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Effect of *Fragaria ananassa* (Strawberry) Crude Extract as an Anticoagulant Determined Through Prothrombin Time and Activated Partial Thromboplastin Time for Platelet-Poor Plasma Samples

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INTRODUCTION

Blood sample analysis is essential in the screening, diagnosis, and monitoring of disease. It provides vital information about organ function and bleeding disorders. Anticoagulants like heparin, citrate, and EDTA are routinely used to prevent clotting during blood collection, but sodium citrate, can disrupt normal coagulation processes. This has prompted interest in natural alternatives like *Fragaria ananassa* (strawberry), which contains phenolic compounds known to inhibit vitamin K-dependent clotting pathways. Strawberries may offer a safer, natural alternative to anticoagulants by interfering with the synthesis of key clotting factors. This study investigates the potential of *Fragaria ananassa* as an effective anticoagulant for platelet-poor plasma, aiming to improve diagnostic accuracy and patient safety.

PROBLEM STATEMENT

The study explores the potential anticoagulant properties of *Fragaria ananassa* extract, aiming to fill the research gap regarding its efficacy, active components, and optimal concentration. It seeks to evaluate its suitability as a natural, sustainable alternative to synthetic anticoagulants for clinical and laboratory use.

OBJECTIVE OF THE STUDY

- Determine the total phenolic concentration of *Fragaria ananassa* using total phenolic content determination that contributes to its potential anticoagulant properties.
- Evaluate whether the potential anticoagulant activity of *Fragaria ananassa* extract in platelet-poor plasma samples is dependent on extract concentration.
- Determine the concentration of *Fragaria ananassa* extract that exhibits the highest prolongation of anticoagulant activity.
- Assess the efficacy of *Fragaria ananassa* extract as a potential alternative anticoagulant for platelet-poor plasma samples by evaluating its effect on activated partial thromboplastin time (aPTT) and prothrombin time (PT) using ANOVA.

RESEARCH QUESTIONS

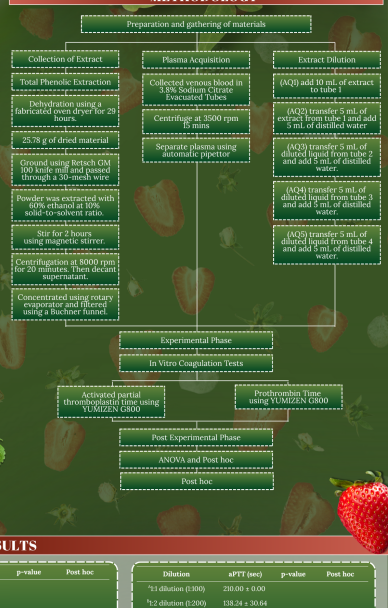
- What is the concentration of the *Fragaria ananassa* extract as determined through total phenolic content determination?
- Is the anticoagulant activity of *Fragaria ananassa* extract in platelet-poor plasma samples dependent on its concentration?
- What concentration of *Fragaria ananassa* extract exhibits the greatest prolongation of anticoagulant activity?
- Is there a significant effect on the aPTT and PT test results of *Fragaria ananassa* extract using the coagulometer by analyzing it through ANOVA?

HYPOTHESIS

H_0 There is no significant effect in the coagulation time using the *Fragaria ananassa* extract when evaluated using aPTT and PT tests.

H_a There is a significant effect in the coagulation time using *Fragaria ananassa* extract when evaluated using aPTT and PT tests.

METHODOLOGY



RESULTS

Sample Name	TPC (ug GAE/mL)	Average
Ethanolic Extract of Strawberry	6105.15	
	5928.11	6013.95
	6008.59	

Table 1. Total Phenolic Content of the Ethanolic Extract or the Strawberry

Dilution	PT (sec)	p-value	Post hoc
^{1}1:1 dilution (1:100)	60.27 ± 27.57		
^{1}1:2 dilution (1:200)	15.94 ± 2.97		
^{1}1:4 dilution (1:400)	13.93 ± 0.97	<0.001	(B=C=D=E)<A
^{1}1:8 dilution (1:800)	13.99 ± 0.76		
^{1}1:16 dilution (1:1600)	14.00 ± 0.84		

Table 2. Prothrombin Time (PT) Using the Five Concentrations of *Fragaria ananassa* Extract

Dilution	aPTT (sec)	p-value	Post hoc
^{1}1:1 dilution (1:100)	210.00 ± 0.00		
^{1}1:2 dilution (1:200)	138.24 ± 30.64		
^{1}1:4 dilution (1:400)	120.25 ± 11.00	<0.001	E<D=(C=B)<A
^{1}1:8 dilution (1:800)	107.07 ± 14.09		
^{1}1:16 dilution (1:1600)	79.55 ± 25.64		

Table 3. Activated Partial Thromboplastin Time (aPTT) Using the Five Concentrations of *Fragaria ananassa* Extract

Dilution	INR	p-value
1:1 dilution (1:100)	4.33 ± 2.71	0.055
1:2 dilution (1:200)	1.33 ± 0.29	
1:4 dilution (1:400)	1.13 ± 0.09	
1:8 dilution (1:800)	1.14 ± 0.07	
1:16 dilution (1:1600)	1.14 ± 0.08	

Table 4. International Normalized Ratio (INR) Using the Five Concentrations of *Fragaria ananassa* Extract

Dilution	PT (sec)	p-value
1:1 dilution (1:100)	60.27 ± 27.57	0.018
1:2 dilution (1:200)	15.94 ± 2.97	0.078
1:4 dilution (1:400)	13.93 ± 0.97	0.080
1:8 dilution (1:800)	13.99 ± 0.76	0.014
1:16 dilution (1:1600)	14.00 ± 0.84	0.026

Table 5. Comparison of *Fragaria ananassa* Extract with Citrate using PT

Dilution	aPTT (sec)	p-value
1:1 dilution (1:100)	210.00 ± 0.00	<0.001
1:2 dilution (1:200)	138.24 ± 30.64	0.001
1:4 dilution (1:400)	120.25 ± 11.00	<0.001
1:8 dilution (1:800)	107.07 ± 14.09	<0.001
1:16 dilution (1:1600)	79.55 ± 25.64	0.014

Table 6. Comparison of *Fragaria ananassa* Extract with Citrate using aPTT

DISCUSSION

Overall Anticoagulant Activity:

The *Fragaria ananassa* extract significantly prolonged both PT and aPTT values, with values notably higher than the control ($p < 0.05$), indicating strong anticoagulant activity even at low doses. Prolongation of PT and aPTT suggests interference with the common pathway coagulation factors, Factors I, II, V, and X. Similar effects were reported by Omar et al. (2020) with *Thymbra spicata* and *Satureja thymbra*, and by Bijak et al. (2014), who found that polyphenols like quercetin and cyanidin inhibit Factor Xa. *Fragaria ananassa* contains flavonoids, phenolic acids, anthocyanins, tannins, and coumarins (Rapuru et al., 2022), compounds known to modulate hemostasis (Durić et al., 2015). These findings support that the extract's anticoagulant effects are likely due to phytochemicals, reinforcing its potential as a natural anticoagulant agent.