



## Evaluation of the effect of mangosteen peel extract (*Garcinia Mangostana* L.) against the wound healing process after tooth extraction

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### Abstract

Tooth extraction can lead to the opening of a wound on the alveolar bone inside the oral cavity. The peel of mangosteen fruit (*Garcinia mangostana* L.) contains various compounds such as saponins, alkaloids, flavonoids, triterpenoids, tannins, and polyphenols. Hence, mangosteen peel has pharmacological effects, including anti-inflammatory, antioxidant, antidiabetic, and antibacterial. This study aimed to analyze the impact of ethanol extract of mangosteen peel (*Garcinia mangostana* L.) with a concentration of 50% and 100% on wound healing time after tooth extraction in the Wistar strain male rats. The test animal population consisted of 32 male Wistar rats. Data was analyzed using the SPSS 21 program with a nonparametric Chi-Square Test and a Sig value ( $p < 0.05$ ). The results showed a significant relationship between the number of fibroblast tissues per field of view in Wistar rats after tooth extraction with the administration of mangosteen peel extract (*Garcinia mangostana* L.) concentrations of 50% and 100%,  $p = 0.002$  ( $p < 0.05$ ). In conclusion, mangosteen peel extract (*Garcinia mangostana* L.) at 50% and 100% effectively accelerated wound healing time after tooth extraction in Wistar rats.

**Keywords:** Effectiveness, mangosteen, wound healing

### Introduction

Extraction of a tooth results in the creation of a wound characterized by exposed alveolar bone within the oral cavity (Putri, 2020) [8]. An injury is the anatomical harm or tissue disruption caused by trauma (Biran *et al.*, 2019) [1]. The wound healing process unfolds through three distinct phases: the inflammatory phase, the proliferation phase, and the remodeling phase (Poernomo & Ma'ruf, 2020) [7]. These phases persist from the moment of injury until the complete closure of the wound (Wissen *et al.*, 2020) [12]. Fibroblasts, identified as primary cells, are crucial in wound healing. Functioning as stem cells, fibroblasts generate and deposit fibers in the matrix, particularly collagen fibers (Novitasari *et al.*, 2017) [5].

The World Health Organization (WHO) advocates using traditional medicine, including herbal remedies, for maintaining public health and preventing and treating diseases (YULIA, 2013) [14], particularly chronic, degenerative, and cancerous conditions. The methanol extract derived from mangosteen rind (*Garcinia mangostana* L.) is rich in saponins, alkaloids, flavonoids, triterpenoids, tannins, and polyphenols. Consequently, mangosteen peels exhibit diverse pharmacological effects such as anti-inflammatory (Yanti, 2021) [13], antioxidant (Wehantouw & Manurung, 2011) [10], antidiabetic (Windarini *et al.*, 2011) [11], and antibacterial (Dharmayanti, 2018) [3]; (Dungir *et al.*, 2012) [4]. Despite being historically used for tanning leather and traditional medicine and as ingredients for manufacturing stainless substances and textile dyes, the application of mangosteen rind for treatment in Indonesia

remains limited. This study aims to assess the efficacy of 50% and 100% ethanol extracts of mangosteen fruit peel (*Garcinia mangostana* L.) in accelerating wound healing following tooth extraction in Wistar rats.

### Research Methods

This laboratory experimental investigation employs a randomized controlled design with a post-test-only control group design pattern. The study involves a population of Wistar rats, consisting of 32 physically healthy male rats aged 2-3 months, with a body weight ranging from 200-250 grams. The rats will be allocated into two groups, each comprising 16 rats. Group I will receive treatment with 50% mangosteen (*Garcinia mangostana* L.) peel extract. In comparison, Group II will be treated with 100% mangosteen (*Garcinia mangostana* L.) peel extract, aiming to compare the acceleration of wound healing after tooth extraction.

Tooth extraction in the rats will be conducted using a modified needle holder under ketamine anesthesia. After tooth extraction, the extraction wound will be observed, and a tampon (cotton pellet) will be applied to arrest bleeding in the damage for 5 minutes. The 50% mangosteen peel extract (*Garcinia mangostana* L.) will be administered in Group I, and the 100% mangosteen peel extract (*Garcinia mangostana* L.) in Group II immediately after tooth extraction, with a volume of 0.05 ml administered daily.

The research design is characterized as a pure experiment, and the nonparametric Chi-Square Test will be employed for statistical analysis. A significance level of ( $p < 0.05$ ) indicates a substantial difference between the 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 ( <i>Garcinia mangostana</i> L.)	
		Concentration 50%	Concentration 100%

		n	%	n	%
1	No fibroblast tissue was found	0	0	0	0
2	A small number of fibroblasts (less than 10% per field of view)	8	50	2	13
3	Moderate amount of fibroblast tissue (10%-50% per field of view)	5	31	7	44
4	A large amount of fibroblast tissue (50%-100% per field of view).	3	19	7	44

Table 1. illustrates that all samples exhibited fibroblast tissue following the administration of mangosteen fruit peel (*Garcinia mangostana* L.) at 50% and 100% concentrations after tooth extraction in Wistar rats. The distribution of fibroblasts is categorized based on the percentage per field of view.

