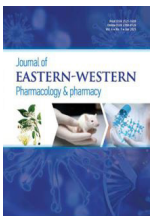

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A STUDY ON HEMOSTASIS AND UTERINE CONTRACTION PROPERTIES *POLYGONUM AVICULARE* (L.)

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KEYWORDS

Vitamin C, water extract, blood clotting, hemostasis, and uterine contraction properties

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ABSTRACT

Background *Polygonum aviculare (L.)* distributed at phyto-geographical regions of Mongolia, where Khuvsgul, Khentii, Khangai, Mongolian Daguur, Central Khalkh, East Mongolia, Depression of Great Lakes, Valley of Lakes, and Gobi-Altai. The aim of the study was to determine the vitamin C content in the aerial parts of *Polygonum aviculare (L.)* by titration method, and to hemostasis and uterine contraction activity.

Methods: A samples of the aerial parts of the *Polygonum aviculare (L.)* were collected according to standards from Gachuurt village, Ulaanbaatar city, in August 2019. Vitamin C content was determined in the aerial parts of the *Polygonum aviculare (L.*). The powdered samples of the plant were extracted with distilled water, and the aqueous extract was used in this study. When examining the hemostatic properties, the activated calcification time was determined using a modified version of the method of U.Bergerhof and L.Rock (1984).

Results: Vitamin C content in the aerial parts was determined by titration and found to be 3.76 mg/ g. The bleeding time from the tail of treated mice was 2 times shorter than that of the control. The fibrinogen formation time in the blood of mice in the experimental group was shortened, and this indicator was different compared to the control.

Conclusions: The extract was shown to enhance the function of the blood coagulation system by exhibiting resistance to heparin, shortening the recalcification time, and increasing the fibrin content in the blood. To assess its uterotonic activity, a 120 mg/ kg dose of the extract was injected into the femoral vein of experimental mice at approximately 20 days of pregnancy. The mice were observed over a period of 8 to 14 hours. Uterine contractions and miscarriage, accompanied by internal bleeding, were observed—indicating that the extract has a strong uterotonic effect.

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INTRODUCTION

Phytochemical studies have shown that the plant contains 3% of the active ingredient, 1.48-1.97% of the flavonoids avicularin, quercetin, isorhamnetin, myricetin, kaempferol, luteolin, 520 mg/g of vitamin C, and 46.7% of carotene. Studies by foreign scientists have shown that *Polygonum aviculare (L.)* has hemostatic, diuretic, stone-removing, anti-inflammatory, anti-allergic, blood pressure-lowering, antibacterial, and uterine-contracting properties. The research was conducted to study the hemostatic and uterine contraction properties of the *Polygonum aviculare (L.)* and developing new herbal medicines and preparations for use in the veterinary field.

