JOURNAL OF MULTIDISCIPLINARY SCIENCES AND INNOVATIONS
VOLUME 5, ISSUE 03
MONTHLY JOURNALS
ISSN NUMBER: 2751-4390
IMPACT FACTOR: 9,08

CHANGES IN BLOOD COAGULATION PARAMETERS FOLLOWING CHRONIC MUMIYO ADMINISTRATION IN DOGS

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Abstract

The present study evaluated the effects of chronic oral administration of mumiyo on the blood coagulation system in dogs. Five clinically healthy adult dogs of both sexes were administered mumiyo at a dose of 300 mg/kg body weight once daily. Blood samples were collected before treatment and on days 3, 5, and 6 of administration to assess coagulation parameters. Blood clotting time, plasma recalcification time, plasma tolerance to heparin, heparin time, thrombin time, coagulation factors II and V, and fibrinolytic activity were analyzed. Data were expressed as mean ± SD, and statistical comparisons were performed using Student's paired t-test. Mumiyo administration produced significant, time-dependent changes in hemostasis. Blood clotting time, plasma recalcification time, heparin time, plasma tolerance to heparin, and thrombin time were significantly prolonged compared with baseline values. Coagulation factors II and V showed significant increases at later stages of the experiment, while fibrinolytic activity was significantly altered throughout the study period. Despite partial compensatory changes in coagulation factors, the overall effect of mumiyo was characterized by a pronounced hypocoagulant and anticoagulant action.

These findings indicate that chronic administration of mumiyo significantly affects multiple components of the hemostatic system in dogs, leading to a net anticoagulant effect. Further studies are warranted to clarify the mechanisms underlying these effects and to evaluate their potential clinical significance.

Keywords: Mumiyo, blood coagulation, anticoagulant activity, fibrinolysis, coagulation factors, chronic experiment, Persian medicine, Arabic medicine, World Health Organization.

Introduction

According to the World Health Organization (WHO), traditional medicine (TM) incorporates health practices of plant, mineral and animal based medicines, applied singularly or in combination to treat and prevent illnesses/maintain well-being (1). The TM was divided into different systems, including traditional Persian medicine (TPM), traditional Arabic medicine, traditional Chinese medicine (TCM) and traditional Indian medicine (Ayurveda) (2).

In traditional medical systems, Mumijo is classified as a herbomineral exudate with a rich ethnopharmacological background. It has been valued for centuries in diverse cultures across mountainous regions. Although widely associated with the Himalayas of India (3,5), Mumijo is also abundant in several territories of the former Soviet Union, including the Urals, Altai, Caucasus, Sayan Mountains, Baikal, Kazakhstan, Uzbekistan, and Tajikistan. Beyond these regions, deposits have been identified in China, Pakistan, Nepal, Afghanistan, and Tibet (6). Throughout history, this substance has been known by a variety of names: *Shilajit* or *Silajita* in Indian traditions; *Asphalt* in English; *Silajatu* in Bengali; *Rock Juice* in Tibetan medicine; *Mountain Conqueror* in Sanskrit; *Hajarul-Musa* or *Arak-al-Jebal* in Arabic; *Mumiyo* or *Mumnae* in Persian; *μουμία* in Greek; *Muemu* in Russian; *Mumiyo* in German; and other descriptors such as *Mineral Resinous Bitumen*, *Jewish Bitumen*, *Mineral Wax*, and *Bragshun*. Typically ranging in color from light brown to dark brown, Mumijo has been utilized for more than 3000 years as a rejuvenating substance and a potent adaptogen (4).

