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BRIEF COMMUNICATION

Food Aversions: Taste Reactivity Responses Elicited by Lithium-Paired Food

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PARKER, L. AND K. JENSEN. *Food aversions: Taste reactivity responses elicited by lithium-paired food.* PHARMACOL BIOCHEM BEHAV **41**(1) 239–240, 1992.—The taste reactivity (TR) test was employed to measure the orofacial, somatic and consummatory CRs elicited by a lithium-paired food. Hungry rats were presented chocolate chips followed immediately by an injection of lithium chloride (CS+ group) or saline (CSc group). During the TR test, the rats' behavioral responses to the chocolate chips were videorecorded. The results demonstrated that rats in the CS+ group did not consume the lithium-paired food, but demonstrated the aversive TR response pattern of chin rubbing, paw treading, and gaping.

Taste reactivity test Conditioned food aversions Conditioned flavor aversions Conditioned taste aversions
Classical conditioning Behavioral CRs Lithium Psychopharmacology Conditioned drug effects

ALTHOUGH most conditioned taste avoidance (CTA) studies involve conditioned fluid rather than conditioned food aversions, Bernstein and her colleagues (1,2) have presented evidence that conditioned food aversions may be even more potent than conditioned fluid aversions. Unlike conditioned fluid aversions, conditioned food aversions are resistant to interference from novel tastes presented during conditioning trials. Garcia and his colleagues [e.g., (4)] argue that after having been paired with an emetic agent such as lithium chloride, the taste of food becomes aversive; this hedonic shift in the palatability of food then motivates the avoidance of consumption of the food.

The exclusive test employed to measure conditioned food aversions has been the consumption test, yet this test is only an indirect measure of the palatability of food. A more direct test of a conditioned aversion to the flavor of food is the Taste Reactivity (TR) test devised by Grill and Norgren (4) to measure the aversiveness of a flavored solution. Grill and Norgren (5) have demonstrated that a lithium-paired flavored solution elicits a distinctive pattern of aversive responses that includes chin rubbing, paw treading and gaping; this pattern resembles that elicited by an unconditionally aversive tasting bitter quinine solution. On the other hand, highly palatable tasting solutions, such as sucrose, elicit a pattern of ingestive responses characterized by tongue protrusions, paw licking, and mouth movements [e.g., (3)]. The following experiment was conducted to determine whether a palatability shift mediates a conditioned food aversion as it has been demonstrated to mediate an aversion to a flavored solution [e.g., (5,6)]. In the following experiment, the TR responses elicited by a food (chocolate chips) paired with lithium chloride were measured.

METHOD

Sixteen male Sprague-Dawley rats (229–262 g) were housed in individual stainless steel cages and maintained on ad lib Purina rat chow and water except as indicated. One week after their arrival in the laboratory, the rats were deprived of food for twenty-four h. They were then assigned to either a CS+ (n=8) or a CSc (n=8) group. On the conditioning day, all rats were given 5 g of Hershey's semi-sweet chocolate chips on a Plexiglas floor placed on the bottom of their cages. Fifteen min later, the chocolate chips were removed and weighed and the rats were injected with 127.2 mg/kg of 0.15 M lithium chloride in solution with distilled water (20 ml/kg) or with 20 ml/kg of physiological saline solution. The rat chow was replaced two h after the conditioning trial. On the following day, each rat in the CSc group received an injection of 127.2 mg/kg lithium chloride solution (20 ml/kg) and each rat in the CS+ group received a 20 ml/kg injection of physiological saline solution, but these injections were not paired with the chocolate chips. All injections were administered intraperitoneally (IP).

The test trial occurred six days after the conditioning trial. The rats were deprived of food for 24 h and were then given the Taste Reactivity (TR) test. Each rat was placed in a glass test chamber (22.5 × 26 × 20 cm) with a Plexiglas ceiling which was located in a testing room. A Hitachi (HV-62) videocamera was focussed on a mirror located at an angle below the chamber to facilitate viewing the rat's ventral surface. The image of the rat was transmitted through a Sony videocassette recorder to a 17 in. Electrohome monitor. Each rat was placed in the chamber for 5 min before 5 g of chocolate chips were scattered on the

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floor of the chamber. The rat's orofacial and somatic responses were videotaped during the next 5-min period. Immediately following the recording period, the rat was returned to its home cage and the remaining chocolate chips in the chamber were weighed. The videotapes were later scored by a rater unaware of assignment to group according to the categories previously described by Grill and Norgren (5). The aversive TR behaviors included chin rubbing (mouth in direct contact with the floor or wall and projecting the body forward), gaping (rapid large amplitude opening of the mandible with concomitant retraction of the corners of the mouth), and paw treading (sequential extension of the one forelimb forward against the floor with the other fore limb is being retracted), and were measured as frequency scores. The ingestive TR behaviors included tongue protrusion (protrusions of the tongue on the midline or either side of the mouth), paw licking (licking the forelimb paws while they are held close to the mouth), and mouth movements (low amplitude, rhythmic movement of the mandible), and were measured in terms of duration (s). Additionally, bouts of eating (frequency of oral contacts with food) and the amount (g) of food consumed were measured. The group means were statistically compared by means of *t*-tests with the criterion level established to control for experiment-wise error ($p<0.01$).

RESULTS

Table 1 presents the score and standard error of the mean for the CS+ and CSc groups. The CS+ group showed more aversive TR responses, $t(14)=2.72$, $p<0.01$, than did the CSc group. On the other hand, the CSc group showed more frequent eating bouts, $t(14)=4.04$, $p<0.01$, and consumed more chocolate chips, $t(14)=3.74$, $p<0.01$, than did the CS+ group. In fact, only two of the rats in the CS+ group made any oral contact with the chocolate chips and none of the rats in the CS+ group consumed any of the chocolate chips as measured to the nearest 0.1 g. The groups did not significantly differ in terms of the amount of time spent displaying ingestive responding.

TABLE 1

MEAN SCORE FOR THE CS+ GROUP AND THE CSc GROUP DURING THE TR TEST

Behavioral Category	CS+ Group Mean ± sem	CSc Group Mean ± sem
Aversive TR Responses (freq)*	7.4 ± 2.5	0.8 ± 0.4
Ingestive TR Responses (s)	9.7 ± 4.4	0.5 ± 0.2
Eating Bouts (freq)*	0.5 ± 0.7	5.6 ± 0.8
Amount Consumed (g)*	0.0 ± 0.0	1.4 ± 0.3

*$p<0.01$.

DISCUSSION

The pattern of orofacial and somatic responses elicited by lithium-paired food is similar to that elicited by lithium-paired fluid in terms of the aversive TR responses of chin rubbing, gaping and paw treading described by Grill and Norgren (4). On the other hand, the CSc group did not display more ingestive response while consuming the chocolate chips than did the CS+ group, as would be expected from the literature on conditioned fluid aversions [e.g., (3, 5, 6)]. Interestingly, the behavioral pattern observed in the CS+ group occurred independently of significant gustatory stimulation, because no rat in the CS+ group ate the chocolate chips (although two CS+ rats made oral contact with the chocolate chips for a brief period of time). The odor and/or visual stimulation provided by the chocolate chips may have been to be sufficient to elicit the pattern of rejection responses.

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