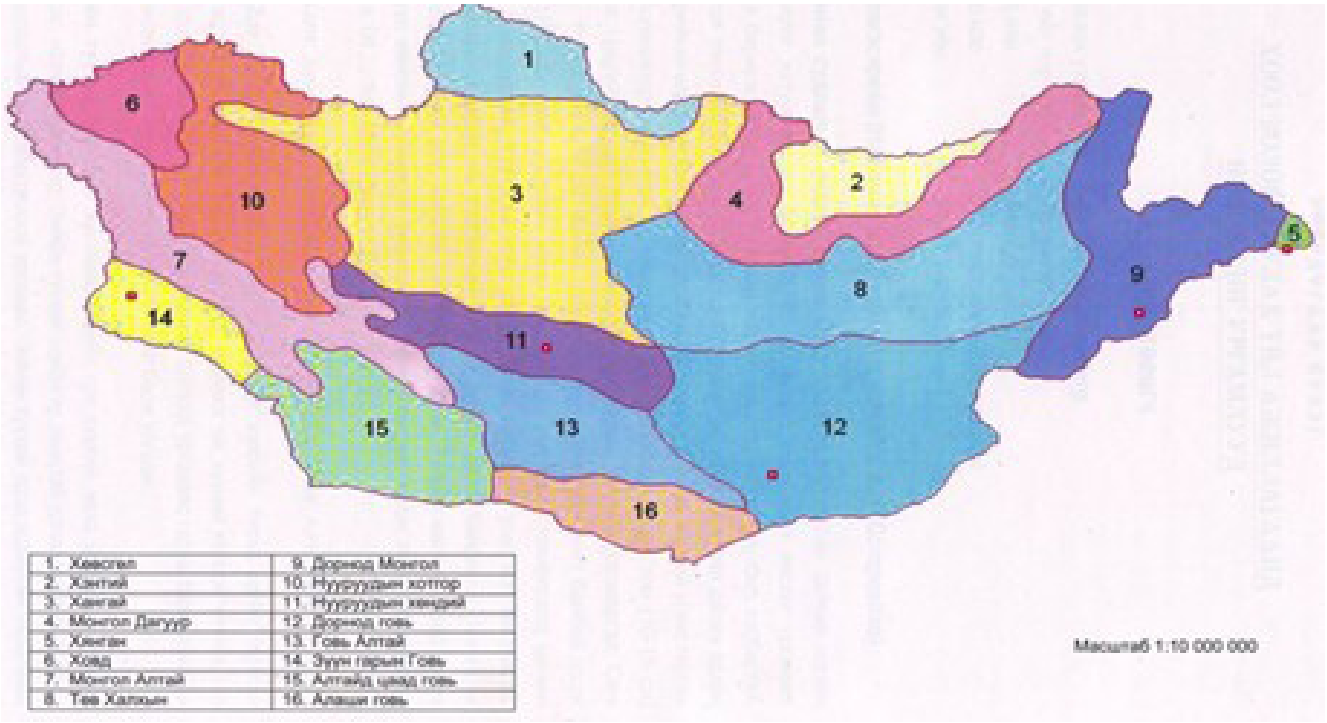

Figure 1. Distribution of the *Polygonum aviculare (*L.)

MATERIALS AND METHODS

Plant material

The aerial parts of *Polygonum aviculare (L.)* were collected from Gachuurt village, Ulaanbaatar city in August 2019 and used in the experiment.

Animals

Animal experiments were conducted with the approval of the "Ethical Review Board for the Use of Animals in Experiments" MEBUS 21/01/04.

Experimental methods

Determination of Vitamin C

The vitamin C content of the samples of the *Polygonum aviculare (L.) plant* was determined by titration[7].

Method of hemostasis

The hemostatic test was carried out according to the method of W.W. Duke (1910). 18-20 g, six mice (Balb/C) were selected and divided into two groups: experimental and controls. The mice in the experimental group were administered a 1% solution of the extract of *Polygonum aviculare (L.)* at a dose of 60 mg/kg for three consecutive days. Three days after drug administration, the tail of the mouse was cut 0.5 cm, the time was recorded on filter paper and the time (sec) when bleeding stopped was recorded.

Determine the activated recalcification time

In order to study the process of fibrin formation, the activated recalcification time was determined by the method of U.Bergerhof and L.Rock, modified version (1984) at the Laboratory of Blood Coagulation Research of the Sechenov Moscow Medical Academy.

Determination the amount of fibrinogen

To determine the amount of fibrinogen, we selected 6 mice and administered the drug in the above manner. Then, the blood of the mice was taken and the amount of fibrinogen was determined using the method of A.Rutberg (1961), which involves adding a 5% solution of calcium chloride to the plasma and measuring the formation of fibrin.

Determination of serum heparin resistance

The heparin resistance of serum is the ability of the serum to provide anticoagulant activity against 1 unit/ml of heparin. We obtained the results using the method of Gormes (1959).

In this study, six mice were selected and divided into an experimental group was given 1% solution of *Polygonum aviculare (L.*) extract at a dose of 60 mg/kg for three consecutive days, and the control group was given distilled water.

Uterine contraction properties

Approximately 20 days pregnant mice were injected into the femoral vein with 120 mg/kg of the solution and observe for 8-14 hours.

RESULTS

Vitamin C content in the aerial parts was determined by titration and found to be 3.76 mg/g.

Table 1. Vitamin C content determination results, mg/g

	The name of the sample	Vitamin C
1	*Polygonum aviculare.L* 1.1	3.61
2	*Polygonum aviculare.L* 1.2	3.92
3	Average	3.76

Results of the study of hemostasis

The hemostatic effect of the extract of *Polygonum aviculare* (L.) was evaluated, with its LD_{50} found to be reduced by 100-fold.