The origin of Mumijo remains a subject of scientific debate, with three primary hypotheses proposed: the biological, geological, and bio-mineralogical theories. The biological hypothesis suggests that Mumijo forms from the decomposition of plant material or the metabolic excretions of animals under specific environmental and physicochemical conditions. The geological perspective interprets Mumijo as a byproduct of long-term geological transformations. Meanwhile, the bio-mineralogical concept integrates both organic and inorganic contributions, proposing that the final composition of Mumijo is shaped by interactions between the precursor organic mass and the surrounding mineral environment. Factors such as local flora, geological substrate, soil properties, mineral composition, climate (temperature and humidity), altitude, and regional ecological conditions influence both the chemical profile and therapeutic potential of Mumijo (9). Despite sharing similar physical appearances across different geographic regions, the proportional representation of its components varies. Generally, Mumijo consists of 60–80% organic matter, 20–40% inorganic constituents, and trace elements including Fe, Ca, Cu, Zn, Mg, Mn, Mo, and P (10).

Historical medical literature provides extensive documentation on the therapeutic applications of Mumijo. In the 10th century, the physician Ahvazi described its benefits in *Kamāl as-Sanā'a*, recommending it for cold-type headaches, hemoptysis, asthma, and aiding the expulsion of retained fetuses. Avicenna, in his seminal work *The Canon of Medicine*, praised Mumijo as a potent neurotonic agent capable of strengthening the brain, enhancing reproductive function, and treating a variety of disorders. By the 12th century, Jurjani's *Zakhire Khwārizmshāhi* also highlighted its usefulness in managing inflammation, ulcers, urinary difficulties, and prostate conditions (7).

Across diverse healing traditions, Mumijo has been administered in multiple dosage forms to manage a broad spectrum of ailments, including disorders of the urinary tract, jaundice, gallstones, gastrointestinal dysregulation, splenic enlargement, epilepsy, hypersensitivity reactions, neurological diseases, chronic bronchitis, tuberculosis, dermatological conditions such as eczema, anemia, and diabetes (11). However, concerns related to fungal contamination—particularly the presence of mycotoxins—pose a significant barrier to its global acceptance and clinical application (12).

Traditional medicine practitioners continue to attribute numerous therapeutic properties to Mumijo, claiming efficacy in conditions such as reduced libido, nephrolithiasis, musculoskeletal pain, bone fractures, osteoarthritis, spondylitis, edema, hemorrhoids, age-related degeneration, wound antisepsis, metabolic disorders, and weight regulation (9). Modern pharmacological analyses support some of these claims, highlighting the anti-inflammatory, antioxidant, antimutagenic, and immunomodulatory activities largely associated with fulvic acid (FA) and humic acid (HA). These bioactive constituents have prompted interest in Mumijo as a potential chemopreventive agent (10). Experimental studies further demonstrate that Mumijo can lower blood glucose levels, improve lipid metabolism in animal models (13), enhance nucleic acid synthesis, and facilitate mineral transport to bone and muscle tissues (6). Additionally, Mumijo has been shown to increase both diuresis and natriuresis, supporting its traditional use in urinary and renal disorders (14).

Materials and Methods

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The study was conducted on five clinically healthy adult dogs (n = 5) of both sexes, maintained under standard laboratory conditions. Animals were acclimatized for at least one week prior to experimentation. All procedures were carried out in accordance with ethical guidelines for the use of animals in biomedical research.

A chronic experimental model was used to evaluate the effect of mumiyo on the blood coagulation system. Mumiyo was administered orally at a dose of 300 mg/kg body weight once daily throughout the experiment.

Blood samples for coagulation analysis were collected at the following time points:

- Baseline (before mumiyo administration)
- Day 3
- Day 5
- Day 6

Blood was drawn from the cephalic vein into tubes containing 3.8% sodium citrate (9:1 blood-to-anticoagulant ratio). Samples were processed immediately after collection.

Data were expressed as mean ± standard deviation (SD). Statistical comparisons between baseline and post-treatment values were performed using Student's t-test for paired samples. Differences were considered statistically significant at $p < 0.05$.

Results

Administration of mumiyo at a dose of 300 mg/kg produced pronounced, time-dependent changes in the coagulation system of dogs throughout the chronic experiment.

