CASE REPORT

Intelligent cages for pet rabbits

Gaiolas inteligentes para coelhos de companhia

Jaulas inteligentes para conejos mascotas

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ABSTRACT

Nowadays in Brazil pet rabbit breeding is expanding and dwarf rabbits are becoming common inside homes. The cages available are small, without attraction and can favor the laziness. This case report describes the use of an enriched environment (intelligent cage) for rabbits and verifies the possibility to put a nest under the floor for rabbit does. A Mini Lion Head doe and a Fuzzy Lop male were used for observations. The cages were built with 1.20 x 0.80m (0.96 m^2) for does and 0.90 x 0.78 m (0.70 m^2) for males. For environmental enrichment, a PVC pipe, a platform, a wood swing, a hanging plate, some dangling chains and a place for treats were added. For the doe, before the parturition date, a nest was adapted underneath the floor. A camera with night vision was used to monitor the animals for 24 periods of 50 minutes each. Observations were made every 30 seconds, as a frame, with a total of 2400 records for each rabbit. In order to build the ethogram, sixteen types of behavior were considered. The permanence in the different zones inside cages was also considered. The rabbit doe performed various types of behaviors and some of them were very important from the welfare point of view such as exploratory and ludic behaviors. This animal visited all zones of the cage, showing higher preference for above the platform. The nest was well prepared and used by the doe for the followings kindlings.A large range of exploratory and ludic behaviors were observed for the male and this animal spent part of time in self-grooming. New studies need to be made with a greater number of animals to confirm the high capacity of intelligent cages to promote safe housing and welfare conditions for the rabbits.

Keywords: Pet animal, welfare, rabbit breeding, friendly systems

RESUMO

Atualmente no Brasil, a criação de coelhos de estimação (cunicultura pet) está se expandindo e coelhos de companhia estão se tornando comuns em residências. As gaiolas disponíveis no mercado são pequenas, sem atração e podem favorecer o ócio. Este relato de caso descreve o uso de um ambiente enriquecido (gaiola inteligente) para coelhos alojados e discorre sobre a possibilidade da utilização de um ninho acoplado ao piso da gaiola. Uma coelha da raça Mini Lion Head e um macho da raça Fuzzy Lop foram usados para observações. As gaiolas foram construídas com 1,20 x 0,80m (0,96 m^2) para a fêmea e 0,90 x 0,78 m (0,70 m^2) para o macho. Para enriquecimento ambiental, foram adicionados um tubo de PVC, uma plataforma em segundo plano, um balanço de madeira, um prato suspenso, correntes dependuradas e um local para guloseimas. Para a coelha, previamente ao parto, um ninho foi adaptado ao piso da gaiola, simulando uma toca. Uma camera com visão noturna foi usada para monitorar os animais por 24 períodos de 50 minutos cada. As observações foram realizadas a cada 30 segundos, como quadro, com um total de 2400 registros para cada coelho. Para construir o etograma, dezesseis tipos de comportamento foram considerados. A permanência nas diferentes zonas dentro das gaiolas também foi considerada. A coelha executou vários tipos de comportamentos e alguns deles são importantes desde o ponto de vista do bem-estar animal, como exploratórios e lúdicos. Este animal visitou todas as zonas da gaiola, mostrando maior preferência pela plataforma em segundo plano. O ninho foi bem preparado e utilizado pela coelha nos partos seguintes ao primeiro. Observou-se uma grande variedade de comportamentos exploratórios e lúdicos realizados pelo macho e este animal passou considerável parte do tempo realizando comportamento de autolimpeza. Novos estudos com um número maior de animais precisam ser realizados para confirmar a elevada capacidade das gaiolas inteligentes em promover condições seguras de alojamento e bem-estar aos coelhos de companhia.

Palavras chave: animal pet, bem-estar animal, cunicultura, sistema amigáveis

RESUMEN

Actualmente en Brasil, la cría de conejos para mascotas se está expandiendo y esos animales se están volviendo comunes en los hogares. Las jaulas disponibles en el mercado son pequeñas, poco atractivas y pueden favorecer la ociosidad. Este reporte de caso describe el uso de una jaula enriquecida (jaula inteligente) para conejos alojados y presenta la posibilidad de usar un nido unido al piso de la jaula. Se utilizaron una hembra de la raza Mini Lion Head y un macho de la raza Fuzzy Lop para las observaciones. Las jaulas fueron construidas con 1.20 x 0.80m (0.96 m^2) para la hembra y 0.90 x 0.78 m (0.70 m^2) para el macho. Para el enriquecimiento ambiental, han sido agregados un tubo de PVC, una plataforma en segundo plano, un columpio de madera, un plato colgado, cadenas de acero y un alambre para fijar golosinas. Para la hembra, antes del parto, un nido fue adaptado al piso de la jaula, simulando una madriguera. Se usó una cámara de visión nocturna para monitorear a los animales durante 24 períodos de 50 minutos cada uno. Las observaciones se realizaron cada 30 segundos como una imagen, con un total de 2400 registros para cada conejo. Para construcción del etograma, se consideraron dieciséis tipos de comportamiento. También se consideró la permanencia en las diferentes zonas dentro de las jaulas. La coneja realizó varios tipos de comportamientos y algunos de ellos son importantes desde el punto de vista del bienestar animal, como el exploratorio y el lúdico. Este animal visitó todas las áreas de la jaula, mostrando una mayor preferencia por la plataforma en segundo plano. El nido estaba bien preparado y fue utilizado por la

