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Research

Fur chewing and other abnormal repetitive behaviors in chinchillas (*Chinchilla lanigera*), under commercial fur-farming conditions

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ABSTRACT

Fur chewing is a behavioral disorder frequently reported in chinchillas kept for fur-farming purposes. Rodents kept in barren cages usually develop some form of abnormal repetitive behavior, which can indicate a past or present welfare problem. Fur chewing may not be the only form of abnormal repetitive behavior present but is the one reported because of its direct repercussion on fur production. The aim of this study was to describe the frequency of occurrence of fur chewing and the distribution of time dedicated to it in chinchillas diagnosed as presenting this behavior. A secondary aim was to determine the presentation of other abnormal repetitive behaviors. Ten chinchillas, 5 fur chewers and 5 controls, were video recorded for 24 hours with an infrared camera. Behavioral analysis was done with The Observer XT from Noldus (The Netherlands). Focal sampling and continual recording were used, the 24-hour time budget was calculated, and abnormal repetitive behaviors were analyzed in terms of time dedication and frequency of presentation. A paired *t* test was used to compare differences in the amount of nocturnal versus daytime abnormal behavior. When normality was not met, a 2-sample *t* test and randomization test were used to compare data between treatments. No differences were observed between the time budgets of fur-chewing and control chinchillas, and all individuals exhibited more than one abnormal repetitive behavior. The amount of time devoted to abnormal repetitive behaviors was significantly higher during night in both groups and reached its lowest level between 13:00 and 17:00 hours. Fur chewing is not the only abnormal repetitive behavior developed by chinchillas in fur-farming systems, although it is the only one reported by the producer. The presence of bar chewing, cage scratching, and backflipping should also be welfare concerns. The higher presentation of abnormal repetitive behaviors at night may be associated with the lack of recognition by the producer, especially because these abnormal behaviors do not result in direct product loss as does fur chewing.

Introduction

The chinchilla (*Chinchilla lanigera*) is a hystricomorphic rodent endemic from the central and northern area of Chile (Cortés et al., 2002). The fur of chinchillas is one of the most valuable in the world, and the chinchilla has been domesticated, selected, and bred for its quality (Grau, 1986). The establishment of intensive chinchilla fur-farming systems has led to the development of fur-chewing or fur-biting behavior, where the chinchilla either continuously or intermittently chews its own fur from the lumbar area down to the tail (Ponzio et al., 2007). The chewed areas are usually covered by short hair and the skin turns darker because of hyperpigmentation, resembling the distinctive lesions of hyperadrenocorticism in dogs (Tisljar et al., 2002). By 1962, it was estimated that 30% of chinchillas in fur-farming systems were affected by this abnormal behavior (Rees, 1962). Tisljar et al. (2002) reported an incidence of 15%-20% in Croatia, but more recent studies estimate that between 3% and 15% of chinchillas are affected in Poland and Chile (Lapinski et al., 2014; Tadich et al., 2013). The etiology of the behavior is still unknown. Several theories have been postulated among which malnutrition, bacteriologic, mycological, and parasitological theories have been rejected. Environmental stress and hyperadrenocorticism remain as possible causes (Ponzio et al., 2007; Tisljar et al., 2002).

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Abnormal repetitive behaviors (ARBs) have been associated with barren and restrictive conditions that may contribute to fear, stress, or frustration (Mason, 1991). The development of these abnormal behaviors may be partially due to effects on the time budget of these individuals, which restricts allocation of behaviors within (Kiley-Worthington, 1987). Most rodent species develop ARBs when kept in barren cages (Würbel, 2006). Among different rodent species, there are differences in the frequency and type of behaviors shown. Approximately 50% of laboratory mice develop some kind of these repetitive abnormal behaviors, being the most common bar biting. Reports for rats remain anecdotal (Würbel and Stauffacher, 1994). ARBs are also common in gerbils (*Meriones unguiculatus*) (Wiedenmayer, 1997) and bank voles (*Clethrionomys glareolus*) (Ödberg, 1986) but less frequently observed in guinea pigs (*Cavia porcellus*) (Würbel, 2006).

ARBs are important because they may have a deleterious effect on the animal's welfare, health, productive, and reproductive performance. It has been established that 68% of the situations that favor the development of ARBs are also causal factors of poor welfare (Mason and Latham, 2004) and can be used as welfare indicators (Parker et al., 2008). In the case of chinchillas, fur chewing has been studied because of the economic consequences in the fur production system. Because of their nocturnal habits, chinchillas may develop other ARBs in response to environmental stress, and these behaviors would not be observed by the producer. Accordingly, the aim of this study was to describe the time budget of chinchilla behaviors and quantify the presentation of ARBs in chinchillas diagnosed as fur chewers, compared with those not identified by the producer to exhibit such behavioral disorders.

