

Acute Effects of Korean Earthworm(*Lamnodrilus gotai* Hatai) Juice on Blood Pressure and Spontaneous Motor Activity in Spontaneously Hypertensive Rats

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Abstract—We investigated the effects of single administration of Korean earthworm (*Lamnodrilus gotai* Hatai) juice (KEJ) on blood pressure and spontaneous motor activity in spontaneously hypertensive rats (SHR) and normotensive Wistar-Kyoto rats. We report that KEJ lowered blood pressure and spontaneous motor activity in SHR.

Keywords—Korean earthworm(*Lamnodrilus gotai* Hatai) juice • blood pressure • spontaneous motor activity • spontaneously hypertensive rats

Earthworm has been reported to have various pharmacological activities including antitumor¹⁾, antipyretic²⁾, antiinflammatory³⁾ effects, and hepatoprotective effect against carbon-tetrachloride-induced hepatotoxicity⁴⁾. Additionally, earthworm is listed in the "Directory of Chinese Materia Medica"⁵⁾ as an agent known to have hypotensive and sedative actions.

In this study we investigated the effects of single administration of Korean earthworm (*Lamnodrilus gotai* Hatai) juice(KEJ) on blood pressure and spontaneous motor activity in spontaneously hypertensive rats (SHR) and normotensive Wistar-Kyoto (WKY) rats. We report that KEJ lowered blood pressure and spontaneous motor activity in SHR.

Experimental

Earthworm juice preparation—Korean earthworm (*Lamnodrilus gotai* Hatai) juice(KEJ) was provided from an earthworm-raising farm (Waegwan, Korea). The procedure of earthworm

juice preparation was heating (120°C, 3 hr) of 4-month old *Lamnodrilus gotai* Hatai fed on bovine feces(breeding condition: moisture 80%, temperature 15~25°C) in a pressure cooker, followed by filtering through a cotton layer. The yield of KEJ was about 500 ml per 1 kg of earthworms. KEJ was stored frozen at -20°C until experiment.

Animals—Fourteen to 16-week old male SHR (Hallym University Laboratory Animal Center) and age-matched male WKY rats (National Institute of Safty Research, Korea), weighing 200~300 g, were used.

Measurements of blood pressure—After 3 days of training period, tail blood pressure was monitored using a microprocessor controlled tail-cuff plethysmograph (Rhema-Labortechnik, Karl Kolb Co., Germany). Rats were heated placed in the restrainer with a tail cuff appiled and allowed to adapt for at least 20 minutes in thermo-controlled box (37°C) prior to recording and/or until tail pulse pressures were perceptible. Mean of 5 consecutively measured BP levels was

obtained. Immediately following the first measurement of BP, KEJ or saline was injected intraperitoneally to conscious SHR and WKY rats. One and 3 hr after the injection of KEJ, BP was monitored repeatedly.

Measurements of spontaneous motor activity—Spontaneous motor activity of a group of 4 rats was measured in a cage (40×35×18 cm) using an automatic activity recording device (Rhema-Labortechnik, Karl Kolb Co., Germany) at 09:00~13:00 under light conditions. Immediately following injection of KEJ or saline, rats were placed in the cage (a group of 4 rats in a cage) and spontaneous motor activity was recorded at 5 min intervals for 180 min.

Statistical analysis—Data are means \pm S.E. M. and were analyzed by Student's *t*-test. $p < 0.05$ was considered significant.

Results and Discussion

The systolic blood pressure (evaluated indirectly) was elevated in SHR relative to WKY rats (199 \pm 4 vs 139 \pm 3 mm Hg; $p < 0.001$). The pulse rate was also elevated in SHR relative to WKY rats (381 \pm 5 vs 327 \pm 10 per min; $p < 0.001$). KEJ (1.25 ml/kg, i.p.) exerted no effect on blood pressure. But KEJ (1.25 ml/kg, i.p.) caused a

slight but significant reduction ($p < 0.05$) in pulse rate in SHR at 3 hr following injection (Table I). Higher dose of KEJ (2.5 ml/kg, i.p.) produced a 15% reduction in blood pressure ($p < 0.05$) at 1 hr following injection with no decrease in pulse rate in SHR (Table I). In contrast, the same dose of KEJ had no effect on either blood pressure or pulse rate in the WKY rats (Table I). Additionally, it was noted that KEJ-treated SHR were much more docile than saline-treated SHR when they were placed in the restrainer for tail blood pressure recording.

