International Journal of Multidisciplinary Research and Development
www.allsubjectjournal.com
ISSN Online: 2349-4182 ISSN Print: 2349-5979
Received: 22-08-2023, Accepted: 10-09-2023, Published: 25-09-2023
Volume 10, Issue 9, 2023, Page No. 93-95

Analysis of the effect of mangosteen (*Garcinia mangostana* L.) peel extract on wound healing after tooth extraction

Liu Zilin
Master of Dental Medicine Program, Faculty of Medicine, Dentistry and Health Sciences, Prima Indonesia University, Indonesia

Abstract
Tooth extraction will cause a wound in the form of exposed alveolar bone in the oral cavity. Mangosteen rind (*Garcinia mangostana* L.) contains saponins, alkaloids, flavonoids, triterpenoids, tannins, and polyphenols. Therefore, mangosteen peel has various pharmacological effects: anti-inflammatory, antioxidant, antidiabetic, and antibacterial. This study aimed to analyze the impact of 30% and 70% Ethanol Extract of Mangosteen Fruit Peel (*Garcinia mangostana* L.) on wound healing time after Wistar extraction studystar laboratory random controlledudy uses apost-tested controlled design with apatternestthenly control group design pattern. The population of expwasental animals used in this study were Wistar rats, in the form of 32 male rats. Data analysis using SPSS 16 program, nonparametric Chi-Square Test with Sig ($p<0.05$). There is a significant relationship between the number of fibroblast tissue per field of view in Wistar rats after tooth extraction by administering mangosteen rind extract (*Garcinia mangostana* L.) with a concentration of 30% and mangosteen rind extract (*Garcinia mangostana* L.) concentration of 70%, $p = 0.014$ ($p <0.05$). Conclusion: 30% and 70% mangosteen (*Garcinia mangostana* L.) peel extract effectively accelerates wound healing time after tooth extraction of Wistar rats.

Keywords: Effectiveness, mangosteen, wound healing

Introduction

Tooth extraction will cause a wound in the form of exposed alveolar bone in the oral cavity [1]. An injury is anatomical damage or destruction of part of the tissue due to trauma [2]. The wound healing process can be divided into three main phases, namely, the inflammatory phase, the proliferation phase, and the remodeling phase [3]. These phases continue from the time of injury until wound closure [4]. The primary cells involved in the wound-healing process are fibroblasts. Fibroblasts are stem cells that form and lay down fibers in the matrix, especially collagen fibers [5]. The World Health Organization (WHO) recommends using traditional medicine, including herbs, to maintain public health and prevent and treat diseases [6], especially chronic diseases, degenerative diseases, and cancer. Methanol extract of mangosteen rind (*Garcinia mangostana* L.) contains saponins, alkaloids, flavonoids, triterpenoids, tannins, and polyphenols. Therefore, mangosteen peels have various pharmacological effects: anti-inflammatory [7], antioxidant [8], antidiabetic [9], and antibacterial [10]; [11]. So far, mangosteen peels are used only for tanning leather, traditional medicine, and ingredients for making stainless substances and textile dyes. The utilization of mangosteen rind for treatment in Indonesia is still not much. This study aimed to analyze the effectiveness of mangosteen fruit peel ethanol extract (*Garcinia mangostana* L.) 30% with 70% on accelerating wound healing time after tooth extraction in Wistar rats.

Research Methods

This laboratory experimental study uses a randomized controlled design with a posttest only control group design pattern. The population of experimental animals used in this study were Wistar rats, in the form of 32 male rats that were physically healthy, 2-3 months old with a body weight between 200-250 grams. The rats will be divided into two groups, namely, 16 rats treated with 30% mangosteen (*Garcinia mangostana* L.) peel extract and 16 rats treated with 70% mangosteen (*Garcinia mangostana* L.) peel extract to see the comparison of accelerated wound healing after tooth extraction. Tooth extraction of rats will be performed using a modified needle holder under ketamine anesthesia. After tooth extraction, observe the extraction wound and apply a tampon (cotton pellet) to stop bleeding in the wound for 5 minutes. Dropped 30% mangosteen peel extract (*Garcinia mangostana* L.) in treatment group I, dropped 70% mangosteen peel extract (*Garcinia mangostana* L.) in treatment group II shortly after tooth extraction as much as 0.05 ml every day. The study used a pure experiment with a nonparametric Chi-Square Test after the test showed that ($p<0.05$) means a significant difference between groups.

Research Results

Table 1: Distribution and frequency data of fibroblast tissue counts per field of view after tooth extraction

No	Number of Fibroblasts	Mangosteen fruit peel extract (*Garcinia mangostana* L.)			
		Concentration 30%		Concentration 70%	
		n	%	n	%
1	No fibroblast tissue found	0	0	0	0
2	Small number of fibroblasts (less than 10% per field of view)	9	28.1	2	6.2
3	Moderate amount of fibroblast tissue (10%-50% per field of view)	4	12.5	6	18.7
4	Large amount of fibroblast tissue (50%-100% per field of view).	3	9.3	8	25.0