Materials and methods

Animals

The experiments were performed in a chinchilla farm located in central Chile. The farm fulfilled all the requirements for fur production, holding a valid permit under the Servicio Agrícola y Ganadero. To establish whether fur chewing was the only ARB present in the fur-farming system, the amount of time dedicated to ARB and the distribution or the time spent performing ARB (day or night), 2 groups of animals were used: group 1 (fur chewing) included 5 chinchillas classified as severe or moderate fur chewers, whereas the second group (control) included 5 chinchillas classified as nonfur chewers. Each chinchilla was categorized during preexperimental trials as described by Ponzio et al. (2007).

Behavioral observations

Behavioral data were collected using focal animal and continual sampling over 24 hours. Each animal was videoed using infrared cameras. Chinchillas were kept in their individual cages, under their normal husbandry practices, and with a day/night cycle of 11:13 hours. The video information was captured and stored using a digital video recording system and an external memory drive.

The behaviors of interest were classified either as maintenance or ARBs according to preexperimental observations. See Table 1, Table 2, and Figure 1 for further descriptions of the behaviors recorded. The duration of each behavior was individually documented by the same observer using the software The Observer XT 2011 (Noldus Software). The behaviors were analyzed in terms of duration (behavioral states) and in terms of frequency (behavioral events) according to Martin and Bateson (2007).

Table 1
Ethogram of maintenance behaviors observed in chinchillas kept in commercial fur-farming systems

Category	Behavioral patterns included
Resting	Sleeping, sitting, lying down
Feeding	Caecotrophy, exploration of feed, eating pellets or alfalfa, drinking
Locomotion	Climb, crawl, walk
Self-directed	Rolling, grooming, shaking, face washing, dust bath
Other behaviors	Play, exploring nonfeedstuff materials, urination, defecation

Statistical analysis

The time budget was analyzed using descriptive statistics and included both maintenance and ARBs. To compare differences among and within groups, the sum of the minutes dedicated to ARB for each individual was classified depending on whether they occurred in the day or in the night. Data were log transformed. To determine differences in the amount of ARB between day and night, we used a paired t test. Finally, to determine differences among groups, we used a 2-sample t test and a randomization test when the assumptions of normality were not met. We accepted a level of $P < 0.05$ as significant. All the analyses were performed using R version 3.0 (R Foundation for Statistical Computing, Vienna, Austria) (R Core Team, 2012).

Results

A total of 7200 minutes (120 hours) were analyzed for the 10 chinchillas. The overall time budget for 24 hours of both groups is shown in Figure 2. Resting and feeding were the main activities for both groups, accounting for over 80% of the time, followed by ARBs, regardless of whether the chinchilla was considered to be in the fur-chewing group. No significant differences between the time budgets of fur-chewing and control chinchillas were found (ARB, $P = 0.42$; self-directed, $P = 0.15$; resting, $P = 0.09$; other behaviors, $P = 0.69$; locomotion, $P = 0.64$; feeding, $P = 0.13$).

Fur-chewing and control chinchillas presented more than one ARB. The time dedicated to, and the frequency of presentation for each behavior is described in Table 3. Although fur-chewing behavior was present in both groups, the number of events was higher in the fur-chewing group. Bar chewing was the most frequent ARB in both groups of chinchillas, in terms of time dedication and number of events. No significant differences were found between control and fur-chewing chinchillas for the time dedicated or the number of events per day for each ARB registered ($P > 0.05$, Table 3).

When comparing the temporal allocation of ARB, both groups showed differences in the pattern of presentation (Figure 3), but their total daily amount of time spent performing the ARB was

Table 2
Ethogram for abnormal repetitive behaviors observed in chinchillas kept in commercial fur-farming systems

Behavioral pattern	Description
Bar chewing, bar gnawing	Subject bites cage bars while holding bars with their paws
Scratching cage or box	Subject scratches cage actively, usually with forepaws and usually in a crouch posture
Backflipping	Subject actively propels itself with its hind legs from the floor to either the wall or ceiling, then drops head first with front feet contacting the floor first
Fur chewing	Subject chews its own fur from the lumbar area down to the tail, either continuously or at intervals