

Taste preference behavior in Long-Evans rats and Egyptian spiny mice

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Taste preferences for representatives of the four taste qualities and the taste of MSG were assessed for Long-Evans rats (*Rattus norvegicus*) and Egyptian spiny mice (*Acomys cahirinus*). The rats preferred hedonic concentrations of all salty and sweet tastants, as well as the taste of MSG, and rejected sour and bitter tastants. The spiny mice preferred water to salty tastants, approached some concentrations of sweet tastants, and rejected all others—including those readily ingested by rats.

In a prior report, we described noteworthy differences in water intake following acute water deprivation between Long-Evans rats and Egyptian spiny mice, as well as in preference behavior for NaCl and MSG, but not for sucrose and KCl, following treatment with furosemide (Kolodiy, N., Brosvic, G. M., Bailey, S., Hawley, K., Pak, D., & Ostrich, S., 1993). Water consumption for spiny mice was nominally influenced by water deprivation, whereas for rats, consumption was significantly and monotonically related to the length of water deprivation. During furosemide challenge (a sodium-depleting drug), rats increased their NaCl and MSG intake as a function of furosemide dose, whereas sodium-salt intake for spiny mice, except at the strongest dose, was relatively unaffected by furosemide.

In part, these differences can be attributed to the spiny mouse's biological processes, by which urine formation and vascular permeability are decreased and evaporative water loss is minimized—regulatory abilities typical of animals inhabiting arid environments (Brunjes, 1990). Although relatively little is known about the feeding behavior of spiny mice, ingestive behavior has been shown to be influenced by naloxone (Czech, 1987) and insulin (Czech, 1988) but not by acute hyperglycemia induced by 2-deoxyglucose (Czech, 1988). Similarly, although the roles of audition, olfaction, and vision in the spiny mouse's prey-catching behavior have been examined (Brunjes, 1990), relatively little is known about the role of taste in the spiny mouse's behavior.

Beginning with the initial observations of Harriman (1980), spiny mice have been reported to demonstrate preferences for tastes described as sweet (e.g., sucrose, maltose, lactose, glucose, and fructose) but not for those described as sour (HCl and citric acid) or salty (NaCl, KCl, and MgSO₄). The etiology of the spiny mouse's taste

behavior is unknown although, unlike several desert species, it appears to be responsive to the consequences of ingestion (see Etscorn, 1977). In the present study, the taste preferences of Long-Evans rats and Egyptian spiny mice were compared using representatives of the four basic tastes as well as the taste of MSG.

METHOD

Subjects

Ten adult male and 10 adult female inbred Long-Evans hooded rats (*Rattus norvegicus*) and an equal number of inbred Egyptian spiny mice (*Acomys cahirinus*) served as subjects. The animals were housed in pairs in stainless steel cages with ad-lib access to Purina Lab Chow in a temperature- and humidity-controlled vivarium with houselights on between 0700 and 1900 h.

Procedure

Taste preferences for NaCl, KCl, MSG, sucrose, maltose, and urea were examined at concentrations ranging from 1×10^{-2} to 4×10^{-1} M. Taste preferences for quinine sulfate, citric acid, and HCl acid were at concentrations ranging from 5×10^{-3} to 5×10^{-3} M.

Taste preferences were examined in separate 2-h test sessions, in which animals were presented with two bottles—one containing a tastant dissolved in triple-deionized water, and the other containing only triple-deionized water. Bottle positions were randomized to control for potential position effects. The results of these tests were initially expressed in terms of percent (%) preference according to the following formula: amount of tastant solution (ml) \times 100/total intake of tastant solution and triple-deionized water (ml). They were then transformed to geometric means.

RESULTS

No differences in any dependent measure were observed as a function of sex of subject, so the data were combined across sexes for subsequent analyses (all *ts* < 0.56, all *ps* > .05).

