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EFFECT OF CORN SILK EXTRACT (*Zea Mays Saccharate Sturt*) ON GINGIVAL FIBROBLAST WOUND HEALING OF WISTAR RATS

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ABSTRACT

Gingiva is a keratinized epithelium that serves as the supporting structure for underlying tissues that tend to be injured during dental procedures. Corn silk contains secondary metabolite substances such as flavonoids, saponins, and tannins that can increase fibroblast levels during wound healing. This study proves that the administration of corn silk extract can increase the number of fibroblasts in gingival wound healing of Wistar rats. This study was an experimental laboratory research with a post-test-only control group design. The sample in this study used 20 male Wistar rats divided into 4 groups. Gingival wounds were performed on the mandibular gingival using a punch biopsy with a diameter of 2 mm. The wound was smeared with corn silk extract gel at concentrations of 25%, 50%, 75%, and aquadest twice a day for 7 days. Euthanasia was delivered on the 8th day after treatment, and histological preparation was performed. The number of fibroblasts was calculated using the Olympus software and analyzed statistically. The results showed that the corn silk extract significantly improved the number of fibroblasts compared with the control group. The highest number of fibroblasts was found in the corn silk extract treatm ent group at a concentration of 25% (34,47) compared with concentrations of 50% (23,87), 75% (20,93), and aquadest (18,80). It could be concluded that the administration of corn silk can increase the number of fibroblasts in gingival wound healing of Wistar rats.

Keywords: Corn Silk, Fibroblasts, Gingiva, Wound Healing

1. INTRODUCTION

Gingiva is a part of the oral mucosa layered by keratinized epithelium serving as the supporting structure for underlying tissues.[1,2] Gingiva is a part of the mucosa that tends to be injured in dental procedures.[1,3] Trauma, tooth extraction, and periodontal disease are potential causes of gingival wounds.[2,4] Healing of the gingiva can occur within several weeks, aiming to restore the original condition.[1,4]

Wounds are damage to body tissues and physiological processes due to external stimulation.[5] Physiologically, wound healing involves four phases: hemostasis, inflammation, proliferation, and maturation (remodeling).[6] Hemostasis occurs when tissue is damaged, the fibrin clot process will block bleeding during this phase, neutrophil cells will get out, and monocytes migrate to the wound area and differentiate into macrophages to release pro-inflammatory cytokine mediators.

The next phase is the proliferation phase, which plays a role in wound healing. Macrophages synthesize growth factors to stimulate fibroblast

and form a collagen fiber matrix. The remodeling phase increases the tensile strength of the new tissue.[7]

Fibroblast cells are important in the proliferation phase of wound.[7] Fibroblasts are released on the third day after injury. Fibroblast cells migrate and proliferate in the formation of collagen fibers in the wound area and accelerate the wound healing process.[3,8]

Corn is one kind of plant that has an advantage in healing wounds. In 2021, Indonesia will produce 2.85 million tons of corn, and South Sumatera will be one of the provinces contributing to national corn production with a diverse agroecosystem .[9,10]

Corn silk contains secondary metabolite substances such as flavonoids, saponins, and tannins.[11] Flavonoids accelerate the epithelialization process. Nuralifah et al. reported that saponin can accelerate collagen synthesis and epithelialization.[12] Tannins are phenolic compounds with astringent properties.[13]

Based on the above descriptions of the properties of natural ingredients corn silk, there has been much research from academics that explores various new strategies to accelerate wound healing. In this study, we analyzed the effect of corn silk extract (Zea mays saccharate Sturt) on gingival fibroblast wound healing of Wistar rats

2. METHODS

This study included laboratory experiments with a post-test-only control group design. The study was conducted in the Pharmacy Laboratory of Sriwijaya University for the preparation of corn silk extract (Zea mays saccharate Sturt), the Animal House Laboratory of the Faculty of Medicine, Sriwijaya University, and the Laboratory of Anatomical Pathology Dyatnitalis Palembang for examination and calculation of the number of fibroblasts.

Research Subject

The samples in this study used 20 male Wistar rats weighing 150-200 grams and aged 10-12 weeks. These were divided randomly into the control group (aquadest) and treatment group (corn silk extract at concentration of 25%, 50%, and 75%).

