INTRODUCTION

Post-extraction bleeding is a complication frequently encountered in dental practice.1 Immediately after blood vessel damage occurs, platelets are rapidly activated, forming an obstructive plug in the damaged area, preventing bleeding. A decrease in the number of platelets will increase the risk of bleeding.2 Bleeding time is the time interval from when blood first comes out until the blood stops coming out.3 Clotting time is the time needed for blood to clot.4 If post-extraction bleeding is not treated, complications can occur, in the form of soft tissue hematomas to severe blood loss.3

About 80% of the world’s population uses traditional medicine.5 The use of medicinal plants for various diseases and symptoms, such as bleeding, is common in traditional and ethnic medicine throughout the world.6 Flavonoids and tannins are the main compounds that play a role in the blood clotting process.7 The ethanol extract of Terminalia catappa L. leaves contains: saponins, alkaloids, tannins, flavonoids, triterpenoids, and phenols.8 This study aimed to determine the bleeding time and clotting time after tooth extraction. White mice were given ethanol extract gel from Terminalia catappa L. leaves.

METHOD

Study design using randomized with post-test only control group design, in vivo. A population of 35 male white rats (Rattus norvegicus) of the Wistar strain, were grouped randomly into 7 groups. The extraction of white rat teeth using artery clamps, measurement of bleeding time and clotting time using three stopwatches, and the results were averaged.

RESULTS: The results of the research showed that the ethanol extract gel of Terminalia catappa L. leaves had a shorter bleeding time and clotting time than pure gel, after tooth extraction from white rats.

CONCLUSION: Terminalia catappa L leaf ethanol extract gels have the ability to shorten bleeding time and clotting time and the best gel concentration is 50%.

Keywords: ethanol extract gel of Terminalia catappa L. leaves, bleeding time, clotting time.


ABSTRACT

INTRODUCTION

Post-extraction bleeding is a complication that is often encountered in dental practice. A decrease in the number of platelets will increase the risk of bleeding. If left untreated, complications can range from hematoma to severe blood loss. The use of medicinal plants is common in traditional medicine throughout the world. Flavonoids and tannins are the main compounds that play a role in the blood clotting process. The ethanol extract of Terminalia catappa L. leaves contains: saponins, alkaloids, tannins, flavonoids, triterpenoids, and phenols. This research aims to determine bleeding time and clotting time after tooth extraction. White mice were given ethanol extract gel from Terminalia catappa L. leaves.

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ABSTRACT

Bleeding time and clotting time post-extraction Rattus norvegicus tooth treated with ethanol extract gel from Terminalia catappa L. leaves

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Terminalia cattapa L. leaf extract which has been homogenized in propylene glycol is mixed little by little into the HPMC gel base, stirred until homogeneous. After that, the physical stability of the gel base was evaluated. Terminalia cattapa L. leaf extract gel formula with HPMC base as follows: extract Terminalia cattapa L. 10-15%, propylene glycol 10 ml, HPMC 2, and 30 ml of distilled water.

The white mice used were first acclimated for ten days at room temperature so that the mice could adapt to their new environment. The white mice were placed in a cage with a plastic tub with a mesh bottom and covered with sieve wire. Every three days the cage is cleaned and the husks replaced. White mice were given food once a day in the morning and given water ad libitum.

Before tooth extraction, the white rats were anesthetized until they were unconscious using ketamine and xylazine in a 1:1 ratio, which was injected intramuscularly 0.2 ml into the thigh muscle. Then the white rats’ teeth were extracted, the left lower incisor using artery clamps. After removing the white rat’s tooth, insert the material being tested: Terminalia cattapa L. leaf ethanol extract gel or pure gel or spongostan into the tooth socket using a dental explorer. While waiting for the blood to stop flowing, the blood that comes out is absorbed with filter paper. Bleeding time is calculated using a stopwatch starting when the tooth is extracted until the blood stops flowing and the stopwatch is stopped. At the same time the second stopwatch is activated until the blood completely clots, the stopwatch is stopped. Clotting time is obtained by means of bleeding time plus time measurement by a second stopwatch. Bleeding and clotting times were measured using three stopwatches respectively and the results were averaged.

