SHORT COMMUNICATION

THE EARLY ONTOGENY OF BAR-GNAWING IN LABORATORY GERBILS

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Abstract *Animal Welfare 1997, 6:* 273-277

The early development of bar-gnawing was studied in young gerbils kept in standard laboratory cages. Bar-gnawing was performed on the bars of the cage lid and developed shortly after eye-opening at an age of 18 days. It increased in bout length and duration with age and there was considerable variability in behaviour between individuals. It is discussed as to whether bar-gnawing is a stereotypy and in which behavioural context it develops.

Keywords: *animal welfare, bar-gnawing, development, gerbil, housing*

Introduction

The majority of animals used in biomedical research are rodents. They are normally kept in laboratory cages which are spatially confined and poorly structured because of economical considerations and standardization. Such intensive housing conditions deviate fundamentally from the natural environment in which the behavioural organization of a species evolved. Therefore, laboratory rodents may acquire abnormal behaviour such as stereotypies (Mason 1991). Under laboratory housing conditions rodents show gnawing of the cage bars which in golden hamsters (Arnold & Estep 1993) and laboratory mice (Würbel *et al* 1996) was considered to be stereotypic. Laboratory-kept Mongolian gerbils (*Meriones unguiculatus*) regularly develop stereotypic digging (Wiedenmayer 1996) but virtually nothing is known about bar-gnawing in gerbils. Elwood and Broom (1978) observed that bar-gnawing in adult gerbils consisted of chewing on bars of the cage lid. The aim of the present study was to provide preliminary data on bar-gnawing in gerbils by describing its early ontogeny qualitatively and quantitatively. An ontogenetic approach was chosen because developmental studies facilitate investigations of the causation and function of a given behaviour (Cheal & Foley 1985; Hogan 1988).

Methods

Animals and housing

Eighteen gerbils (5 males, 13 females) of four different litters were observed. Their parents, which were of a laboratory breeding stock (Møllegaard, Denmark), were housed under standard laboratory conditions. Two days after birth (day of birth is day 0), the pups were transferred with their parents to Plexiglas laboratory cages (34x56x19cm) which were

covered by a grid. Food pellets (NAFAG 850, Switzerland) and water were provided ad libitum through the roof grid. The floor of the cages was covered with woodchip bedding and every few days paper towels were delivered, which were shredded by the gerbils and used as nest material. Cages were not cleaned until data collection had been completed. The cages stood in a laboratory room which had a 12-hour light-dark cycle, with light onset at 0800h. Room temperature was 22 ± 2°C.

Behavioural data sampling

At the age of 15 days the young gerbils were labelled individually by cutting a mark in their fur. Data collection began on day 17, before eye-opening, and lasted until the end of day 37. This period of 21 days was divided into seven time blocks of three successive days. On two of these three days observations were made. The data of each block were pooled so that seven data points resulted. The points were labelled by the middle day. At the start of an observation period a focal animal was randomly chosen from among those animals that were active, ie not resting or sucking. The active behaviour of every young gerbil was recorded for a total of 20 minutes per day. This recording time was composed of a variable number of observation periods. A single period lasted at most 7 minutes, or until the focal animal was no longer active, or until a total of 20 minutes observation on that day was completed. This distribution is important because the activity of gerbils in laboratory cages occurs in multiple peaks throughout the day (Susic & Masirevic 1986). The observer sat in front of the cages at a distance of approximately 1m and recorded the behaviour continuously with an electronic event-recorder. The behaviour 'bar-gnawing' was defined as chewing on bars of the cage lid and the duration of every gnawing bout was recorded. The total gnawing duration was calculated as a percentage of the time spent active. The behaviour patterns shown just before and after bar-gnawing were also recorded and included 'rearing' (animal rears on hindpaws), 'sniffing' (holds snout close to bar) and 'feeding' (feeds on pellets in trough).

Results

Bar-gnawing was first shown by some gerbils on day 18. The young gerbils stood on their hindpaws and with their forepaws grasped the bars of the cage lid. The young gerbils could only reach the bars of the lid which were closest to the floor, ie those which formed the food trough. They bit on a single bar of the cage lid and chewed on it at a particular spot, or along the bar on several spots, or changed between bars. On the first day when bar-gnawing occurred it was preceded by sniffing the bars (51.8% of total behaviour observed) or rearing up to the bars (26.8%), and was followed by sniffing (44.6%) or feeding (21.4%). The duration of gnawing bouts increased with age (linear regression (because the data did not conform to a normal distribution a square root transformation was performed first), r^2 = 0.813, n = 7, $P < 0.01$; Figure 1) resulting in an increase in total gnawing time (linear regression after square root transformation, r^2 = 0.851, n = 7, $P < 0.01$; Figure 2). All animals exhibited bar-gnawing but there were large individual differences. The durations of bar-gnawing (expressed as mean duration across the 21 observation days) varied considerably among animals (Figure 3). There was no significant difference between the duration of bar-gnawing in the males and the females (Mann-Whitney U test two-tailed, Z = -0.345, $P > 0.7$).