Salty Tastes

Mean preferences for NaCl, MSG, and KCl are presented in Figures 1-3, respectively. As seen in Figure 1, the rat's preference was highest between .05 and .2 M—concentrations that the spiny mice readily rejected. As seen in Figure 2, the rat's preference for MSG was greater

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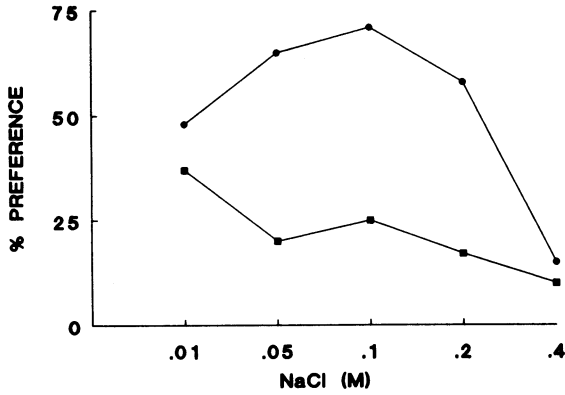


Figure 1. Mean preferences for NaCl for Long-Evans rats (filled circles) and Egyptian spiny mice (filled squares) as a function of NaCl (M) test stimulus.

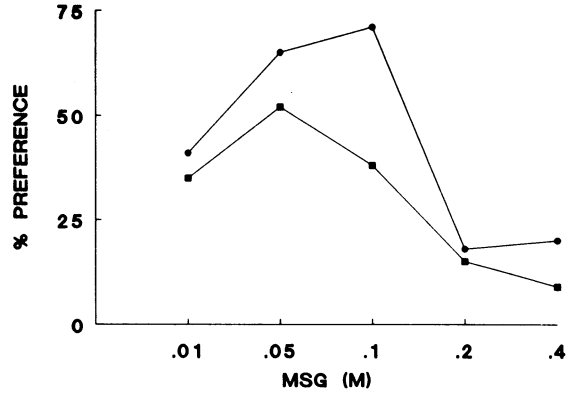


Figure 2. Mean preferences for MSG for Long-Evans rats (filled circles) and Egyptian spiny mice (filled squares) as a function of MSG (M) test stimulus.

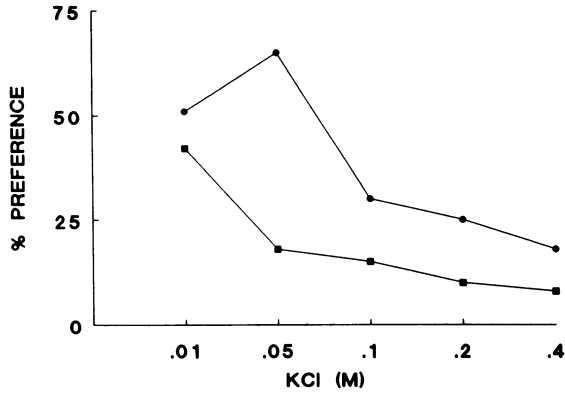


Figure 3. Mean preferences for KCl for Long-Evans rats (filled circles) and Egyptian spiny mice (filled squares) as a function of KCl (M) test stimulus.

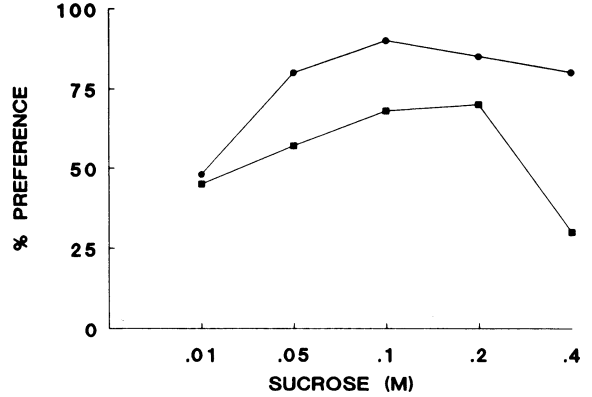


Figure 4. Mean preferences for sucrose for Long-Evans rats (filled circles) and Egyptian spiny mice (filled squares) as a function of sucrose (M) test stimulus.

