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Effect of Giving Mangosteen Peel Extract (*Garcinia mangostana L.*) on Wound Healing after Tooth Extraction

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Abstract
Tooth extraction is a minor surgical procedure commonly performed in dental practice, but it often causes open wounds in the alveolar bone that require a complex healing process. One of the essential factors in wound healing is the presence of fibroblasts that play a role in collagen formation and tissue regeneration. This study aims to evaluate the effectiveness of ethanol extract of mangosteen fruit peel (*Garcinia mangostana L.*) in accelerating wound healing after tooth extraction based on the number of fibroblasts formed. The research design used a laboratory experimental method of the post-test-only control group with a total sample of 32 male Wistar rats divided into two treatment groups: mangosteen peel extract with a concentration of 25% and 50%. The extract was given topically for five days, and then a histological analysis was carried out using Eosin Hematoxylin staining to calculate the number of fibroblasts. The results showed that the group with a concentration of 50% had a higher number of fibroblasts than the 25% group. The Chi-Square test showed a significant relationship between the concentration of the extract and the number of fibroblasts (p=0.008). In conclusion, mangosteen peel extract is 50% more effective in accelerating wound healing after tooth extraction than a concentration of 25%, which is shown through an increase in fibroblasts. These results support the potential use of mangosteen peel as a phytotherapeutic agent in wound care in dentistry.

Keywords: mangosteen peel, fibroblasts, wound healing, tooth extract, ethanol extract, Wistar rat

Introduction

Tooth extraction can cause injuries in the form of an opening of the alveolar bones. A wound is tissue damage or loss due to trauma, with the severity depending on the magnitude of the trauma. The body has a natural mechanism of wound healing through three phases: inflammation (±3 days), proliferation (3–24 days), and remodeling (up to >1 year) (Sorongan *et al*., 2015; Novyana & Susianti, 2016) [14, 7]. Research at RSGMP FKG UNHAS (2013) showed post-extraction complications such as a crown fracture (16.8%), root fracture (13.6%), dry socket (4%), bleeding and pain (1.6%). Meanwhile, RSGM PSPDG FK UNSRAT recorded bleeding (4.54%) and swelling (2.27%) (Lande *et al*., 2015) [5]. RISKESDAS 2007 data states that the number of tooth extraction in Indonesia reached 38.5%, and in 2013, the DMFT index was 4.6, with the missing component reaching 2.9 (RISKESDAS, 2007; 2013) [9, 10]. Tooth extraction, as a minor surgical procedure, can have a psychological impact and should be done painlessly, minimize trauma, and support optimal healing (Pogrel, 2014; Howe, 1990) [8, 3].

Fibroblasts play an essential role in wound healing by producing collagen that strengthens tissues. Its activity increases as wounds form, accelerating regeneration (Junqueira, 2007) [4]. The use of herbs as an alternative to medicine is increasingly in demand because they are safer and have fewer side effects. WHO also encourages using traditional medicine to treat chronic and degenerative diseases (Hemalatha & Hemagaran, 2015; Sewta *et al*., 2015; Mirza *et al*., 2017) [2, 12, 7]. One potential herbal ingredient is mangosteen fruit peel (*Garcinia mangostana L.*), which contains active compounds such as saponins, flavonoids, and tannins and has anti-inflammatory, antioxidant, and antibacterial activity (Windarini *et al*., 2011; Yanti *et al*., 2011; Worotikan *et al*., 2017; Winarti *et al*., 2018; Sitanggang *et al*., 2019) [15, 18, 17, 16, 13].

So far, mangosteen peel has only been used in a limited way, even though it has the potential for wound treatment. This study aims to evaluate the effectiveness of mangosteen peel ethanol extract with a concentration of 25% and 50% in accelerating the healing of wounds after tooth extraction in Wistar rats.

