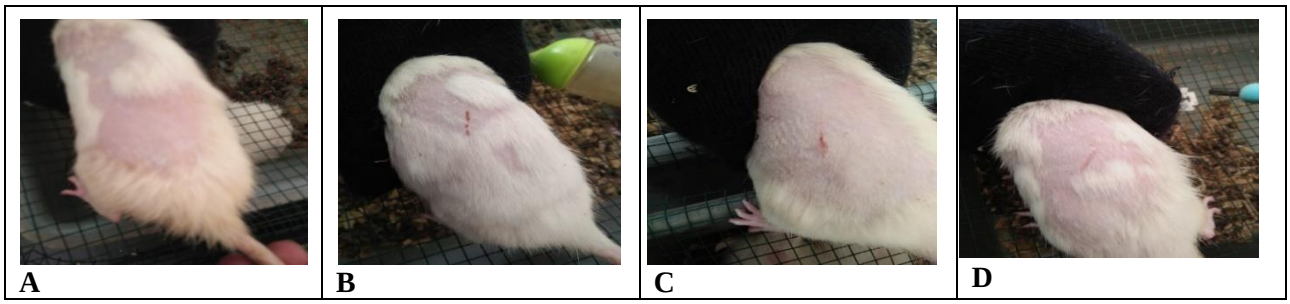


Figure 1. Observation of the level of wound healing on the first day



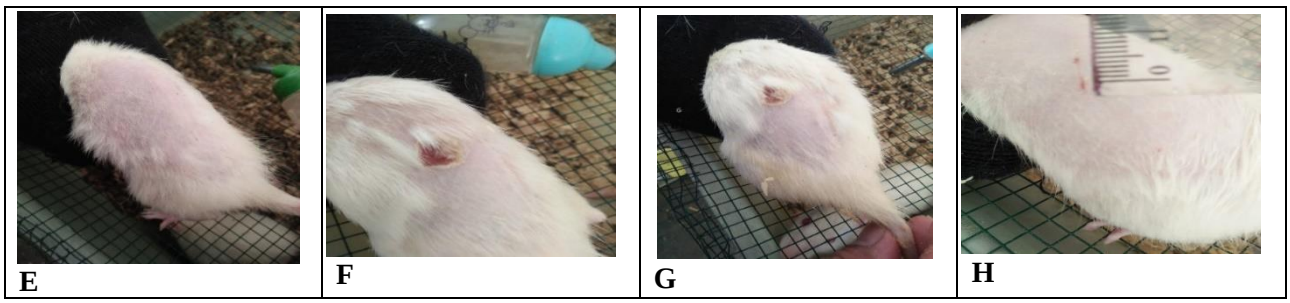


Figure 2. Observation of the level of wound healing on day 14

Table 2. Histological Measurement of Skin Epithelial Thickness

Code	Treatment	Skin epithelial thickness (µm)			Mean epithelial thickness (µm)
		Length 1	Length 2	Length 3	
A	Normal (healthy control)	15.21	15.62	14.63	15.15
B	Negative control	9.76	9.10	9.71	9.52
C	Cream base	9.22	10.81	10.77	10.27
D	Positive control	13.34	12.86	13.09	13.10
E	Incision wound	13.83	13.27	15.28	14.13
F	Hot object injuries	14.24	15.41	16.90	15.52
G	Second degree burns	16.54	16.69	16.26	16.50
H	Diabetic ulcers	14.24	13.19	14.03	13.82