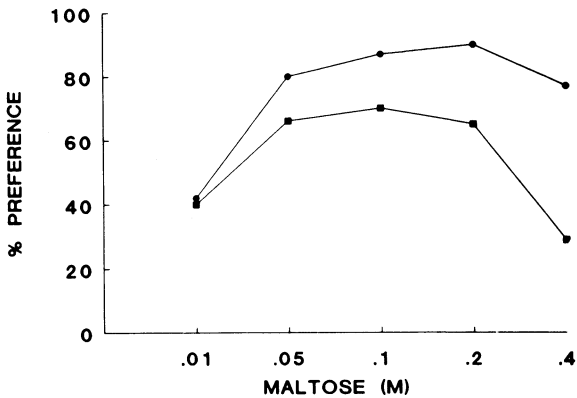


Figure 5. Mean preferences for maltose for Long-Evans rats (filled circles) and Egyptian spiny mice (filled squares) as a function of maltose (M) test stimulus.

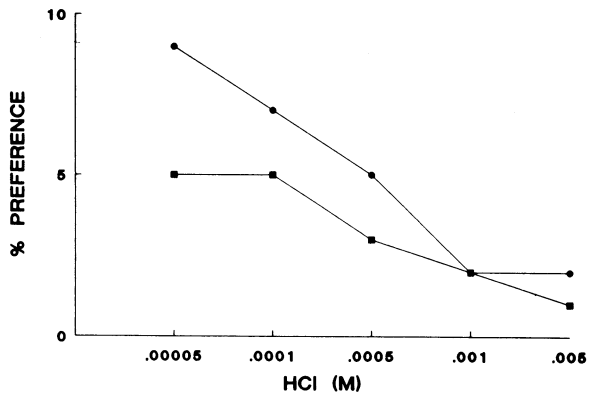


Figure 6. Mean preferences for HCl acid for Long-Evans rats (filled circles) and Egyptian spiny mice (filled squares) as a function of HCl (M) test stimulus.

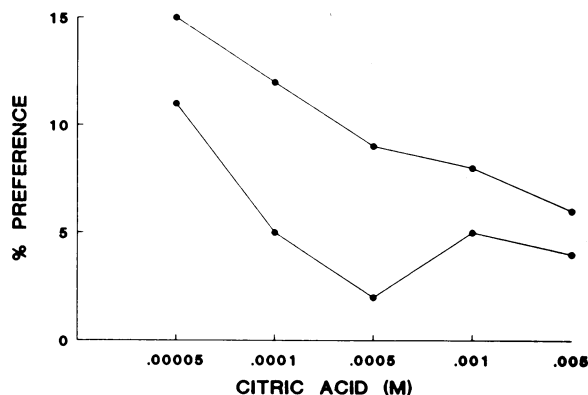


Figure 7. Mean preferences for citric acid for Long-Evans rats (filled circles) and Egyptian spiny mice (filled squares) as a function of citric acid (M) test stimulus.

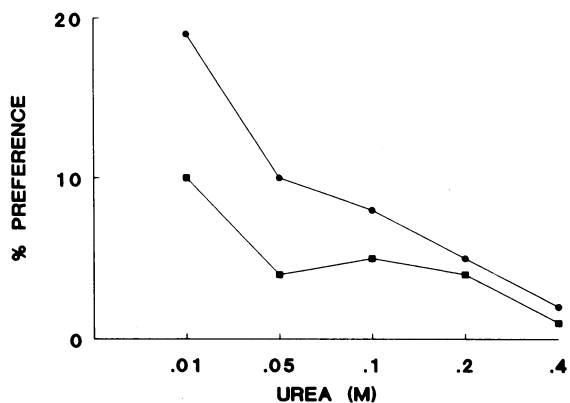


Figure 8. Mean preferences for urea for Long-Evans rats (filled circles) and Egyptian spiny mice (filled squares) as a function of urea (M) test stimulus.

