

Evaluation of the effect of using turmeric ethanol extract (*Curcuma Longa*) in healing wounds after tooth extraction

Li Jinling

Department of Dentistry, Master Program in Dentistry, Faculty of Medicine, Dentistry, Health Sciences, Universitas Prima Indonesia

Abstract

Turmeric (*Curcuma longa* Linn or *Curcuma domestica* Val) has been known by the public as a source of diverse benefits, including anti-inflammatory, anticancer, antioxidant, antiulcer, and antibacterial. This study aimed to evaluate the effectiveness of turmeric extract (*Curcuma longa*) with concentrations of 40% and 80% in accelerating the wound healing process after tooth extraction in Wistar rats. This laboratory experimental study used a randomized design complete with a post-test-only control group design pattern. A total of 32 physically healthy male Wistar rats, aged 2-3 months, weighing 200-250 grams, were used as research subjects. Federer's formula determines the sample size, namely: $(t - 1) (r - 1) \geq 15$, and the minimum number of samples for each treatment is 16 mice. The results showed that there was a significant relationship between the number of fibroblast tissues per field of view in Wistar rats after tooth extraction with turmeric extract (*Curcuma Longa*) concentration of 40% and turmeric extract (*Curcuma longa*) concentration of 80%, with a value of $p = 0.001$ ($p < 0.05$). It can be concluded that turmeric extract (*Curcuma longa*) at concentrations of 40% and 80% effectively accelerates the healing time of wounds after tooth extraction in Wistar rats. In addition, turmeric extract (*Curcuma longa*) at a concentration of 80% proved to be more effective than turmeric extract (*Curcuma longa*) 40% in accelerating the wound healing process, possibly due to the flavonoid content in turmeric extract (*Curcuma longa*) 80% which helps increase the speed of wound healing compared to turmeric extract (*Curcuma longa*) 40%.

Keywords: Turmeric (*Curcuma longa* Linn), wound healing, tooth extraction

Introduction

In dentistry, tooth extraction is one of the most commonly performed surgical procedures globally. The ideal tooth extraction involves the painless removal of an entire tooth or tooth root, aiming to minimize trauma to the surrounding tissues and ensure complete healing at the extraction site. This approach is crucial to prevent potential postoperative prosthetic issues in the future. The extraction process results in a wound exposing the alveolar bone within the oral cavity, representing anatomical damage or tissue destruction due to trauma. Wound healing is a dynamic and intricate process that encompasses three primary phases: the inflammatory phase, the proliferation phase, and the remodeling phase.

Recognizing the value of traditional medicine, the World Health Organization (WHO) recommends the use of herbal remedies for maintaining public health and preventing/treating various diseases, particularly chronic and degenerative conditions, as well as cancer (Budiman *et al.*, 2015) [2]; (Ardhani *et al.*, 2017) [1]; (Hastari Wuryastuti, 2015) [6]. Herbal products have a rich history of use in medicine, with contemporary research highlighting their effectiveness and lower incidence of side effects compared to chemical drugs (Safwan *et al.*, 2014) [13]. *Curcuma longa* L., commonly known as turmeric, has been employed for medicinal purposes for centuries. It possesses various pharmacological properties, notably anti-inflammatory actions (Fioni, 2021) [4]. Curcumin, a vibrant yellow compound extracted from *Curcuma longa* Linn's rhizome, is a potent modulator of intracellular signaling pathways governing cell growth, inflammation, and apoptosis (Fitriani, 2014) [5]. Scientific studies have consistently

demonstrated the positive pharmacological effects of curcumin (Cobra, 2019) [3]; (Roihatul Mutiah, 2015) [12].

This study aims to assess the impact of administering turmeric (*Curcuma longa*) extract at concentrations of 40% and 80% on the acceleration of wound healing after tooth extraction in Wistar rats.

Research Methods

This experimental laboratory study, conducted in January 2024, adopts a randomized controlled design with a post-test-only control group design pattern. The experimental subjects utilized in this research are 32 physically healthy male Wistar rats, aged 2-3 months, with a body weight ranging between 200-250 grams. The rats will be categorized into two groups: 16 will undergo treatment with 40% turmeric extract (*Curcumin Longa*), and the remaining 16 will be treated with 80% turmeric extract (*Curcumin Longa*). The primary objective is to compare the effects of these different concentrations on the accelerated wound-healing process after tooth extraction in Wistar rats.

The sample size was determined using the Federer formula: $(t - 1) (r - 1) \geq 15$, where t represents the number of treatments (2 treatments), and r represents the number of replications. Consequently, the minimum sample size for each treatment group was 16 rats.

$$\begin{aligned} &= (t-1) (r-1) \geq 15 \\ &= (2-1) (r-1) \geq 15 \\ &= (r-1) \geq 15 \\ &= (r-1) \geq 15 \\ &= r \geq 15 + 1 \\ &= r \geq 16 \end{aligned}$$

Materials used in the study

1. Turmeric (Curcumin Longa) Extract 40%
2. Turmeric Extract (Curcumin Longa) 80%
3. Ketamine.
4. Formalin 10%.
5. Histology preparation material with Hematoxylin Eosin (HE) staining.
6. 70% alcohol as sterilization material.
7. Cotton pellet.