Table 1. Effect of mumiyo at a dose of 300 mg/kg on blood coagulation in dogs in chronic experiments (time in seconds, n = 5)

Indicators	Baseline data	Days of blood sampling		
		3	5	6
Blood clotting time	261±23	295±23	866±17	866±17
P		<0.05	<0.01	<0.01
Plasma recalcification time	58±17	166±12	179±14	188±13
P		<0.01	<0.01	<0.01
Plasma tolerance to heparin	175±39	326±16	324±43	300±43
P		< 0.05	<0.01	<0.01
Heparin time	101±25	182±30	353±48	408±52
P		< 0.01	< 0.01	< 0.01
Factor II	23±4,6	20±6.0	30±9,0	45±1,4
P		*>0,05*	<0,05	<0,05
Factor V	17±1,5	28±0.8	23±1,0	29±1.0
P		*>0,05*	<0,05	<0,05
Thrombin time	9,0±1,6	16±1.2	18±0.33	21>0.33
P		< 0.01	< 0.01	< 0.01
Fibrinolytic activity (min)	70±9	190±12	126±15	140±17
P		<0,05	<0,05	<0,05

Statistically significant differences ($p < 0.05$) compared with baseline values.

Chronic oral administration of mumiyo at a dose of 300 mg/kg resulted in significant, time-dependent alterations in the blood coagulation system of dogs. Blood clotting time increased significantly by day 3 compared with baseline ($p < 0.05$) and showed a marked prolongation by days 5 and 6 ($p < 0.01$).

Plasma recalcification time was significantly prolonged at all post-treatment time points ($p < 0.01$), indicating inhibition of coagulation activation. Plasma tolerance to heparin increased significantly throughout the experiment, with the most pronounced effects observed on days 5 and 6 ($p < 0.01$). Similarly, heparin time increased progressively and significantly compared with baseline values ($p < 0.01$).

Thrombin time was significantly prolonged at all sampling points following mumiyo administration ($p < 0.01$), suggesting suppression of the final stage of fibrin formation. Coagulation factor II and factor V activities showed no significant changes on day 3; however, both factors increased significantly on days 5 and 6 ($p < 0.05$). Fibrinolytic activity was significantly altered, with prolonged fibrinolytic time observed throughout the experimental period ($p < 0.05$).

Discussion

The results indicate that mumiyo exhibits a pronounced anticoagulant effect in dogs during chronic administration. The significant prolongation of blood clotting time and plasma recalcification time suggests inhibition of both intrinsic and common coagulation pathways. Increased heparin time and plasma tolerance to heparin further confirm the hypocoagulant properties of mumiyo.

Despite the observed increase in coagulation factors II and V during later stages of the experiment, overall coagulation remained suppressed, indicating a compensatory response rather than restoration of normal hemostasis. The consistent prolongation of thrombin time suggests that mumiyo may interfere with thrombin activity or fibrin polymerization.

Alterations in fibrinolytic activity demonstrate that mumiyo affects not only coagulation but also the fibrinolytic system, contributing to complex regulation of hemostasis. Overall, these findings suggest that mumiyo influences multiple components of the hemostatic system, resulting in a net anticoagulant effect during prolonged administration.

Conclusion

Chronic oral administration of mumiyo at a dose of 300 mg/kg body weight produces significant, time-dependent alterations in the blood coagulation system of dogs. The observed prolongation of clotting times, increased sensitivity to heparin, and changes in thrombin activity indicate a pronounced anticoagulant and hypocoagulant effect.

Although compensatory increases in certain coagulation factors were noted during later stages of the experiment, these changes did not reverse the overall suppression of coagulation. The results suggest that mumiyo may influence multiple components of the hemostatic system, including coagulation pathways and fibrinolytic activity.

These findings provide experimental evidence for the anticoagulant properties of mumiyo and may have implications for its potential therapeutic use. However, further studies involving larger sample sizes and mechanistic investigations are necessary to fully elucidate its effects and ensure safety during prolonged administration.

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