SPSS version 25.0 was used to analyze difference between group, ANOVA test was used to analyze significant difference among the group. All value considered significant if \( p < 0.05 \).

**RESULT**

The bleeding time after white rat tooth extraction can be seen in Table 1 and Figure 1. The results of this study showed that all treatments had a shorter bleeding time than pure gel (negative control group), while the bleeding time was shortest in the spongostan group (positive control).

In order to determine the difference in bleeding time and blood clotting time, a one-way ANOVA test was carried out. Based on the results of the one-way ANOVA test, the bleeding time obtained a \( p \)-value <0.05. This means that there is a significant difference in bleeding time in all treatment groups compared to the spongostane control. Data shows that the ethanol extract of Terminalia cattapa L. (Table 1) leaves with a concentration of 50% has the same ability to shorten bleeding time as the positive control, namely spongostan. Based on the ANOVA Table 2, it is known that there is no significant difference in blood clotting time between the 50% concentration of Terminalia cattapa L. leaf ethanol extract gel treatment group and the spongostan control group.

Based on Table 2, it can be seen that the fastest average clotting time was in the group of white mice given spongostan (positive control) 76.00 seconds. Meanwhile, the white mice given pure gel group had the longest clotting time, with an average of 129.80 seconds. The research results also showed that the higher the ketapang leaf ethanol extract concentration, the shorter the clotting time.

Based on the results of the one-way ANOVA clotting time test, \( p < 0.05 \) was obtained. This means that there is a difference in clotting time between the treatment group and the spongostan control group except for treatment group 5. All Terminalia cattapa L. leaf ethanol extract gels in concentrations of 10%,

### Table 1. Bleeding time

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Mice model number</th>
<th>Bleeding time (seconds)</th>
<th>x ± SD</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Gel 10% (P1)</td>
<td>100</td>
<td>111</td>
<td>87</td>
<td>98</td>
</tr>
<tr>
<td>Gel 20% (P2)</td>
<td>89</td>
<td>93</td>
<td>115</td>
<td>88</td>
</tr>
<tr>
<td>Gel 30% (P3)</td>
<td>78</td>
<td>73</td>
<td>84</td>
<td>90</td>
</tr>
<tr>
<td>Gel 40% (P4)</td>
<td>87</td>
<td>80</td>
<td>84</td>
<td>78</td>
</tr>
<tr>
<td>Gel 50% (P5)</td>
<td>66</td>
<td>70</td>
<td>62</td>
<td>71</td>
</tr>
<tr>
<td>Pure gel (negative control) (K-)</td>
<td>105</td>
<td>123</td>
<td>118</td>
<td>126</td>
</tr>
<tr>
<td>Spongostan (positive control) (K+)</td>
<td>63</td>
<td>73</td>
<td>54</td>
<td>58</td>
</tr>
</tbody>
</table>

**Figure 1.** Bleeding time (seconds).
20%, 30%, 40% and 50% have the ability to shorten clotting time more better than pure gel, but only gel with a concentration of 50% has the same ability as spongostan (Figure 2).

Based on the results of this research, Terminalia catappa L. leaf ethanol extract gel with concentrations of 10%, 20%, 30%, 40% and 50% can help shorten bleeding time and clotting after tooth extraction. However, the best concentration is 50%.

**DISCUSSION**

Previous research results show that all Terminalia catappa L. leaf extract fractions contain: saponins, alkaloids, tannins, flavonoids, triterpenoids and phenols. The highest content of tannins: 53,140.72 mg/100g and flavonoids: 2,5964.14 mg/100g. The flavonoid content in the ethanol extract of red betel leaves is 4,577.1 g/100g, higher than the ethanol extract of green betel leaves, 1,185.7 g/100g. Based on this, it can be seen that the flavonoid and tannin content in the ethanol extract of Terminalia catappa L. leaves is higher than that contained in the ethanol extract of betel leaves. Betel has many benefits, including stopping bleeding, the main compounds that play a role in the blood clotting process are flavonoids and tannins found in the 70% ethanol extract of betel leaves (Piper betle L.).