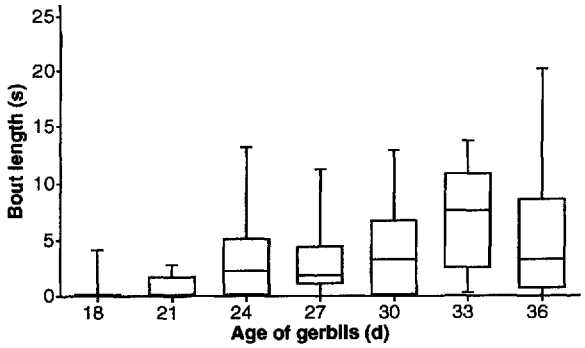

Figure 1 Development of the bout length of bar-gnawing of gerbils in laboratory cages. Box plots display 10th and 90th (whiskers), 25th and 75th (box), 50th (centre vertical line) percentiles.

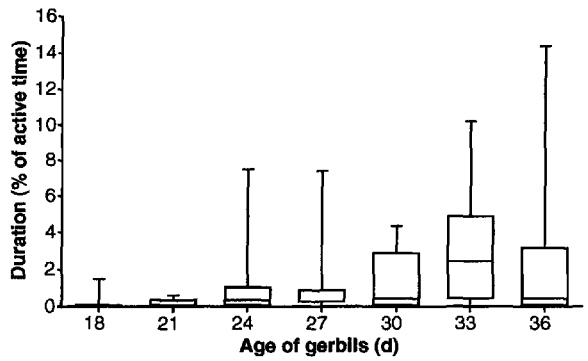

Figure 2 Development of the duration of bar-gnawing of gerbils in laboratory cages. Box plots display 10th and 90th (whiskers), 25th and 75th (box), 50th (centre vertical line) percentiles.

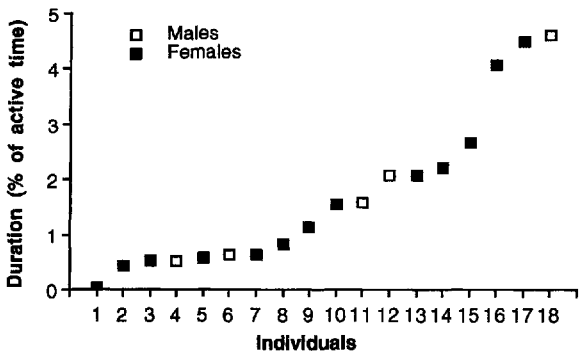

Figure 3 Individual means of the duration of bar-gnawing of gerbils in laboratory cages.

Discussion

Gerbils reared in standard laboratory cages showed their first bar-gnawing bouts shortly after eye-opening at around day 18. At that age young gerbils begin to leave the litter-nest on their own and show a sudden burst of activity including walking, rearing, exploration and digging (Kaplan & Hyland 1972; Wiedenmayer 1992). The context in which bar-gnawing was first performed can provide indications about the original underlying motivation of bar-gnawing. The temporal proximity to sniffing could indicate an explorative function, which was also suggested for wire-gnawing in mice (Würbel *et al* 1996). Alternatively, bar-gnawing could have developed in the context of feeding. Feeding motivation has been shown to underlie the development of oral stereotypies such as bar-biting in pigs (Terlouw *et al* 1991). Although not yet weaned, young gerbils start to feed on solid food particles at an age of 18 days (Kaplan & Hyland 1972; Elwood 1975). As the food pellets were in the trough of the cage lid, the bars could have interfered with feeding activity and thus may have induced or reinforced bar-gnawing.

The lack of sex differences in bar-gnawing behaviour is consistent with the results of Cheal and Foley (1985), who also found no significant sex differences in several other behavioural measures in young gerbils. However, the amount of bar-gnawing between individuals differed considerably. The level of wire-gnawing in mice also showed a huge individual variability (Würbel *et al* 1996). Although individual differences may arise through random fluctuations caused by genetic and developmental accidents (Slater 1981), individual variation could also reflect differences in coping behaviour among animals (Jensen 1995; Wechsler 1995). It remains to be investigated whether individual gerbils develop different coping styles in reaction to the laboratory environment later in ontogeny.

Stereotypic behaviour is commonly defined by a lack of function and by morphological criteria, ie behaviour patterns that are repetitive and unvarying (Mason 1993). Wire-gnawing in mice was considered to be stereotypic because it was extremely fast, repetitive, invariant and performed at particular spots on the bars (Würbel *et al* 1996). Additionally, a lack of function was suggested because wire-gnawing was considered to develop from outside-directed exploration during climbing at the cage lid, which, after becoming stereotypic, no longer contributed to exploration (Würbel *et al* 1996). Because the criterion 'lack of function' is still under debate (for a review see Dantzer & Mittleman 1993), morphological features of the motor pattern, such as repetitiveness should be used as criteria to assess whether a given behaviour pattern is stereotypic (Wiedenmayer 1992). As described qualitatively, the gerbils not only bar-gnawed at one fixed spot but also changed between several spots of the cage lid. Therefore, additional quantitative data are required, such as data on the repetitiveness of gnawing at one single spot, to decide whether bar-gnawing in gerbils is a stereotypic behaviour.

Animal welfare implications

In a semi-natural enclosure, where a cage lid was present, gerbils did not show bar-gnawing (Roper & Polioudakis 1977). Therefore, the early development of bar-gnawing in young laboratory gerbils seems to be induced by cage design. Specific experiments have to be carried out to reveal the origins of bar-gnawing and whether it is stereotypic. If confirmed as such, the development of bar-gnawing would support the findings on stereotypic digging in gerbils. Stereotypic digging develops around day 24 if young gerbils are prevented from

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retreating into burrow-like structures (Wiedenmayer 1997). Stereotypic digging indicates that the laboratory-cage environment does not allow the young animal to regulate its behaviour and is thus not an appropriate housing system for gerbils.

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