Gel Formulations of Corn Silk Extract Preparation

Corn silks aged 70 to 85 days were washed with distilled water before extract preparation. Corn silk was then dried for 24 h at 60°C. Corn silk was then ground into a fine powder using a grinder. Using a solvent, mix 337.87 grams of corn silk powder. The ethanol used was 5 L, which was macerated three times for 24 h at room temperature. The dregs were separated after extraction using a water bath shaker at 70°C, and then separated using a rotary flash evaporator at 60°C.

According to Hamzah, the formula for the corn silk extract gel with Na-CMC gel base based on % w/w: [14]

R/	Na-CMC	5%
	Gliserin	10%
	Propilenglikol	5%
	Aquadest ad	100

Table 1. Corn Silk Extract Gel Formulation

	25%	50%	75%
Corn Silk Extract	6,25 g	12,5 g	18,75 g
Na-CMC	1,25 gr	1,25 g	1,25 g
Glycerin	2,5 g	2,5 g	2,5 g
Propylene Glycol	1,25 g	1,25 g	1,25 g
Nipagin	0,25 g	0,25 g	0,25 g
Aquadest ad	13,5	7,25	1

In this study, gel preparations were made with extract concentrations of 25%, 50%, and 75%, totaling 25 grams.

Wistar rats were acclimatized in the laboratory at a temperature of 20-25°C. Mice were given water and pellets to eat during the adaptation period. Gingival wounds were performed on the mandibular gingival using a punch biopsy with a diameter of 2 mm. Before the gingiva wound was made, intramuscular anesthesia was administered to provide a sedative effect on the right upper thigh of Wistar rats. Corn silk extract gel was smeared on the treatment group, and aquadest was smeared. Treatment using a cotton pellet applied twice a day for 7 days. Euthanasia was delivered on the 8th day after treatment.

Samples obtained from Wistar rat gingiva after euthanasia on day 8 were analyzed histologically to observe fibroblast cells after being fixed in 10% formalin at room temperature. After fixation, the gingival tissue was observed under a microscope with a magnification of 400 in three fields of view. A photograph of the gingival tissue was taken from an observation using a Micro-ocular MD 130 electron eyepiece that was connected with Olympus software. The number of fibroblasts was counted using Image Raster 3.0.

The one-way ANOVA parametric test was then used to compare the number of fibroblasts under gel administration based on each concentration. A post hoc test was then performed using a 95% confidence level to identify significant differences between the treatment groups.

3. RESULTS

Based on research that has been done using 20 samples of Wistar rats divided into 4 groups, namely the control group (Aquadest) and the treatment group (corn silk extract at concentration of 25%, 50%, and 75%). After treatment, each group was euthanized to count fibroblasts on day 8. The examination of fibroblasts was performed under a microscope with a magnification of 400 in three fields of view. Based on the calculations in Table 2, the highest mean number of fibroblasts was found in the corn silk extract at 25%.

Table 2. Average fibroblast count in Wistar rats

Treatment Group	Mean ± SD Number of fibroblasts
Aquadest	18,80 ± 7,56
Corn silk extract gel 25%	34,47 ± 5,96
Corn silk extract gel 50%	23,87 ± 6,12
Corn silk extract gel 75%	20,93 ± 6,59

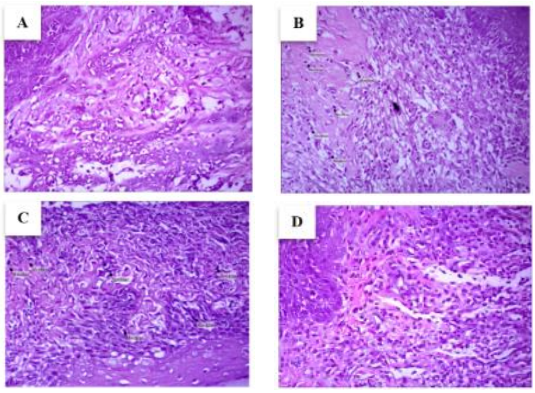

Figure 1. Histology of gingival tissue in the treatment group: (A) Aquadest, (B) 25% Corn silk Extract Gel, (C) 50% Corn silk Extract Gel, and (D) 75% Corn silk Extract Gel with 400 Olympus microscope.