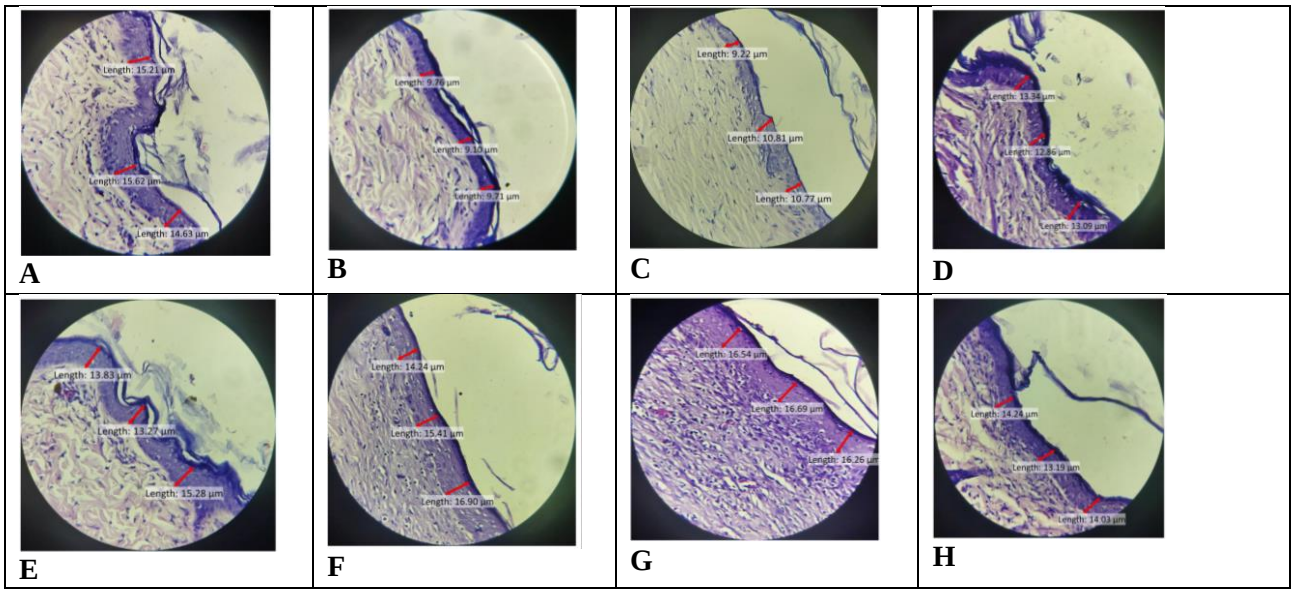


Figure 3. Microscopic observation of skin tissue treated with Hematoxyllin Eosin staining at 400x magnification

The results show that galenic preparations are effective in the healing process based on the formation of granulation tissue thickness in cuts, blisters, second degree burns and diabetic ulcers (E, F, G, H) which are equivalent to the positive control (D). The negative control (B) showed the thinnest granulation compared to all treatment groups. The compared with the others group that granulation tissue formed was the thickest (G). The effectiveness of galenic preparations of snail seromucoid cream and chitosan on the healing rate of cuts, blisters, burns and diabetic ulcers is due to the bioactive compound content of snail seromucoid, durian peel extract and chitosan. Based on table 2 showed that the galenic preparation of snail seromucoid cream, durian peel extract and chitosan (E,F,G,H)

provides an effective level of healing as a preparation. cream against types of cuts, blisters, burns and diabetic ulcers in test animals in vivo on day 14. The results of histopathological observations of the anatomy of the thickness of the epithelium with Hematoxylin Eosin staining at a microscopic magnification of 400 times on the wound healing process in the formation of granulation tissue showed that thickness of granulation tissue in incision wound (14.13 μm), hot object injuries (15.52 μm), second degree burns (16.50 μm); diabetic ulcer wound (13.82 μm) and positive control (13.10 μm).

Basically, the wound healing process is a physiological process in the body, namely that living tissue cells will regenerate back to their previous structure. The process of wound healing process consists of 3 phases, namely the inflammatory phase which occurs on days 0-3 or up to day 5, the proliferation phase (granulation phase) which occurs on days 2 to 24, and the maturation phase which occurs on the 24th day up to 1 year or more. The wound care method that has developed has the principle of moist wound healing, namely keeping the wound condition moist so that the rate of tissue epithelialization increases, accelerates tissue autolysis, minimizes infection and reduces pain (Chrisanto, 2017), (Dai *et al.*, 2011). Treating wounds and choosing the right wound dressing can speed up healing, prevent secondary infections, and minimize scars so that the problem of high wound care costs and depression due to non-healing wounds can be resolved (Widyartha *et al.*, 2020). In diabetic ulcer sufferers, the healing process will be disrupted by hypoxia, dysfunction of fibroblasts and epidermal cells, or disruption of angiogenesis (Purnama, Sriwidodo and Ratnawulan, 202AD).