In the small category (less than 10% per field of view), administering 50% mangosteen fruit peel extract after tooth extraction in Wistar rats resulted in 8 heads (80%). In comparison, the administration of 100% mangosteen fruit peel extract had two heads (13%). For the moderate

category (10%-50% per field of view), the 50% mangosteen fruit peel administration had five heads (31%), and the 100% administration had seven heads (44%). In the large category (50%-100% per field of view), the 50% mangosteen fruit peel administration had three heads (19%), and the 100% administration had seven heads (44%).

The next step, to ascertain the relationship between the number of fibroblast tissues per field of view in Wistar rats after tooth extraction with mangosteen peel concentrations (*Garcinia mangostana* L.) 50% and 100%, data analysis was carried out using the Chi-Square test:

**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 50% and 100%.

Number of Fibroblasts	Mangosteen fruit peel extract ( <i>Garcinia mangostana</i> L.)		
	Concentration 50%	Concentration 100%	P-value
No fibroblast tissue was found	0	0	0,002*
A small number of fibroblasts (less than 10% per field of view)	8	2	
Moderate amount of fibroblast tissue (10%-50% per field of view)	5	7	
A large amount of fibroblast tissue (50%-100% per field of view).	3	7	

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 50% and mangosteen fruit peel extract (*Garcinia mangostana* L.) with a concentration of 100%,  $p = 0.002$  ( $p < 0.05$ ).

**Discussion**

Tooth extraction results in a wound characterized by the exposure of alveolar bone in the oral cavity, representing anatomical damage or tissue destruction due to trauma. This study aims to compare the effectiveness of 50% and 100% mangosteen peel extract (*Garcinia mangostana* L.) in accelerating the wound healing time after tooth extraction in Wistar rats. The research utilized Wistar rats as experimental subjects, chosen for their physiological similarity to humans and a relatively short average lifespan of 1-2 years, making them suitable for experimentation (Lailani *et al.*, 2013). 32 physically healthy Wistar rats, aged 2-3 months, with a body weight ranging between 200-250 grams, were included as research samples. The samples were divided equally into two groups: one receiving 50% mangosteen peel extract (*Garcinia mangostana* L.) treatment and the other receiving 100% mangosteen peel extract (*Garcinia mangostana* L.) treatment.

Rat tooth extraction will be conducted with ketamine administration at a dosage of 1000 mg/10 ml, given intraperitoneally at a rate of 20 mg/kg body weight. Following the extraction, the post-operative wound will be re-evaluated, and cotton pellets will be applied for 5 minutes to stem bleeding at the site of damage. Treatment will be initiated shortly after tooth extraction, with Group I receiving 50% mangosteen peel extract (*Garcinia mangostana* L.) and Group II receiving 100% mangosteen

peel extract (*Garcinia mangostana* L.), each administered at a daily dose of 0.05 ml through drops.

On the 5th day post-extraction, the rat jaws will be collected and preserved in 10% formalin for 24 hours at room temperature. Subsequently, the decalcification process will be carried out using an ethylene diamine tetraacetic acid (EDTA 10%) solution at room temperature. Following decalcification, tissue dehydration will be achieved by immersing it into a toluol alcohol solution (1:1) using pure toluol. This series of steps aims to prepare the tissue for further analysis and examination in the study.

The Chi-Square data analysis revealed a significant relationship between the number of fibroblast tissues per field of view in Wistar rats after tooth extraction when administering 50% mangosteen peel extract (*Garcinia mangostana* L.) and 100% mangosteen peel extract (*Garcinia mangostana* L.) with a p-value of 0.002 ( $p < 0.05$ ). This indicates a statistically significant difference. The study's results suggest that 100% mangosteen peel extract is more effective in wound healing than the 50% concentration. This observation is attributed to the higher concentration leading to a more excellent content of mangosteen peel extract (*Garcinia mangostana* L.), resulting in a faster wound healing process. However, the study encountered challenges, particularly with the teeth of Wistar rats, which tended to fracture during extraction easily. This difficulty may be attributed to the unique anatomy of Wistar rat teeth, characterized by length and crookedness in the socket. Overcoming these challenges required careful extraction techniques and subsequent removal of any remaining teeth by delicately tearing the soft tissue from the socket. This is because the anatomy of the Wistar rat teeth is long in the socket and crooked (Dewi, I. D. A. D. Y., Astuti, K. W., dan Warditiani, 2013) [2], so when the fracture occurs, the researcher must remove the remaining teeth by

slightly tearing the soft tissue from the socket (Sunarjo, 2015)<sup>[9]</sup>; (Parmita *et al.*, 2017)<sup>[6]</sup>.

### Conclusion

Based on the findings and discussion presented, the conclusion of this study asserts that both 50% and 100% concentrations of mangosteen peel extract (*Garcinia mangostana* L.) demonstrate effectiveness in accelerating wound healing time after tooth extraction in Wistar rats. The study suggests that mangosteen peel extract, regardless of concentration, contributes positively to the wound-healing process in tooth extraction in the studied rat population.

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