The research results by Soetopo et al. show that ethanol extract of betel leaves in concentrations of 10%, 20% and 40% can shorten bleeding time with the average time to stop bleeding respectively being 124.60 seconds, 104.80 seconds and 92.60 seconds. Based on this, it can be seen that the ethanol extract of Terminalia catappa L. leaves in concentrations of 10%, 20%, 30%, 40% and 50% has the ability to shorten bleeding time better than the ethanol extract of betel leaves. The results of this research show that the higher the concentration of Terminalia catappa L. leaf ethanol extract, the shorter the bleeding time. This is because the higher the concentration of Terminalia catappa L. leaf ethanol extract in the gel, the higher the flavonoid and tannin levels.

The main function of platelets is to help stop bleeding through the formation of clots or blood clots. The influence of tannins on platelet function includes mobilization of platelet-rich plasma calcium, P-selectin expression induced by thrombin, adenosine triphosphate (ATP) secretion induced by thrombin, increased intracellular calcium concentration caused by thrombin, production of collagen-treated platelets, washed and stirred platelets, aggregation induced by thrombin, induces caspase activation and translocation, produces washed platelets from type 2 diabetes patients. Tannins are able to precipitate blood proteins while contracting tissue in narrow bleeding so it is useful as a hemostatic and blood clotting agent.

Blood clotting time or clothing time after white rat tooth extraction can be seen in Table 2 below.

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Clotting time (seconds)</th>
<th>Mice model number</th>
<th>x ± SD</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gel 10% (P1)</td>
<td>113 122 107 112 131</td>
<td>117.00 ± 9.513</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>Gel 20% (P2)</td>
<td>109 113 125 99 116</td>
<td>112.40 ± 9.529</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gel 30% (P3)</td>
<td>89 87 98 108 102</td>
<td>96.80 ± 8.815</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gel 40% (P4)</td>
<td>98 90 92 89 77</td>
<td>89.20 ± 7.662</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gel 50% (P5)</td>
<td>78 81 71 81 70</td>
<td>76.20 ± 5.357</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pure gel (negative control) (K-)</td>
<td>115 131 127 137 139</td>
<td>129.80 ± 9.550</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spongostan (positive control) (K+)</td>
<td>73 85 70 69 83</td>
<td>76.00 ± 7.483</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure 2.** Clotting time (seconds).

Table 2. Clotting time
important in the body, namely stopping bleeding due to ruptured blood vessels.\textsuperscript{16}

Research data shows that the trend of decreasing bleeding time is directly proportional to the decreasing trend of clotting time along with increasing the concentration of \textit{Terminalia catappa} L. leaf ethanol extract in the gel that was tested after extraction of the left lower incisor teeth of white mice. The relationship between bleeding time and clotting time was tested using the Pearson-r correlation, obtaining a p = 0.000 and Pearson correlation: 0.977 (very strong relationship).\textsuperscript{17} This means that there is a very strong relationship between bleeding time and clotting time.

CONCLUSION

All \textit{Terminalia catappa} L. leaf ethanol extract gels have the ability to shorten bleeding time and clotting time and the best gel concentration is 50%.

ETHICAL CONSIDERATION

This study has been approved by Ethical Committee Politekik Kesehatan Denpasar, with ethical clearance reference number: LB.02.03/EA/KEPK/0622/2023.

CONFLICT OF INTEREST

All author declares there is no conflict of interest regarding publication of the study.

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AUTHOR CONTRIBUTION

All authors had contributed to manuscript writing and agreed for the final version of publication.

REFERENCES