Table 1 shows that all samples found fibroblast tissue in the administration of mangosteen fruit peel (*Garcinia mangostana* L.) 30% and 70% after tooth extraction of Wistar rats. The number of fibroblasts found in the small category (less than 10% per field of view) in the administration of mangosteen fruit peel extract (*Garcinia mangostana* L.) 30% after tooth extraction of Wistar rats as many as 9 (28.1%) heads and in the administration of mangosteen fruit peel extract (*Garcinia mangostana* L.) 70% as many as 2 (6.2%) heads. The number of fibroblasts found in the moderate category (10%-50% per field of view) in the administration of mangosteen fruit peel (*Garcinia mangostana* L.) 30% after tooth extraction of Wistar rats as many as 4 (12.5%) heads and in the administration of 70% Turmeric (Curcuma Longa) extract as many as 6 (18.7%) heads. The number of fibroblasts found in the large category (50% - 100% per field of view) in the administration of mangosteen fruit peel (*Garcinia mangostana* L.) 30% after tooth extraction of Wistar rats as many as 3 (9.3%) heads and in the administration of mangosteen fruit peel (*Garcinia mangostana* L.) 70% as many as 8 (25%) heads.

To determine the relationship between the number of fibroblast tissue per field of view in Wistar rats after tooth extraction by giving mangosteen fruit peel (*Garcinia mangostana* L.) with a concentration of 30% and mangosteen fruit peel (*Garcinia mangostana* L.) concentration of 70%, data analysis was carried out using the Chi-Square test as follows:

Table 2: Relationship between the number of fibroblast tissue per field of view in Wistar rats after tooth extraction with mangosteen peel extract (*Garcinia mangostana* L.) concentrations of 30% and 70%.

Number of Fibroblasts	Mangosteen fruit peel extract (*Garcinia mangostana* L.)		
	Concentration 30%	Concentration 30%	P-value
No fibroblast tissue found	0	0	0,014*
Small number of fibroblasts (less than 10% per field of view)	9	2	
Moderate amount of fibroblast tissue (10%-50% per field of view)	4	6	
Large amount of fibroblast tissue (50%-100% per field of view).	3	8	

Significant p<0.05. Chi Square Test

From Table 2, it can be seen that there is a significant relationship between the number of fibroblast tissue per field of view in Wistar rats after tooth extraction by administering mangosteen fruit peel extract (*Garcinia mangostana* L.) with a concentration of 30% and mangosteen fruit peel extract (*Garcinia mangostana* L.) with a concentration of 70%, p = 0.014 (p <0.05).

Discussion

Tooth extraction will cause a wound in the form of exposed alveolar bone in the oral cavity. Wounds are anatomical damage or destruction of some tissues due to trauma. This study aims to determine the comparison of the effectiveness of mangosteen peel extract (*Garcinia mangostana* L.) 30% and mangosteen peel extract (*Garcinia mangostana* L.) 70% in accelerating wound healing time after tooth extraction of Wistar rats. The samples used in this study were Wistar rats. Wistar rats are known to have a physiological body similar to human physiology and have a short average age of 1-2 years, so it is appropriate to use it as an experimental object (Lailani *et al*., 2013). The number of research samples taken was 32 Wistar rats that were physically healthy and 2-3 months old with body weight between 200-250 grams. The samples were divided into two groups, namely 16 (50%) for the group treated with 30% mangosteen (*Garcinia mangostana* L.) peel extract and 16 (50%) for the group treated with 70% mangosteen (*Garcinia mangostana* L.) peel extract.

Rat tooth extraction will be performed under the anesthetic effect of ketamine 1000 mg/10 ml dose of 20 mg/kg bw intraperitoneally. After extraction, the post-extraction wound is observed again, and tampons (cotton pellets) are given to stop bleeding in the damage for 5 minutes. 30% mangosteen peel extract (*Garcinia mangostana* L.) is allocated to treatment group I, and 70% mangosteen peel extract (*Garcinia mangostana* L.) in treatment group II shortly after tooth extraction as much as 0.05 ml daily by dropping. On the 5th day, the rat jaw was taken and fixed with 10% formalin for 24 hours at room temperature; then, the decalcification process was carried out using Ethylene Diamine Tetra Acetic Acid (EDTA 10%) solution at room temperature. Then, dehydrate the tissue into toluol alcohol solution (1:1) using pure toluol.

Based on Chi-Square data analysis, there was a significant relationship between the number of fibroblast tissue per field of view in Wistar rats after tooth extraction by administering 30% mangosteen (*Garcinia mangostana* L.) peel extract and 70% mangosteen (*Garcinia mangostana* L.) peel extract, p=0.014 (p<0.05). From the results of this study, it can be seen that 70% mangosteen peel extract (*Garcinia mangostana* L.) is more effective in the wound healing process than 30% mangosteen peel extract (*Garcinia mangostana* L.) because the higher the concentration of the section, the higher the content of mangosteen peel extract (*Garcinia mangostana* L.) so that the wound healing process is faster. Some difficulties in this study are the teeth of Wistar rats that easily fracture when extracted. This is because the anatomy of the Wistar rat teeth is long in the socket and crooked [12], so when the fracture occurs, the researcher must remove the remaining teeth by slightly tearing the soft tissue from the socket [13]; [14].

Conclusion

Based on the results of research and discussion, the conclusion of this study states that mangosteen peel extract (*Garcinia mangostana* L.) 30% and 70% are effective in accelerating wound healing time after tooth extraction of Wistar rats.

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