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Research Article

THROMBOLYTIC ACTIVITY OF *CURCUMA AMADA* AND *CURCUMA CAESIA*

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ABSTRACT

Objective: To compare the thrombolytic activity of *Curcuma amada* and *Curcuma caesia.*

Methods: Hydroalcoholic extractions of *C. amada* and *C. caesia* were prepared. Clot lysis potential of the extracts was checked, and the results were statistically analyzed.

Results and Conclusion: On comparing the thrombolytic potential, the percentage of clot lysis of synthesized silver nanoparticle using *C. caesia* (51%) was found to be higher than *C. amada* (34.7%) extract. Similarly, *C. caesia* extract (38.75±2.217) showed higher percentage of clot lysis than *C. amada* (34.74±6.074). The mean percentage of clot lysis of rhizome extracts and synthesized silver nanoparticle was statistically more significant ($p<0.05$) when compared to the positive control streptokinase and negative control water. Active component involvement analysis will be helpful to utilize the *C. amada* and *C. caesia* as potent therapeutic agent.

Keywords: *Curcuma amada*, *Curcuma caesia,* Thrombolytic potential.

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INTRODUCTION

Active ingredients of medicinal plants are used in the synthesis of different drugs. Many of the laxatives, anticoagulants, antibiotics, and antimalarial drugs contain ingredients from plants [1]. The family Zingiberaceae has much medicinal value, and it is distributed widely throughout the Southeast Asian region. Gingers are important natural source, used as a raw material for the production of food, spices, medicines, dyes, perfume, etc. The ginger family comprises 53 genera and over 1200 species. India is one of the richest and diverse regions for Zingiberaceae, having 20 genera and around more than 200 species. The members of Zingiberaceae are annual or perennial rhizomatous herbs [2].

Mango ginger (*Curcuma amada*) is famous due to its raw aroma which belongs to Zingiberaceae family [3]. Various study reports revealed that the mango ginger has wide pharmacological properties such as antidiabetic, immunomodulatory, antioxidant, antitumor, and hepatoprotective effects [4]. In India, the *Curcuma caesia* rhizomes are used in the treatment of sprains and bruises and also in the preparation of cosmetics [5]. Black turmeric powder is utilized by the tribes of Nadia of West Bengal, to treat certain illnesses such as fevers, stomach problems, allergies, diarrhea, chronic cough, heartburn, and for various other ailments [6]. Various studies revealed that the presence of flavonoids and phenolic compounds in plants are responsible for the antioxidant, anti-inflammatory, and anticarcinogenic activity [7].

Plants exert thrombolytic effects due to the presence of certain fibrinolytic protease enzymes. Plasmin is formed from its zymogen by plasminogen activators such as urokinase (UK)-type plasminogen or tissue-type plasminogen activator [8,9]. Plasmin cleaves the fibrin network supporting blood clots and restores blood flow to the affected tissue [8]. Heart disease caused by blood clot (thrombus) formation is the most severe disease which is increasing at an alarming rate in the recent years. Thrombolytic agents are used to lyse the clot and in the management of thrombosis in patients. UK, streptokinase (SK), etc., are the tissue plasminogen activator (t-PA) used for the treatment of thrombosis, but their usage is found to cause side effects [10]. In the present study, the thrombolytic activity of *C. amada* and *C. caesia* extracts and synthesized silver nanoparticles using these extracts was compared.

METHODS

Sample collection

C. amada and *C. caesia* were commercially brought from Local Siddha Medical Shop, Chennai. Sample collected was authenticated and deposited in the Department of Biotechnology, Faculty of Science and Humanities, SRM University.

Hydroalcoholic extraction

10 g of fresh rhizome of both *C. amada* and *C. caesia* was cut into small pieces, placed in 100 ml of hydroalcoholic solvent (70 ml alcohol, 30 ml water) and left for 7 days with occasional shaking (cold maceration) [11]. The extract was filtered, processed, and stored.