Table 3. Results of the one-way ANOVA test

	F	Sig.
Between Groups	5.563	.008*

*showed a significant difference (p<0.05)

One-way ANOVA test on corn silk on gingival fibroblast wound healing of Wistar rats obtained a value of 0.008 based on the parametric test result table 3 which means that there are significant differences in the number of fibroblast

cells from each treatment group. The post hoc LSD test was used in the additional analysis to determine the extent of the difference in the mean number of fibroblasts between each group after treatment. The post hoc LSD test showed a significant difference ($p<0.05$). **Table 4.** Results of post hoc LSD between each group

4. DISCUSSIONS

Based on the histological examination of the results obtained, it was found that the mean number of fibroblasts in the treatment group administered corn silk extract gel after gingival wounds were made increased in the treatment group (corn silk extract gel) at a concentration of 25% compared with concentrations of 50%, 75%, and the control group (aquadest). Noni Rahayu et al. stated that corn silk extract gel was effective in improving the healing process of burn wounds.[16]

	Aqua-dest	**CSE Gel 25%**	**CSE Gel 50%**	**CSE Gel 75%**
Aquadest		0,002*	0,242	0,616
CSE Gel 25%	0,002*		0,022*	0,005*
CSE Gel 50%	0,242	0,022*		0,492
CSEGel 75%	0,616	0,005*	0,492	

Corn silk extract stimulates the proliferation and migration of fibroblasts during wound healing.[17] Fibroblast cells in the wound area proliferate to degrade fibrin clots by producing extracellular matrix components, such as collagen, to support and regulate fibroblast migration and form granulation tissue, and epithelialization to accelerate wound healing.[18,19]

Corn silk extract contains secondary metabolite substances, namely flavonoids, saponins, and tannins.[20] Flavonoids can stop bleeding with vasoconstriction of blood vessels and have antioxidant and anti-inflammatory effects.[21] Saponins contribute to increased migration of macrophages to the wound site. Cytokines produced by macrophages activate fibroblasts in wound tissue to accelerate re-epithelialization by stimulating collagen synthesis.[21,22] Tannin is a content in corn silk that is commonly used in wound healing, has an antioxidant role, accelerates the process of epithelialization in the formation of granulation tissue, and increases the number of fibroblasts.[23,24]

This study showed that corn silk extract at a concentration of 25% had the highest number of fibroblast cells, whereas at concentrations of 50% and 75%, there was a decrease in the number of fibroblasts. Based on this research, corn silk contains secondary metabolites in certain doses that can inhibit cell development. Hao Guo et al. stated that corn silk can stop the synthesis phase at high concentrations, which will stop the development of cancer cells.[25] Al-Oqail et al. stated that corn silk extract can increase the production of reactive oxygen species (ROS), which can cause cancer cell apoptosis.[26]

Flavonoids contained in corn silk function as antioxidants to reduce *reactive oxygen species* (ROS). Higher amounts of corn silk extract decrease the antioxidant effect of flavonoid components, turning them into pro-oxidants that cause fibroblast apoptosis. Tannin is an active secondary metabolite molecule with a high degree of polarity. As a result, high amounts of the extract cause genotoxic conditions, causing the cell's genetic information to be destroyed. Polar substances bind to cell lipoproteins, causing the accumulation of substances and

breakdown of lipids, which disrupts the permeability of fibroblasts and causes cell death.[22]

This study showed that the number of fibroblasts in each treatment group had different results. Other factors, such as variations in the size of the resulting incisions, may also impact this and delay wound healing. The potential that the application of corn silk extract gel to the gingival lesions was inadequate due to the position of the wound being susceptible to tongue movement and saliva build-up may also have contributed to fewer fibroblasts in each group. The financial support for this study from Sriwijaya University is gratefully acknowledged.

5. CONCLUSIONS

Based on the research results, the administration of corn silk can accelerate the healing of gingival wounds in Wistar rats. Corn silk extract at a concentration of 25% had the highest increase in the number of fibroblasts compared with concentrations of 50%, 75%, and the aquadest group.

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