Research Methods

This study is a laboratory experimental research with a controlled random design using *a post-test-only control group design*, March 2025. The samples used were 32 healthy male Wistar rats, aged 2–3 months with a body weight of 200–250 grams, which were divided into two treatment groups: mangosteen peel extract (*Garcinia mangostana L.*) 25% and 50%. The inclusion criteria included healthy male rats, while exclusions included sick, infected, inflammatory, or physically disabled rats. Data collection uses cages, diagnostic sets, microscopes, and histology preparation tools. The ingredients include 25% and 50% mangosteen peel extracts, ketamine, formalin, alcohol, and HE dyes. Primary data were obtained from the histological evaluation of the tissue after treatment. The extract is obtained through maceration and evaporation and then diluted into two concentrations. After the extraction of the rat teeth was performed under ketamine anesthesia, the extract was dripped into the wound daily for five days. On the fifth day, mice were sacrificed for tissue analysis using the Eosin Hematoxylin staining method, and the number of fibroblasts was calculated at five fields of view. Histopathological scoring is determined based on fibroblast density. The study-free variables were 25% and 50% mangosteen peel extract, while the bound variable was the wound healing process after tooth extraction measured based on the number of fibroblasts. Data were analyzed using the Chi-Square test with the SPSS 21 program, and significant results were determined at $p<0.05$.

Results and Discussion

Data distribution and frequency of the number of fibroblast tissue per field of view in Wistar rats after tooth extraction in the group given mangosteen *peel extract (Garcinia mangostana L.)* 25% and 50% can be seen as follows:

Table 1: Data on the Distribution and Frequency of the Number of Fibroblast Tissue Per Post-Tooth Extraction Field of View

No	Number of Fibroblasts	Mangosteen Fruit Peel Extract			
		Concentration 25%		Concentration 50%	
		n	%	n	%
1	No fibroblast tissue was found	0	0	0	0
2	Low number of fibroblasts (less than 10% per field of view)	6	19	3	9
3	Moderate fibroblast tissue count (10%-25% per field of view)	5	16	7	22
4	The number of fibroblast tissues is large (25%-50% per field of view).	4	13	6	19

Based on Table 1, the distribution and frequency of the number of fibroblast tissue per field of view after tooth extraction showed a difference between the groups given mangosteen peel extract (*Garcinia mangostana L.*) with concentrations of 25% and 50%. In both groups, no samples had any fibroblast tissue (0%). In the group with a concentration of 25%, the number of fibroblasts that were relatively small (less than 10% per field of view) was found in 6 samples (19%), while in the group with a concentration of 50%, this number was lower, namely three samples (9%). Fibroblast tissue in the moderate category (10%-25% per field of view) was found in 5 samples (16%) in the 25% concentration group, while at 50% concentration, the number was higher, namely seven samples (22%). The fibroblast tissue that was classified as a large number (25%-50% per field of view) was found in 4 samples (13%) at a concentration of 25%, while in the group with a concentration of 50%, the number increased to 6 samples (19%).

These results show that a higher concentration of the extract (50%) results in a greater number of fibroblasts than a concentration of 25%, which indicates greater effectiveness in accelerating wound healing after tooth extraction. To determine the relationship between the number of fibroblast tissue per field of view in Wistar rats after tooth extraction and the administration of mangosteen *fruit peel (Garcinia mangostana L.)* with a concentration of 25% and the peel of mangosteen *fruit (Garcinia mangostana L.)* 50% concentration, data analysis was carried out using *the Chi-Square* test as follows:

Table 2: Relationship of Fibroblast Tissue Count Per Field of View in Wistar Rats After Tooth Extraction with Mangosteen Peel Extract (*Garcinia mangostana L.)* Concentration 25% and 50%

Number of Fibroblasts	Mangosteen peel extract		
	Concentration 25%	Concentration 50%	p
1. No fibroblast tissue found	0	0	0,008*
2. The number of fibroblasts is small (less than 10% per field of view)	6	3	
3. Moderate fibroblast tissue count (10%-25% per field of view)	5	7	
4. The number of fibroblast tissues is large (25%-50% per field of view).	4	6	

Significant $p<0.05$. Uji Chi-Square

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 with the administration of *Turmeric Extract (Curcuma Longa)* with a concentration of 25% and *Turmeric Extract (Curcuma Longa)* with a concentration of 50%, $p=0.008$ ($p<0.05$).

Based on the study's results, the distribution and frequency of fibroblast tissue after the tooth extraction procedure showed a significant difference between the treatment groups given mangosteen peel extract (*Garcinia mangostana L.*) with concentrations of 25% and 50%. No samples were found to have fibroblast tissue in either group, indicating that both concentrations of the extract affected the formation of healing tissue; in the group that received 25% extract, the relatively

small number of fibroblasts (<10% per field of view) was found in 6 samples. In comparison, in the 50% group, only three samples were found. The number of fibroblast tissue in the moderate category (10%–25% per field of view) was recorded in 5 samples in the 25% group and increased to 7 samples in the 50% group. Meanwhile, the category of high fibroblast counts (25%–50% per field of view) was found in 4 samples in the 25% group and increased to 6 samples in the 50% group.