Treatment of Wistar Rats

1. Before treatment, 32 rats were divided into 40% turmeric extract and 80% turmeric extract. After that, all rats were adapted for one week. Then, animals were put into cages, with five rats in each cell in the same environmental conditions, given the same food, and monitored for health.
2. Rat tooth extraction will be performed using a modified needle holder under the anesthetic effect of ketamine 1000 mg/10 ml at a dose of 20 mg/kg bw intraperitoneally.
3. One incisor tooth will be extracted from every five rats daily.
4. After tooth extraction, observe the extraction wound and apply a tampon (cotton pellet) to stop bleeding in the wound for 5 minutes.
5. Dropped turmeric extract (Curcumin Longa) 40% in treatment group I and dropped turmeric extract (Curcumin Longa) 80% in treatment group II shortly after tooth extraction as much as 0.05 ml every day.
6. After extraction and treatment, the test animals (rats) were fed fine porridge with attention to the health of the test animals.
7. On the 5th day after tooth extraction, rats from each group were physically sacrificed by neck dislocation. The rat's tail was held and then placed on a surface it could reach. The rat will stretch its body; when the rat's body extends, a holder carried by the left hand is placed on the nape of the neck. The right-hand pulls the tail hard so the rat's neck will be dislocated. Then, the jaw of the rat is taken out.
8. Then, the tissue was fixed with 10% formalin for 24 hours at room temperature, and the decalcification process was carried out using an ethylene diamine tetraacetic acid (EDTA 10%) solution at room temperature.
9. Tissue dehydration was then performed using alcohol. First, the specimen was put into a toluol alcohol solution (1:1) using pure toluol and then into a paraffin-saturated toluol solution.
10. The following process is infiltration in the oven by inserting the specimen into liquid paraffin.
11. The embedding process is carried out (inserting the tissue into paraffin) and then labeled/coded. After the embedding stage, the tissue is sliced in series with a thickness of approximately 6 microns using a microtome.
12. We were evaluating fibroblast cell response using Hematoxylin Eosin (HE) staining. The procedure that must be done is deparaffinization using xylol and alcohol solution, then continued with the rehydration process with alcohol. After that, it is washed with running water, rinsed with distilled water, and then wiped. The glass slide was then placed in Meyer's

hematoxylin solution, flushed with running water, and then washed with distilled water, after which the staining was assessed under a light microscope. If the staining has been considered good, proceed to the next step, namely the dehydration process with alcohol in stages, and then wipe.

13. The next step was to put it into xylol solution, and the object glass was covered with deck glass and observed using a light microscope.
14. Fibroblast density was assessed by counting the fibroblasts in 5 fields of view.

Histopathology Scoring Parameters for Fibroblast Counts

Histopathology scoring parameters to determine the distribution of fibroblast tissue is done based on the field of view:

1. (-) = No fibroblast tissue found
2. (+) = small number of fibroblasts (less than 10% per field of view)
3. (++) = moderate amount of fibroblast tissue (10%-40% per field of view)
4. (+++) = large amount of fibroblast tissue (40%-80% per field of view)

Research Variables

The variables in this study consist of:

1. The independent variables are turmeric extract (curcumin longa), 40%, and 80%.
2. **Dependent variable:** Wound healing process after tooth extraction.

Data Analysis Method

Data analysis using the SPSS. Ver 21 program. Research using a pure experiment with a nonparametric Chi-Square Test, after testing, showed that (p <0.05) means there is a significant difference between groups.

Results and Discussion

Table 1: Distribution and Frequency Data of Fibroblast Tissue Counts Per Field of View After Tooth Extraction

No	Number of Fibroblasts	Turmeric (Curcuma Longa)			
		Concentration 40%		Concentration 80%	
		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)	7	44%	2	13%
3	Moderate amount of fibroblast tissue (10%-40% per field of view)	5	31%	6	38%
4	A large amount of fibroblast tissue (40%-80% per field of view).	4	25%	8	50%

From the data presented in Table 1, it is evident that all examined samples exhibited fibroblast tissue in response to the administration of turmeric extract (Curcuma Longa) at concentrations of 40% and 80% following 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), the administration of turmeric extract (*Curcuma Longa*) at a concentration of 40% after tooth extraction in Wistar rats yielded nine samples (28%). In comparison, the administration of turmeric extract (*Curcuma Longa*) at 80% resulted in 3 pieces (9%). Moving to the moderate category (10%-40% per field of view), the administration of turmeric extract (*Curcuma Longa*) at 40% after tooth extraction in Wistar rats accounted for five samples (16%). In comparison, at 80%, it was six samples (19%). In the large category (40%-80% per field of view), the administration of turmeric extract (*Curcuma Longa*) at 40% after tooth extraction in Wistar rats showed two samples (6%), whereas, at 80%, it exhibited seven models (22%).

