

Effects of Yibei multi-active elements on mesenteric microcirculation in rats

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Mytilus edulis linnaeus (Yibei) belongs to mytilide, gill lamella, and mollusc. There are rich resources in Bohai and Huanghai of China. Yibei multi-active elements (YBMAE)^[1] come from *mytilus edulis linnaeus* containing taurine, EPA, Zn, Ci, Ferris, etc. Its preparation and composition were described previously^[2]. This paper aims at studying the effect of YBMAE on the mesenteric microcirculation in rats.

MATERIALS AND METHODS

Materials

YBMAE was provided by the Department of Pharmacology, Medical College of Qingdao University. Sterile amniotic fluid and Panax Notoginsenosidum (PNS) were obtained from Taishan Medical College. Wistar rats were purchased from the Animal Center of Shandong Medical University. The microcirculation monitoring system was product of Xuzhou Optic Instrument Factory, China.

Methods

Thirty Wistar rats (male or female, weighing 300g±50g) were divided into 5 groups: YBMAE group I (1.2g/kg), group II (3g/kg), group III (6g/kg), PNS group (40mg/kg) and control group (with saline). Each group consisted of 6 rats. The drugs were givenig qd for 28 days^[3-5]. Thirty minutes after the last administration of drugs, the rats were anaesthetized with vinbarbitol 50mg/kg

ip. A 2-cm incision was made on the abdominal wall. The blood color, flow velocity and vessel wall clarity of tertiary blood vessels were observed, meanwhile blood flow and flow velocity were monitored with microcirculation monitoring system. Sterile amniotic fluid (1ml/kg) was given intravenously. The above-mentioned indexes were monitored and video recorded immediately 10 and 30min after amniotic fluid injection.

Statistical analysis Student's *t* test was used for the statistical study.

RESULTS

Effect of YBMAE on blood flow of Wistar rat mesenteric microcirculation

Immediately, 10min and 30min after amniotic fluid injection, blood flow of the control group was decreased significantly ($P<0.05$, $P<0.01$, $P<0.01$), while the blood flow of YBMAE groups I and II showed no obvious changes compared with that before amniotic fluid injection, but more significant changes than that of the control groups ($P<0.05$, $P<0.01$). In YBMAE group III, the blood flow at 10min was lower than that before amniotic fluid injection ($P<0.05$), significantly higher at 30min than the control group ($P<0.01$). In PNS group, the blood flow had no obvious changes immediately and 10min after amniotic fluid injection, and increased at 30min ($P<0.01$), being significantly different compared with the control group ($P<0.05$, $P<0.01$) (Table 1).

Effect of YBMAE on blood flow velocity of rat mesenteric microcirculation

The blood flow velocity was greatly decreased immediately, 10min and 30min after amniotic fluid injection in the control group ($P<0.05$, $P<0.01$), while in the YBMAE group I, there was little change in the blood flow velocity, but greater than that of the control group ($P<0.05$, $P<0.01$). In YBMAE group II, right after amniotic injection, the velocity was significantly decreased ($P<0.05$), but still faster than that of the control group. At 10min, 30min, the velocity was increased, but not faster than that before amniotic injection. In YBMAE group III, the velocity was decreased

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immediately and 10min after injection ($P<0.05$), and increased at 30min, which was significantly faster than that of the control group at any time ($P<0.05$, 0.01). In PNS group, the velocity had no obvious changes after injection, but significantly faster than the control group ($P<0.05$) (Table 2).

Effect of YBMAE on microcirculation status, blood color and vessel wall clarity of rat mesentery

The microcirculation condition of the control group changed from linear to linear granular flow after

amniotic fluid injection. At 30min, 90% of the vessels turned to linear granular flow, the blood color was dark red, the vessel wall was not clear, and there was stasis in the venous blood. At 12 h, 50% of the animals died. In the three YBMAE groups and PNS group, 40%, 10%, 0% and 0% vessels had linear granular flow after amniotic fluid injection. The blood color changed from bright red to dark red in about 30%, 20%, 20%, 10% vessels respectively. Thirty minutes later, it returned to normal, and the vessel walls became clear. No animals died within 12 h.

Table 1 Effect of the drugs on blood flow ($\mu\text{m}^3 \cdot \text{s}^{-1}$) of mesenteric microcirculation in rats ($\bar{x} \pm s$)

Groups	Dosage (g/kg)	n	Before amniotic fluid injection	After amniotic fluid injection		
				Immediately	10min	30min
NS			6616±91.79	432±132.68 ^a	358±64.32 ^b	348±84.30 ^b
YBMAE	1.2	6	576±67.41	545±105.47	593±70.63 ^d	560±57.12 ^d
	3.0	6	560±57.88	450±86.49	561±77.96 ^c	588±50.75 ^d
	6.0	6	733±100.76	602±99.26	578±93.03 ^{ac}	665±73.12 ^d
PNS	0.04	6	586±60.58	616±67.34 ^c	638±55.11 ^d	766±60.40 ^{bd}

Compared with before amniotic fluid injection, ^a $P<0.05$, ^b $P<0.01$; compared with NS, ^c $P<0.05$, ^d $P<0.01$.

Table 2 Effect of the drugs on the blood flow velocity of rat mesenteric microcirculation ($\bar{x} \pm s$)

Groups	Dosage (g/kg)	n	Before amniotic fluid injection	After amniotic fluid injection		
				Immediately	10min	30min
NS			60.51±0.10	0.35±0.05 ^a	0.32±0.10 ^a	0.32±0.08 ^a
YBMAE	1.2	6	0.56±0.05	0.52±0.07 ^c	0.49±0.07 ^c	0.55±0.05 ^d
	3.0	6	0.54±0.05	0.45±0.07 ^a	0.53±0.07 ^d	0.55±0.04 ^d
	6.0	6	0.64±0.06	0.48±0.08 ^a	0.49±0.08 ^{ac}	0.59±0.06 ^d
PNS	0.0	6	0.50±0.07	0.45±0.06	0.49±0.06 ^c	0.52±0.07 ^c

Compared with before amniotic fluid injection, ^a $P<0.05$, ^b $P<0.01$; compared with NS, ^c $P<0.05$, ^d $P<0.01$.

DISCUSSION

Recent studies showed that the flow velocity, blood flow, flow status, the agglutination ability of platelet and red blood cell, the amount of opening capillary were important factors determining the functional status of the flow velocity, improve the blood flow status, the blood color, the vessel wall clarity, increased the amount of opening capillaries^[6]. The results of this study demonstrated that YBMAE could increase the blood flow, and could improve the microcirculation status. The increment of flow velocity and blood flow were proportional to the amount of YBMAE before and 30min after amniotic fluid injection. According to the literature, taurine could regulate Ca^{++} metabolism and prevent arterial atherosclerosis^[7]. EPA could inhibit the blood vessel constriction induced by norepinephrine, and vasoconstrictin A2 and increase elasticity of RBC, decrease the blood

viscosity and synthesis of TXA_2 ^[8]. YBMAE contains plenty of taurine, EPA, amino acid and unsaturated lipid acid, therefore the effect of YBMAE in improving microcirculation may be related to its components.

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