The quality of granulation tissue formation is one indication of the wound healing process (Rowe, Sheskey and Quinn, 2009). The thicker the granulation tissue formed, the shorter the wound healing process (Yaman *et al.*, 2010). Granulation tissue is the growth of new tissue in the wound healing process included the formation of new capillaries and fibroblast cells that fill the cavity so that the thickness of the granulation tissue formed depends on angiogenesis or the formation of capillaries and the number of proliferating fibroblast cells (Bauer, Bauer and Velazquez, 2005). The proliferation phase will increase monocytes and macrophages to the wound area. Macrophages derived from monocytes function to phagocytose cellular antigens, especially microbial cells, because macrophages function to produce growth factors needed for proliferation of fibroblast cells and angiogenesis as well as regeneration of the dermis and proliferation of the epidermis (Simarmata, 2018), (Srimiyati, 2018).

The formation of granulation tissue which plays an important role in the re-epithelialization process characterized a good wound healing. Re-epithelialization is a parameter of wound healing which is characterized by the presence of keratinocytes that go into mitosis in the basal stratum 12 hours after the wound, resulting in flat protrusions forming, thus losing the attachment of the hemidesmosomes to the surrounding basal cells and then migrating 24 after the wound, followed by the epithelial cell proliferation phase within 48 hours after the wound, resulting in the mucosa will return to its original condition (Iqda, Munawir and Srisurani, 2018). The occurrence of fibroblast proliferation will increase collagen and extracellular matrix synthesis so that the proliferation phase is completed more quickly and is continued with the remodeling phase and the healing process is faster (Rosa *et al.*, 2018).

The proliferative response of lymphocyte culture in synthetic media can be used to describe lymphocyte function and individual immune status. The ability of lymphocytes to proliferate or form clones indirectly indicates the ability of the immunological response or immune level. Ingredients that are able to stimulate an increased immune response are called immunostimulators. The use of bioactive biological response modifier compounds as immunostimulators is to suppress the occurrence of intracellular infections by pathogenic microbes through the mechanism of increasing the growth of body defense cells in the immune system including increasing the number and activity of T cells, NK cells and macrophages as well as releasing interferon and interleukin to increase cellular defense thereby preventing the occurrence of immunodeficiency (Harti *et al.*, 2018).

The selection and utilization of natural biomaterial sources is currently more widely used as raw material for pharmaceutical preparations because they are biodegradable, non-toxic and more acceptable to the body compared to synthetic materials. Natural ingredients also have advantages

compared to chemicals because of the large availability of natural ingredients (Umarudin and Surahmaida, 2019).

Snail seromucoid has been used by the community as a galenic preparation for wound healing because it contains glycoprotein, a carbohydrate consisting of mannose, glucose, N-acetyl muramic acid and the α-1 globulin – oromucoid fraction. The presence of the bioactive compound seromucoid in snails means that in the medical field it is used as a cosmetic ingredient to soften the skin, treat respiratory infections and burns. The bioactive compounds of the glycoprotein type in snail seromucoid, namely hemocyanin and lectin, are able to function as anti-tumor and non-toxic and can even stimulate lymphocyte proliferation, while chondroitin sulfate in snail hemolymph is able to function as an immunomodulator and immunosuppressant (Harti *et al.*, 2020).

Chitosan is a chitin derivative with the formula N-acetyl-D glucosamine which is found in the exoskeleton of crustaceans such as crabs, shrimp and shellfish (Ibrahim *et al.*, 2016), (Rajasree and Rahate, no date). Chitosan has been proven to be a biomaterial multifunctional as anti-hypercholesterolemia, anti-hyperlipidemia, anti-inflammatory and antimicrobial that is biocompatible, biodegradable and non-toxic compared to other biomedical polymers (Susilowati, . and ., 2015).

Chitosan plays a role by increasing the re-epithelialization process in wound healing and the activity of inflammatory cells (Fan *et al.*, 2016). Chitosan is able to increase the extracellular matrix and increase collagenation and act as an accelerator in the wound healing process such as macrophage cells, Transforming Growth Factor Beta 1 (TGF ß1), Platelet Derived Growth Factor (PDGF) and Fibroblast Growth Factor (FGF-2), Polymorphonuclear leukocyte cells (PMN), fibroblasts and osteoblasts (Gupta, Rattan and Rai, 2019).