Table 2: Relationship between the number of tissue fibroblasts per field of view in Wistar rats after tooth extraction with turmeric extract concentrations of 40% and 80%

Number of Fibroblasts	Turmeric (<i>Curcuma Longa</i>)		P
	Concentration 40%	Concentration 80%	
No fibroblast tissue was found	0	0	0,001*
A small number of fibroblasts (less than 10% per field of view)	7	2	
Moderate amount of fibroblast tissue (10%-40% per field of view)	5	6	
A Large fibroblast tissue (40%-80% per field of view).	4	8	

Significant $p < 0.05$. Chi-Square Test

The data presented in Table 2 indicates a noteworthy correlation between the number of fibroblast tissues per field of view in Wistar rats after tooth extraction when administering Turmeric Extract (*Curcuma Longa*) at concentrations of 40% and 80%. The statistical analysis reveals a significant relationship, with a p-value of 0.001 ($p < 0.05$). This suggests that the concentration of Turmeric Extract (*Curcuma Longa*) considerably impacts the number of fibroblast tissues observed in the post-tooth extraction scenario among Wistar rats.

Discussion

The obtained P-value in this study is 0.001, which is less than or equal to the significance level of 0.05. This indicates a significant effect of administering turmeric extract on accelerating the healing process after tooth extraction in experimental animals. These findings align with a study by Budiman *et al.* in 2015 [2], where the impact of Turmeric (*Curcuma Longa*) on the closure time of incision wounds in mice was investigated. Budiman's study demonstrated that Turmeric (*Curcuma Longa*) influenced the closure time of incision wounds in the oral mucosa of Wistar rats. Wounds in Wistar rats treated with Turmeric (*Curcuma Longa*) closed at a faster rate compared to those not receiving Turmeric (*Curcuma Longa*) (Budiman *et al.*, 2015) [2].

The active compounds present in Turmeric (*Curcuma Longa*), such as mannose, glucomannan, chrysophane acid, acemannan, flavonoids, saponins, tannins, vitamin A, vitamin C, vitamin E, and enzymes, are identified as beneficial contributors to the wound healing process. Collectively, these components play a role in enhancing the

healing mechanism, supporting the observed acceleration in wound closure following the administration of turmeric (*Curcuma Longa*) in the experimental animals.

Tannin, present in Turmeric (*Curcuma Longa*), is recognized for its astringent properties that contribute to halting bleeding, expediting wound healing, alleviating mucous membrane inflammation, and fostering the regeneration of new tissue (Ningrum *et al.*, 2016) [10]. Additionally, tannin exhibits antibacterial capabilities. The acceleration of wound healing attributed to tannin content involves various cellular mechanisms, including the scavenging of free radicals and reactive oxygen, promotion of wound closure, and augmentation of the capillary blood vessel and fibroblast formation (Wahyuningtyas *et al.*, 2017) [14] (Pangemanan *et al.*, 2016) [11].

Furthermore, the flavonoids in Turmeric (*Curcuma Longa*) serve as antioxidants, antimicrobials, and anti-inflammatories in wound healing (Yunianto *et al.*, 2017) [16]. Flavonoids play a role in the healing process by bolstering collagen formation, diminishing tissue edema, and increasing the quantity of fibroblasts (Wientarsih *et al.*, 2012) [15]. Examination results revealed that the total flavonoid content in 80% Turmeric (*Curcuma Longa*) extract was 2.39%, while in 40% Turmeric (*Curcuma Longa*) extract, it was 1.19%. Consequently, it was determined that the 80% Turmeric (*Curcuma Longa*) extract exhibited greater effectiveness in accelerating the wound healing process (Indah & Br, 2019) [7].

The study results indicate that the 80% Turmeric (*Curcuma Longa*) extract exhibits greater effectiveness in wound healing than the 40% Turmeric (*Curcuma Longa*) extract. This is attributed to the higher concentration of the section, which results in an elevated content of beneficial compounds in Turmeric (*Curcuma Longa*). Consequently, the wound healing process is accelerated, highlighting the positive correlation between extract concentration and the speed of the healing response (Kumara *et al.*, 2019) [8]; (Milasari, 2019) [9].

Conclusion

In conclusion, based on the conducted results and discussions in this study, it can be affirmed that turmeric extract (*Curcuma longa*) effectively accelerates wound healing time after tooth extraction in Wistar rats. The study suggests that a higher concentration of turmeric extract enhances the effectiveness of the healing process in the scars of experimental animals.

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