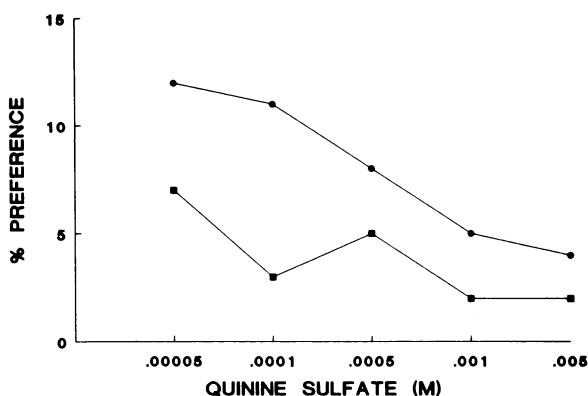


Figure 9. Mean preferences for quinine sulfate for Long-Evans rats (filled circles) and Egyptian spiny mice (filled squares) as a function of quinine sulfate (M) test stimulus.

between .05 and .1 M, whereas the spiny mice rejected MSG at all concentrations except .05 M. The rats preferred KCl at .05 M, whereas the spiny mice rejected KCl independent of test stimulus concentration.

Sweet Tastes

Mean preferences for sucrose and maltose are presented in Figures 4 and 5, respectively. As seen in Figure 4, the rats preferred the .05 to .4 M concentrations, whereas the spiny mice preferred sucrose to water at the .05 to .2 M concentrations. As seen in Figure 5, similar results were observed for maltose.

Sour Tastes

Mean preferences for HCl and citric acid are presented in Figures 6 and 7, respectively, where it can be seen that the rats and spiny mice rejected sour tastants at each concentration presented.

Bitter Tastes

Mean preferences for urea and quinine sulfate are presented in Figures 8 and 9, respectively. As seen in both figures, the rats and spiny mice rejected bitter tastants at each concentration presented.

DISCUSSION

In the present study, preferences for representatives of the four taste qualities and for the taste of MSG were assessed for Long-Evans rats and Egyptian spiny mice. The rats preferred hedonic concentrations of all salty and sweet tastants, as well as the taste of MSG, and rejected sour and bitter tastants. The spiny mice preferred some concentrations of sweet tastants and rejected all others. Preference values observed for the Long-Evans rats in the present study are in agreement with those described previously for control animals (see Catalanotto, 1978, 1979; Catalanotto & Lacy, 1977; Chan & Cote, 1979; Greeley & Gniecko, 1986; McConnell & Henkin, 1974; Zawalich, 1971). Preference values observed for the spiny mice in the present study are also in agreement with those reported by Harriman (1980) and Kolodiy et al. (1993).

Between the two species, the rats preferred hedonic concentrations of all salty and sweet tastants, as well as the taste of MSG, and rejected sour and bitter tastants; the spiny mice preferred water to salty tastants, approached some concentrations of sweet tastants, and rejected all others. It is unlikely that these outcomes are attributable to species-specific differences in the opioid modulation of ingestive behavior, especially because drinking behavior for both species is similarly affected by at least one opiate agonist and antagonist (see also Czech et al., 1984). Similarly, although differences were observed between the two species for normally preferred tastants, there were no differences in the avoidance of normally aversive tastants, suggesting again that the experimental outcomes are not attributable to species-specific differences in illness-induced taste-aversion learning (see Etscorn, 1977). In future studies, it would be of interest to examine a broader range of the feeding and foraging behaviors of spiny mice, as well as to examine potential differences between these two species on the signal detection measures of taste-detection performance commonly used in our laboratory. These studies and others examining conditioned taste-aversion learning and taste generalizations and discriminations are currently under investigation in our laboratory.

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