ISSN: 2582-4686 SJIF 2021-3.261,SJIF 2022-2.889,
2024-6.875 ResearchBib IF: 9.948 / 2024

THE MULTIDISCIPLINARY JOURNAL OF SCIENCE AND TECHNOLOGY

VOLUME-5, ISSUE-6

Comparative Anticoagulant Activity of Afghan, Indian, Chinese, and Transbaikal Mumiyo in a Rat Model

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Abstract

This study aimed to compare the anticoagulant effects of different regional types of mumiyo Afghan, Indian, Chinese, and Transbaikal on blood coagulation in vitro using the Lee-White method in a rat model.

Aqueous solutions of each mumiyo type were prepared at concentrations of 1, 2, 5, and 10 mg/mL. Whole blood samples were collected from healthy Wistar rats and exposed to the mumiyo solutions. Clotting times were measured using the Lee White method at 37°C. A control group with no mumiyo treatment was used for baseline comparison. Each test was conducted in triplicate.

Chinese mumiyo demonstrated minimal effect on clotting time, while Afghan, Indian, and Transbaikal mumiyo showed significant anticoagulant activity in a dose-dependent manner. At concentrations of 2–5 mg/mL, clotting times were prolonged by up to 9–30 minutes, with the most pronounced effect observed in Afghan mumiyo at 10 mg/mL (90 minutes).

Keywords: Mumiyo, blood coagulation, Lee-White method, Natural compounds, Afghan mumiyo, Indian mumiyo, Chinese mumiyo, Transbaikal mumiyo, Traditional medicine.

Introduction

Traditional medicine (TM) encompasses the knowledge, skills, and healing practices developed over generations within various cultures. These approaches are rooted in cultural beliefs, theories, and experiences, and are applied to maintain health, as well as to prevent, diagnose, and treat both physical and mental illnesses (1). In recent years, growing scientific interest has led to numerous studies investigating the health-promoting properties of natural substances used in TM, with several demonstrating beneficial effects in managing various diseases (2). Traditional medicine can be categorized into distinct systems, such as Traditional Persian Medicine (TPM), Traditional Arabic Medicine, Traditional Chinese Medicine (TCM), and Traditional Indian Medicine (Ayurveda) (3). In this context, **Moomiaii** stands out as a distinctive and widely recognized natural substance frequently used across various traditional medicine (TM) systems. Known by many names around the world—including *Shilajit*, *Silajita*, *Marathi*, or *Gujarati* in Hindi; *Asphalt* in English; *Silajatu* in Bengali; *Rock Juice* in Tibetan; *Conqueror of Mountains* in Sanskrit; *Hajarul-Musa* or *Araq-al-Jibal* in Arabic; *Moomiaii* or *Mumnaei* in Persian; *μούμια* in Greek; *Myemu* in Russian; *Mumie* in German; as well as *Mineral Pitch*, *Jew's Pitch*, *Mineral Wax*, and *Bragshun*—this pale-brown to dark brown resin-like substance has been used for over 3,000 years. It is especially valued for its rejuvenating and adaptogenic properties (4).

The origin of Mumijo is explained by three main theories: biological, geological, and bio-mineralogical. According to the biological theory, it is assumed that Mumijo forms from decayed plant residues or animal excretions under certain physicochemical conditions. The geological theory asserts that Mumijo is the result of long geological processes. Additionally, the bio-mineralogical concept suggests that this compound is the product of mechanical contamination of the liquid

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precursor of Mumijo with mineral factors, including the production region, types of plants, geological characteristics of rocks and soil, local temperature, humidity, and altitude, among others, all of which play a role in influencing the composition and therapeutic properties of Mumijo (7). Despite similar physical characteristics across different regions of the world, these factors affect the composition and ratio of components in Mumijo. Overall, Mumijo consists of organic compounds (60-80%), inorganic compounds (20-40%), and trace elements such as Fe, Ca, Cu, Zn, Mg, Mn, Mo, and P (8).

In the 10th century, Ahvazi in his book *Kamāl as-Sanā'a* recommended Mumijo for treating cold headaches, hemoptysis, asthma, and the removal of dead fetuses. Avicenna, the famous Persian physician of that time, in his renowned book *The Canon*, suggested Mumijo as a highly effective remedy for strengthening the brain, enhancing fertility, and treating various other ailments. Moving into the 12th century, the Persian book *Zakhire Khwārizmshāhi*, written by Jurjani, recommended Mumijo for inflammation, ulcers, urinary problems, and prostate issues (5).

Mumijo has been recommended in various doses to address a range of health problems, including urinary system disorders, jaundice, gallstones, gastrointestinal disturbances, spleen enlargement, epilepsy, hypersensitivity, nervous disorders, chronic bronchitis, tuberculosis, eczema, anemia, and diabetes (9). However, fungal contamination, especially mycotoxins, is a significant limiting factor for the widespread use of Mumijo in global practice (10).