Chitosan is able to induce adhesion and activate platelets so that blood clots can form more quickly. The amino groups contained in chitosan (poly-N-acetyl glucosamine) can also aggregate erythrocytes through electrostatic interactions with the charges on their surface, and after that hemostasis is induced when the platelets are activated. The N-acetyl glucosamine monomer in chitosan can also bind to the mannose receptor which is the main receptor on macrophages, which will then trigger migration and proliferation of macrophage cells. During the proliferation phase, chitosan will stimulate inflammatory cells to the wound area and increase the proliferation of inflammatory cells in the wound area (Wang *et al.*, 2007). Increased proliferation of inflammatory cells will increase the release of cytokines and growth factors (Goy, De Britto and Assis, 2009). Several growth factors and cytokines are involved in the wound re-epithelialization process such as FGF family, namely Keratinocyte Growth Factor (KGF) and Transforming Growth Factor (TGF)-ß1 and the Epidermal Growth Factor (EGF) family, Heparin Bind EGF (HB-EGF). Activated macrophage cells can also increase the production of growth factors such as VEGF, FGF and TGF-ß which induce fibroblast proliferation. TGF-ß1 triggers fibroblast cell activity to help fibroblast cell proliferation, so that the proliferation process in ulcer healing can run well. This increased activation of macrophage cells will stimulate the release of growth factors and cytokines. FGF and TGF-ß1 are also stimulated by polysaccharide components to increase the proliferation process of fibroblast cells, so that the wound healing process runs faster. Activation of macrophages will stimulate macrophages to release IL-6 and TNF-alpha which can kill bacteria and debris (Indraswary, Amalina and Firmansyah, 2022). Research results show that the bioactive compounds in *Aloe vera* can accelerate the wound healing process through stimulation of inflammatory cells, cytokines and fibroblast activity (Astuti, Agfiany and Abidin, 2020).

The research results of Harti, 2016; 2018 showed that there was a synergistic effect of antimicrobial compounds combining 100% snail mucus and 1.5% chitosan against *Staphylococcus aureus* in vitro and in vivo. Bioactive compounds as bioimmunostimulators and bioimmunomodulators against intracellular facultative pathogenic bacterial infections are capable of stimulating cellular immune function through the mechanism of increasing lymphocyte proliferation and macrophage production of reactive oxygen media (Sutanto *et al.*, 2020; Sutanto *et al.*, 2022).

Durian peel which can be processed into multi-functional materials, namely bio briquettes, bioethanol and raw materials for galenic preparations because it contain contains lignin (15.45%),

holocellulose (73.45%) and cellulose (60.45%) (Kumoro, Alhanif and Wardhani, 2020), (Sato *et al.*, 2011). Durian peel pectin polysaccharide type pectin is a polymer of D-galacturonic acid which is polar and non-toxic (Hasem *et al.*, 2018); (Pongsamart, Sukrong and Tawatsin, 2001). Durian peel polysaccharides can be processed in pharmaceutical fields as jelly, tablets, suspensions and emulsions and can be extracted as polysaccharide gel (PG) which is useful in the food and (Ho and Bhat, 2014), (Khoo *et al.*, 2016). Durian peel polysaccharide have the potential to be developed in the medical and pharmaceutical fields because contains antimicrobial bionatural compounds which are non-toxic and water soluble ((Zhan *et al.*, 2021). PG extract from durian fruit skin (*Durio zibethinus* L.) can be used as an ingredient for making wound dressing biofilms ((Harti *et al.*, 2020), (Chansiripornchai *et al.*, no date), (Pongsamart, Tawatsin and Sukrong, 2002). Durian peel extract polysaccharides contain tannin and flavonoid compounds which function as natural antioxidants, antiseptics and burn medicines (Wulandari *et al.*, 2020), (Thunyakitpisal *et al.*, 2010), (Zhan *et al.*, 2021).

The results of examining the degree of healing based on the results of swab culture of healed scars on Vogel Johnson Agar medium showed no growth of *Staphylococcus aureus* in all treatments. *S. aureus* as a pathogenic bacteria that produces pus in wounds from diabetic ulcer patients at An Naffi Homecare.

CONCLUSIONS

The bioformulation of 2% snail seromucoid galenic preparation, 2% durian peel extract polysaccharide and 2% chitosan and a combination ratio of 1:1:1 is effective as an anti-inflammatory galenic cream preparation so that it can be applied for healing chronic wounds, acute wounds and diabetic ulcers.

Author contribution

A.S.H, Y.S.S designed the research and supervised the process; W.R.A., R.P raw material handling process. J.S, T.A.P galenic preparation bioformulation process. M.S.I, S.D.S analyzed data and prepared the manuscript. B.P., H.I.H, N.D.A and S.S. product implementation and health promotion activities.

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Conflict of Interest

The authors declare that they do not have a conflict of interest.

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