HYPERTONIC SALINE INJECTION ACTIVATES HEAT ESCAPE/COLD SEEKING BEHAVIOR VIA CENTRAL V_1-RECEPTOR IN RATS

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Hypertonic saline injection activated heat escape/cold seeking behavior in rats (Nagashima *et al.*, 2001), although the mechanism is still obscure. We speculate that arginine vasopressin (AVP) is involved in the mechanism via V_1-receptors in the brain. Therefore, we tested the hypothesis that a cerebroventricular administration of V_1-receptor antagonist attenuated heat escape/cold seeking behavior in rats. A biotelemetry device ($15 \times 30 \times 8$mm) for a core temperature (Tcore) measurement was placed in the abdominal cavity for each rat (male crj-Wistar rats, n = 14, body weight 350 ± 5 g (means ± SE)) under intraperitoneal anesthesia with sodium pentobarbital (5 mg/100 g•body wt), and a chronic cannula for a vehicle injection to the right lateral ventricle was implated. In addition, the major salivary glands were removed to minimize evaporative heat loss. After a two-week recovery, rats were trained an operant behavior three times: Each rat was placed in an experimental box ($50 \times 10 \times 30$cm) in the heat of 40°C, and rats could get a cold air reward of 0°C for 30 s when moved in the specific area of the box. The rats learned moving periodically in and out the area to get the cold-air reward. At least 4 days after the training session, either 400 pmol/μl/100g•body wt V_1-antagonist, [beta-mercapto-beta, beta-cyclopenta-methylenepropionyl^1, O-Me-Tyr^2, Arg^8]-vasopressin, or the same amount of normal saline was injected via the ventricular cannula (ANT(+) and ANT(-), respectively). Thirty minutes after the ventricular injection, either hypertonic (2500 mM, HS) or normal saline (154 mM, NS) of 1 ml/100 g•body wt was subcutaneously injected. Then, the rats was placed in the operant system kept at 26°C until Tcore was stabilized, and exposed to 40°C heat for another 2 h. The same experiment was repeated by injecting another tonicity of saline for the same rat with a one-week interval. Baseline Tcore was lower in ANT(-)/HS group than ANT(-)/NS group ($P<0.05$, 36.5 ± 0.2 and 37.4 ± 0.1°C). In contrast, the Tcore was higher ($P<0.05$) in ANT(+)/HS group (37.4 ± 0.1°C) than ANT(-)/HS group. At the end of 2-h heat exposure in the operant system, Tcore was similar between ANT(-)/HS and ANT(-)/NS (37.5 ± 0.2 and 37.6 ± 0.1°C) with greater number of the operant behaviors ($P<0.05$, 57 ± 4 and 41 ± 2). Moreover, Tcore in ANT(+)/HS group (38.5 ± 0.2°C) was higher ($P<0.05$) than ANT(-) /HS group with less number of the operant behaviors ($P<0.05$, 42 ± 2). There was no difference in Tcore and the operant behaviors between ANT(-)/NS and ANT(+)/NS group (37.6 ± 0.2°C, 40± 2). From these results, hypertonic saline injection activates heat escape/cold seeking behavior. Further, central AVP is involved in the mechanism for the activation of behavior via central V_1-receptors. We surmize that the activation of heat escape/cold seeking behavior is one of heat-defense mechanisms especially in dehydrated condition.

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