Specialists in traditional medicine argue that Mumijo effectively addresses issues such as lack of sexual desire, kidney stones, bone pain and fractures, osteoarthritis, spondylitis, edema, hemorrhoids, aging, rejuvenation, antiseptic properties, obesity, anorexia, and weight loss (7). Due to its anti-inflammatory, antioxidant, antimutagenic, and immunomodulatory properties of fulvic acid (FA) and humic acid (HA), there is some evidence suggesting that Mumijo may serve as a potential agent for cancer prevention (8). Moreover, various doses of Mumijo have shown a reduction in blood glucose levels and beneficial effects on lipid profiles in rats (11). Mumijo extract also improves nucleic acid synthesis and increases the transport of minerals to muscle and bone tissues (4). Mumijo increases diuresis and natriuresis (12).

Materials and Methods

Samples: Four types of mumiyo Afghan, Indian, Chinese, and Transbaikal were used in this study. Each type was finely ground and dissolved in distilled water to prepare aqueous solutions at concentrations of 1 mg/mL, 2 mg/mL, 5 mg/mL, and 10 mg/mL. The solutions were freshly prepared before each experimental session to maintain chemical stability and prevent degradation of bioactive compounds. All samples were filtered to remove insoluble particulates and stored at room temperature in sterile conditions until use.

Blood Collection and Testing: Whole blood was obtained from healthy adult male Wistar rats (200–250 g), housed under standard laboratory conditions with free access to food and water. All procedures involving animals were conducted in accordance with institutional animal care and use guidelines and approved by the appropriate ethical review board.

Prior to blood collection, animals were anesthetized using an intraperitoneal injection of ketamine (80 mg/kg) and xylazine (10 mg/kg) to minimize distress. Blood was drawn via cardiac puncture using sterile syringes and immediately transferred to clean, dry glass test tubes without anticoagulants to assess coagulation behavior under physiological conditions.

The **Lee-White method** was employed to evaluate in vitro blood clotting time. In this method, 1 mL of whole blood was added to each test tube containing the mumiyo solution of a defined concentration. Tubes were gently inverted and maintained in a water bath at 37°C. The time taken for

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the blood to form a visible clot was recorded as the clotting time, with the point of complete coagulation (no fluid phase remaining) noted as the endpoint.

Experimental Design:

- **Control Group:** Blood samples with no added mumiyo (baseline clotting time).
- **Test Groups:** Blood samples treated with each of the four mumiyo types at concentrations of 1, 2, 5, and 10 mg/mL.
- Each test condition was performed in triplicate (n=3) to ensure reproducibility and statistical validity.
- Results were recorded in minutes, and the mean clotting times for each group were calculated.

Results

Type of Mumiyo	Control Test	1 mg/mL	2 mg/mL	5 mg/mL	10 mg/mL
Afghan	6 min	16 min	30 min	30 min	90 min
Indian	3 min	5 min	16 min	30 min	—
Chinese	3 min	4 min	6 min	8 min	—
Transbaikal	3 min	11 min	28 min	30 min	—

The data demonstrate a significant increase in clotting time with Afghan, Indian, and Transbaikal mumiyo, starting at 1 mg/mL. Chinese mumiyo only slightly prolonged coagulation time, even at higher concentrations. The anticoagulant effect was particularly strong at 2 mg/mL and 5 mg/mL for Afghan and Transbaikal mumiyo, with clotting times increasing up to 30 minutes. Afghan mumiyo at 10 mg/mL showed a dramatic prolongation of coagulation (90 minutes).

Discussion

The results reveal that three of the four types of mumiyo tested Afghan, Indian, and Transbaikal possess dose-dependent anticoagulant properties. The mechanism likely involves interference with one or more stages of the blood clotting cascade, though further biochemical analysis is necessary to confirm the specific pathways affected. The negligible effect observed with Chinese mumiyo suggests it either lacks active anticoagulant compounds or contains them in significantly lower concentrations. The pronounced increase in clotting time at relatively low doses (2–5 mg/mL) makes these mumiyo types potential candidates for further pharmacological investigation as natural anticoagulant agents.

Conclusion

Afghan, Indian, and Transbaikal mumiyo exhibit strong anticoagulant effects in vitro, as demonstrated by significant increases in blood clotting time using the Lee-White method. Chinese mumiyo, in contrast, has minimal impact on coagulation. The anticoagulant effect is clearly dose-dependent, with the strongest activity observed at 2–5 mg/mL concentrations. These findings warrant further research into the clinical potential and active components of mumiyo as natural anticoagulants.

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