These findings show that administering mangosteen peel extract with a higher concentration (50%) can increase the number of fibroblasts more than the concentration of 25%, thus indirectly showing greater effectiveness in accelerating the wound healing process after tooth extraction. These results align with the findings of Ruauw *et al*. (2019) [11], who reported that an increase in the concentration of herbal extracts is directly proportional to an increase in fibroblast activity in the wound healing process. In addition, research by Arijani and Khoswanto (2020) [1] also showed that mangosteen peel extract can increase collagen density, which is essential in tissue regeneration.

Tooth extraction is a minor surgical procedure to remove teeth or tooth roots from the alveolus due to pathological conditions that cannot be maintained (Lande *et al*., 2021) [5]. This procedure gives rise to open wounds that require healing time, which relies heavily on the body's biological ability to repair tissues. The wound healing process involves three main phases: inflammation, proliferation, and remodeling (Novyana & Susianti, 2022) [7], in which fibroblast cells play an essential role in forming granulation and collagen tissues that strengthen the injured area (Masir *et al*., 2020). This study aims to compare the effectiveness of two concentrations of mangosteen peel extract in accelerating wound healing after tooth extraction using a Wistar mouse experimental animal model, which was chosen because it has similar biological characteristics to humans and a relatively short life cycle (Lailani *et al*., 2021). Thirty-two healthy male rats aged 2–3 months weighing 200–250 grams were used and divided into two treatment groups. Tooth extraction was carried out under ketamine anesthesia (20 mg/kg BB, i.p.), followed by the administration of 0.05 ml of extract, which was dripped directly into the wound every day for five days. On the fifth day, the mice were sacrificed, and their jaws were fixed in 10% formalin, then decalcified using 10% EDTA before being analyzed with Eosin Hematoxylin staining to count the number of fibroblasts.

Fibroblasts are known to be active from the 3rd to 7th day after injury, so day 5 is chosen as the optimal time for sampling (Stojanovic *et al*., 2021). The analysis showed that all mice from both groups had active fibroblast tissue. However, the group with a concentration of 50% showed a consistently higher number of fibroblasts. This indicates that the concentration of the extract affects the tissue proliferation process. Statistical analysis using the Chi-Square test corroborated these findings, showing a significant association between the number of fibroblast tissue and the concentration of mangosteen peel extract ($p = 0.008$; $p < 0.05$). This is strengthened by the research of Ruauw *et al*. (2021), which states that mangosteen peel extract is effective in accelerating the healing of the mucosa of the oral cavity, as well as the research of Arijani & Khoswanto (2022), which shows that a 100% concentration of mangosteen peel extract can increase collagen density after tooth extraction in guinea pigs. This effect is thought to come from the content of active compounds such as flavonoids, tannins, and saponins that increase fibroblast activity and form new tissues.

Overall, the results of this study confirm that mangosteen peel extract, especially at a concentration of 50%, has the potential to be an effective natural wound healing agent. Thus, the use of this extract can be considered as an alternative to post-tooth extraction therapy. For further development, further research is needed in human clinical trials and formulations of more applicable preparations, such as gels or ointments, that are safe and easy to use in dental practice.

Conclusion

Mangosteen peel extract (*Garcinia mangostana L*.) with a concentration of 50% is more effective in increasing fibroblasts than 25%, thereby accelerating the wound healing process after tooth extraction. Statistical analysis showed a significant relationship between the number of fibroblast tissues and the concentration of the extracts administered ($p = 0.008$; $p < 0.05$). This therapeutic effect is strongly thought to be influenced by the content of bioactive compounds such as flavonoids, tannins, and saponins that can stimulate fibroblast activity and accelerate tissue regeneration. Based on these results, mangosteen peel extract has excellent potential as a natural wound-healing agent applicable in dentistry. Therefore, further research on a clinical scale is needed to ensure its effectiveness and safety in humans, along with a more in-depth analysis of the phytochemical content to identify key active compounds. Exploration of formulations such as gels or ointments, concentration variations, and evaluation of long-term effects are also essential steps in developing products based on mangosteen peel extract as a complementary therapy in wound healing after oral surgery.

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