Spontaneous motor activity of SHR was greater than that of WKY rats (2396 \pm 279 counts/3 hr vs 816 \pm 121 counts/3 hr; $p < 0.001$). Single intraperitoneal injection of KEJ (2.5 ml/kg) lowered total activity in 180 min (2396 \pm 279 counts/3 hr vs 1401 \pm 132 counts/3 hr; $p < 0.01$) and specifically lowered the periodic peaks of motor activity upto 3 hr in SHR (Fig. 1). In contrast, the same dose of KEJ had no significant effect on spontaneous motor activity in the WKY rats (816 \pm 121 counts/3 hr vs 1467 \pm 319 counts/3 hr).

In the present experiments, KEJ lowered both blood pressure and spontaneous motor activity in SHR with no effect in WKY rats at the dose of 2.5 ml/kg. The inhibitory effect of KEJ on

Table I. Effects of Korean earthworm juice (KEJ) on systolic blood pressure and pulse rate in SHR and WKY rats

Groups	Time after injection(hr)		
	0	1	3
SHR			
Saline	193 \pm 9(368 \pm 9)	196 \pm 10(372 \pm 10)	198 \pm 8(408 \pm 18)
KEJ(1.25 ml/kg)	196 \pm 7(408 \pm 10)	185 \pm 5(386 \pm 14)	197 \pm 8(373 \pm 9*)
KEJ(2.50 ml/kg)	207 \pm 10(366 \pm 12)	177 \pm 7*(367 \pm 12)	186 \pm 5(364 \pm 6)
WKY			
Saline	137 \pm 2(315 \pm 5)	141 \pm 6(361 \pm 47)	141 \pm 8(306 \pm 22)
KEJ(2.50 ml/kg)	141 \pm 6(332 \pm 21)	132 \pm 10(308 \pm 13)	145 \pm 8(320 \pm 24)

Figures in parenthesis represent the pulse rate per minute. Each value represents mean \pm SEM (N=4). * $p < 0.05$ compared with 0 hr value.

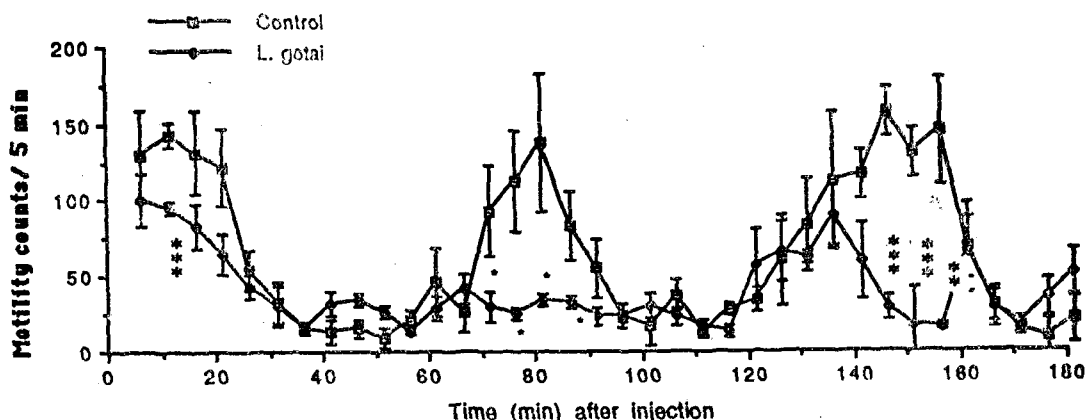


Fig. 1. Effect of Korean earthworm juice (KEJ) on spontaneous motor activity in SHR

Immediately following injection of KEJ (0) or saline (0), rats were placed in the cage (a group of 4 rats in a cage) and spontaneous motor activity was recorded at 5 min intervals for 180 min. Each point represents mean \pm S.E.M. (N=4). Significant difference was noted at 70, 75, 80, 85, 140 ($p < 0.05$), 155 ($p < 0.01$), 10, 145, 150 ($p < 0.001$) minutes after KEJ injection.

spontaneous motor activity was more profound and more prolonged than its effect on blood pressure, suggesting that its sedative action is more prominent than its hypotensive action. In a separate experiment, a decrease in plasma concentrations of norepinephrine was noted when a water extract of freeze-dried *Lamnodrilus gotai* Hatai was administered to SHR, reflecting the decrease in sympathetic tone (unpublished observation). So it is tempting to speculate that KEJ lowered blood pressure in SHR by decreasing sympathetic outflow from the central nervous system. But, it is uncertain that the hypotensive activity of KEJ can be separable from its sedative activity. Further studies are warranted to clarify the exact molecular nature of active agent(s) and the mechanisms of these actions.

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