Table 2. Results of hemostasis

№	Control group	*Polygonum aviculare (L.)* extract was administered at a dose of 60 mg/kg	P
	time, sec		
1	900	421	< 0.001
2	900	362	< 0.001
3	1200	562	< 0.001
Sum	3000	1345	< 0.001
Average	1000	448.3	< 0.001

The table shows that the bleeding time from the tails of treated mice was reduced by half compared to the control group (Table 2).

Table 3. Serum heparin resistance

№	Control group	*Polygonum aviculare (L.)* extract was administered at a dose of 60 mg/kg	P
	time, sec		
1	900	601	< 0.005
2	1020	700	< 0.005
3	960	779	< 0.010
Sum	2880	2080	< 0.001
Average	960	693.3	< 0.005

The table shows that the fibrinogen formation time in the blood of mice in the experimental group was shortened, and this indicator to differed from that of the control.

Table 4. Results of fibrinogen amounts

№	Control group	*Polygonum aviculare (L.)* extract was administered at a dose of 60 mg/kg	P
	time, sec		
1	0.01	0.02	< 0.025
2	0.012	0.015	> 0.100
3	0.01	0.016	< 0.050
Sum	0.032	0.051	< 0.050
Average	0.010	0.017	> 0.100

The table indicates that the extract of *Polygonum aviculare (L.)* increases the amount of fibrinogen in the blood.

Table 5. Results of activated recalcification time

№	Control group	*Polygonum aviculare (L.)* extract was administered at a dose of 60 mg/kg	P
	time, sec		
1	1800	640	< 0.001
2	1600	670	< 0.001
3	1800	560	< 0.001
Sum	5200	1870	< 0.001
Average	1733	623.6	< 0.001

The tables show that adding kaolin and calcium solutions to platelet-rich plasma accelerates the clotting time, or fibrin formation time.

Figure 2. The Results of the uterine contraction properties
A. Experimental group B. Control group

Uterine contractions and miscarriage, accompanied by internal bleeding, were observed-indicating that the extract has a strong uterotonic effect.

DISCUSSION

Vitamin C, or ascorbic acid, is one of the essential vitamins in the human body that improves protein and other metabolism in organs, blood clotting, and tissue regeneration. Vitamin C not only activates the immune system, but also stimulates the synthesis of interferon, which is able to stop the inhibitory effects on viral proliferation, and inhibits the pathogenesis of allergies.

Polygonum aviculare (L.) is widely used in traditional folk medicine due to the plant's content of tannins, saponins, flavonoids, alkaloids, and sesquiterpenes[3]. Phytochemical studies have shown that the plant contains 3% of the active ingredient, as well as 1.48-1.97% of the flavonoids avicularin, quercetin, isorhamnetin, myricetin, kaempferol, luteolin, 520 mg/g of vitamin C, and 46.7% of carotene. Studies by foreign scientists have shown that *Polygonum aviculare (L.)* has hemostatic, diuretic, stone-removing, anti-inflammatory, anti-allergic, blood pressure-lowering, antibacterial, and uterine-contracting properties[4]. The aerial parts of the *Polygonum aviculare (L.*) have been found to have no acute toxicity and a strong diuretic[1]. *Polygonum aviculare (L.*) dry extract significantly reduced the duration and extent of bleeding in rats. It increases the number of platelets and their functional activity. It is consistent with the results of studies that strengthen the capillary wall[2]. *Polygonum aviculare (L.)* extract and quercetin attenuate contraction in airway smooth muscle[9]. Quercetin is consistent with its effects on uterine smooth muscle contractility[10].

Conclusion

1. The plant contains vitamin C, which improves blood clotting, prevents bleeding, and reduces the permeability of vascular walls.
2. ***Polygonum aviculare (*** **L.)** reduces heparin tolerance, shortens recalcification time, and increases the amount of fibrin in the blood, indicating that it has the effect of activating the blood coagulation system.
3. It was determined that the ***Polygonum aviculare (*** **L.)** has hemostatic and astringent properties.

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