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Social influences on the amount of food eaten by Norway rats

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A naive observer Norway rat offered a choice between two foods, after it interacts with a demonstrator rat fed one of those foods, increases its preference for whichever food the demonstrator rat ate. It is not known whether interaction with a demonstrator rat would also increase the amount that an observer rat would eat if it were given access only to the food the demonstrator had eaten. In this study, each observer rat interacted with a demonstrator rat fed a food, either familiar or unfamiliar to the observer, and the observer was then offered a weighed sample of the food that the demonstrator had eaten. It was found that, during the first hour of testing, observer rats that had interacted with demonstrators fed an unfamiliar food, increased their intake of that food roughly four-fold. Observer rats that interacted with demonstrator rats fed a familiar food however, did not increase their food intake. Socially enhanced intake of unfamiliar food was seen only during the first hour that observers had access to food and was compensated for during the next 23 h of feeding. This short-term increase in observer intake of unfamiliar foods appeared to result from socially-induced motivation to ingest unfamiliar foods rather than from socially-induced reduction in neophobia.

Introduction

A naive observer Norway rat (*Rattus norvegicus*) offered a choice between two foods after interacting with a conspecific demonstrator fed one of those foods will increase its relative intake of whichever food its demonstrator ate (Chou & Richerson, 1992; Galef & Wigmore, 1983; Posadas-Andrews & Roper, 1983; Richard, Grover & Davis, 1987; Stetter *et al.*, 1995; Strupp & Levitsky, 1984). Such demonstrator influence on observers' food selections is surprisingly robust (Galef, Kennett & Wigmore, 1985) and can reverse not only palatability-based food preferences (Galef, 1986, 1989; Galef & Whiskin, 1998), but also food preferences resulting from learned aversions or sodium appetites (Galef, 1986, Heyes & Durlach, 1990).

In examining the causes and functions of such social effects on the feeding behavior of rodents, investigators have consistently measured changes in the food preferences of observers offered a choice between foods; social influences on intake of a single food have not been examined. As a consequence, it is not known whether social interactions that alter rats' food preferences also alter their food intake.

The present experiments were undertaken to determine whether interaction with a demonstrator rat fed a distinctively flavored food would increase conspecific observers' intake of that food. Because it has been found previously that diet novelty is an important determinant of expression of social influence on food choice (Galef, 1993; Galef & Whiskin, 1994), in Experiment 1, we looked for effects on observers' intake of interaction with demonstrators fed diets either slightly or totally unfamiliar to their respective observers.

Experiment I

This experiment was conducted to determine whether interaction with a demonstrator rat that had eaten either a relatively familiar or a relatively unfamiliar food would increase its observer's subsequent absolute intake of that food.

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Method

Subjects

Sixty experimentally naive, 48-day-old, female, Long-Evans rats obtained from Charles River Canada (St Constant, Quebec) served as observers. An additional 40, 56- to 62-day-old female rats that had served as observers in previous experiments served here as demonstrators.

Subjects were maintained in a single colony room illuminated on a 12 : 12-h light/dark schedule with light onset at 0800h.They had *ad libitum* access to Purina Rodent Laboratory Chow 5001 for at least 7 days before the start of the experiment.

Apparatus

Throughout the experiment, each of the 100 subjects resided in a stainless-steel hanging cage measuring 20 cm × 20 cm × 34 cm. Food was provided in semi-circular, stainless-steel cups (10 cm in diameter and 5 cm deep) filled to only half their depth to prevent spilling.

As described below, some subjects serving as observers were exposed to glass jars (7 cm high × 5·7 cm diameter) with metal screw tops in each of which a hole 3·2 cm in diameter had been cut. This hole was covered with a piece of hardware cloth (0·64-cm grid) allowing subjects to smell and see the food in a jar, but not to taste it. Each jar was filled with food to within 2 cm of its lid.

Diets

Four different diets were used in the experiment: (1) unadulterated, powdered Purina Rodent Laboratory Chow 5001 (Diet Chow; Ralston-Purina Canada, Woodbridge, Ontario); (2) Diet Chow to which 10 g/kg Club House Pure Ground Cinnamon was added (Diet Cin-Chow); (3) Teklad Normal Protein Test Diet (Diet NPT: Teklad Diets, Madison, WI; Catalogue No. TD 170590; in g/kg: 598·2 corn starch, 260·1 casein, 108·1; 80·0 vegetable oil, 40·0, mineral mix; 20·0 cod-liver oil, and 1·8 vitamin mix); and (4) Diet NPT to which 10 g/kg cinnamon (Diet Cin-NPT) was added.

Procedure

The procedure was the same as that used in our previous studies of social influence on food choice (for a review; see Galef, 1988) except that here, during testing for social influence on ingestion (Step 3), each observer was offered a single food to eat rather than two foods to choose between.

Step 1 All 40 demonstrators were placed on a 23-h schedule of food deprivation, and for 1 h on each of 3 consecutive days, equal numbers of demonstrators were given a weighed food cup containing either Diet NPT, Diet Cin-NPT, Diet Chow, or Diet Cin-Chow. At the end of the last of these 1-h feeding periods, each demonstrator's food cup was weighed and the amount that it had eaten was ascertained.

Step 2 Immediately after demonstrators had finished their third scheduled feeding, one demonstrator was placed in the cage of each of 40 observers and a jar filled with either Diet Cin-NPT or Diet Cin-Chow was placed in the cage of each of the remaining 20 observers. Each observer was then left free to interact with its demonstrator or jar for 30 min, before the jar or demonstrator was removed from each observer's cage.

Step 3 A weighed food cup containing Diet Cin-NPT was placed in the cages of observers that had interacted during Step 2 with: (1) a jar containing Diet Cin-NPT; (2) a demonstrator fed Diet Chow; or (3) a demonstrator fed Diet Cin-NPT. At the same time, a weighed food cup containing Diet Cin-Chow was placed in the cages of observers that had interacted with: (1) a jar containing Diet Cin-Chow; (2) a demonstrator fed Diet Cin-Chow; or (3) a demonstrator fed Diet NPT.

Step 4 An experimenter weighed the food cup in each observer's cage 1, 3, 5, 10, and 24 h after it had been placed there.

Results

Demonstrators ate a mean (± 1 *SEM*) of $6{\cdot}2 \pm 0{\cdot}3$ g during the hour before they interacted with their respective observers (Step 2), and there was no difference in the amount eaten by demonstrators fed Diet Cin-Chow and Diet Cin-NPT ($F(3, 37) = 1{\cdot}41$, *NS*).

Data were lost from one observer that urinated in her food cup and from two observers when, because of clogged water bottles, their demonstrators failed to eat on Day 3 of Step 1.

The main results of Experiment 1 are presented in Fig. 1a and b. The figure shows the mean g/h eaten by observers offered the relatively unfamiliar Diet Cin-NPT (Fig. 1a) and the relatively familiar Purina chow-based Diet Cin-Chow (Fig. 1b) during testing (Step 3).

As can be seen in the upper panel of Fig. 1, treatment of demonstrators had a profound influence on their observers' intake of the relatively unfamiliar Diet Cin-NPT (Repeated-measures ANOVA, $F(2, 25) = 12{\cdot}89$, $p < 0{\cdot}0001$). Further, there was a significant hour of testing × group interaction ($F(4, 50) = 12{\cdot}82$, $p < 0{\cdot}0001$). These effects reflected greater intake of Diet Cin-NPT during the first hour of testing by observers that interacted with demonstrators fed Diet Cin-NPT.