Thrombolytic activity

2 ml of venous blood (n=4) was drawn from healthy human volunteers without a history of oral contraceptive or anticoagulant therapy which were taken into different pre-weighed sterile microfuge tube. The microfuge tubes were incubated at 37°C for 45 minutes. Serum was removed without disturbing the clot and each tube weighed again to determine the clot weight (clot weight=Weight of clot containing tube − Weight of tube alone). Then, to each of the microfuge tube containing clot, 100 µl of *C. caesia* rhizome extract, 100 µl of synthesized silver nanoparticle using *C. caesia* rhizome extract, 100 µl of *C. amada* rhizome extract, 100 µl of silver nanoparticle of *C. amada* rhizome extract, 100 µl of SK (positive control), and 100 µl of distilled water (negative control) were separately added. All the tubes were then incubated for 90 minutes at 37°C, and clot lysis was analyzed. After incubation, the fluid was discarded, tubes were weighed, and the difference in weight after clot disruption was marked [10,12]. Finally,

percentage of clot lysis was determined as percentage of clot lysis = (Weight of released clot/clot weight) × 100.

Statistical analysis

All the results obtained were expressed as mean±standard error of mean. The data for the sample were analyzed using Mann–Whitney (Non parametric Statistic for sample size that is usually small). $p<0.05$ was considered statistically significant [12].

RESULTS AND DISCUSSION

Numbers of drugs approved by the Food and Drug Administration currently have plant origins. The existing proof shows that consuming food supplements having anticoagulant, antiplatelet, and fibrinolytic activity leads to prevention of coronary diseases [13]. In the present study, thrombolytic activity analysis of *C. amada* and *C. caesia* rhizome extract showed removal of clot by 34.74% and 38.75%, respectively, with that of positive control SK of 77.93% and negative control of 7.1% clot lysis (Fig. 1). In the earlier work, we synthesized and characterized silver nanoparticle using hydroalcoholic extracts of *C. amada* and *C. caesia* [14]. The silver nanoparticle synthesis was used for analyzing the thrombolytic potential along with the extracts. The comparative study reveals that the silver nanoparticle of *C. caesia* had high potential to lyse the clot than the silver nanoparticle of *C. amada* and the rhizome extracts (Fig. 2). The available proof for the non-toxicity of silver nanoparticle will bring improvements in the treatment of thrombosis [15,16]. Statistical analysis revealed that the rhizome extracts have a significant percentage of clot lysis when compared with positive and negative control. As the first generation drugs (SK and UK), found to cause side effects [17], plant-based thrombolytic drugs will improve the treatment of thrombosis. Therefore, *in-vivo* study of *C. amada and C. caesia* is further needed, to be recognized as a thrombolytic agent.

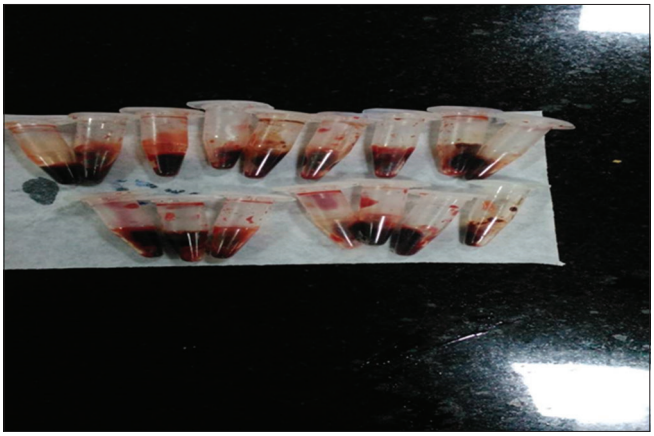

Fig. 1: Clot lysis

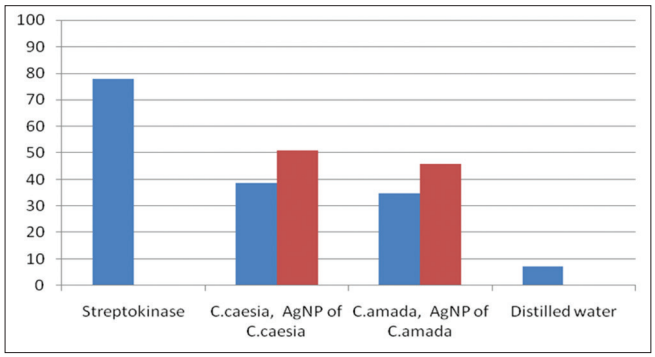

Fig 2: Comparative thrombolytic activity of rhizome extracts and synthesized silver nanoparticle of *Curcuma amada* and *Curcuma caesia* expressed as percentage of clot lysis

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