coneja por los partos posteriores. Hubo una amplia gama de comportamientos exploratorios y lúdicos realizados por el macho y este animal pasó un tiempo considerable realizando comportamientos de auto limpieza. Es necesario realizar más estudios con un mayor número de animales para confirmar la elevada capacidad de las jaulas inteligentes para promover condiciones de alojamiento seguro y bienestar para conejos mascotas.

Palabras clave: animal de compañía, bienestar animal, cria de conejos, sistema amigable

Introduction

In Brazil few are the number of studies about housing, behavior and welfare of rabbits, and there is lack of specific equipment and utensils for pet rabbits maintained in homes. Brazil is one of the countries with the largest population of pet animals and it is an important growing market that provides wealth and welfare for the society (ABINPET, 2018). In the last years, the presence of rabbits as pets has grown and some related problems have appeared.

There is a lack of information necessary to promote improvements in the living conditions of these animals (SCHEPERS et al, 2009). For instance, the existing cages purchased today in the marked are small and without attractions for the animals. In this way it can lead to laziness, reduction in life quality and longevity. If the pet rabbits are maintained outside a cage they can dig holes, chew on furniture, eat plants, run away from home and urinate or defecate in inappropriate places. Therefore, the development of new equipment that solve part of this problem is crucial. On the other hand, equipment that provide an environment similar to natural conditions can be better to improve the natural behavior.

There are some ways to improve rabbit welfare such as the use of environmental enrichment in the cage, the use of a bigger space for the cage and the promotion of social contact between animals, mainly for rabbit does that are maintained isolated in their cages.

Nowadays the society discusses about rabbit welfare and the European Parliament (EUROPEAN PARLIAMENT, 2017) has made new appointments for rabbits maintained in commercial farms. Some countries already have specific laws for rabbits, although the rabbit researchers are yet looking for solutions so solve the most serious problem of high aggressiveness, that occurs when more than one adult rabbit are maintained together in the same environment (MUGNAI et al. 2009; ROMMERS et al. 2014; BUIJS et al. 2015; CERVERA et al. 2017;

MACHADO and CERVERA, 2017; ZOMEÑO et al. 2018).

In Brazil, positive changes in the behavioral pattern were reported by Bozicovich et al. (2016) and Heker and Lui (2014) when were adopted different techniques based on environmental enrichment to improve welfare and comfort. Despite of this, Uczay et al. (2015) did not perceived improvements in the behavior when a shelter was used as an environmental enrichment. Machado et al. (2018) and Santa Ines et al. (2018) verified differences in behavior when different housing systems were used, showing that the elements inside cage used for environmental enrichment or the number of individuals or the total space of the enclosure have a great influence on their life quality.

About pet rabbits, Dixon et al. (2010) concluded that many housing systems, as the traditional cages, do not provide enough space to allow the animals to adequately express a number of activities. The access to a larger enclosure could increase the volume of activities and therefore improve the pet rabbit welfare. Considering that studies involving behavior and welfare of rabbits are very important to ensure the improvement of life in environments different from the natural habitat, this work aimed to propose a new kind of cage for males and rabbit does, collecting data from the behavior and evaluating the possibility to use a nest under the floor.

Material and Methods

The essays were performed in Minas Gerais Federal Institute in the year 2013, from June to July. To simulate the home environment a closed room was used and inside it a window was opened during the day. The average minimum and maximum temperatures during the period of observations were 11.6º C and 27.0º C. The rabbit commercial feed was offered *ad libitum*. The essay was approved by etic committee in the use of animals (21/2019-CEUA/IFMG).

The intelligent cage developed for does (Figure 1-b) had internal dimensions of 120 cm (length) x 80 cm (width) x 50 cm (height) and the environment was enriched with a metal chain, a hanging plate, a wood swing, an elevated platform, a manger for hay, a support for treats and a PVC tube with diameter of 150 mm, that was used as a hiding place. The cage was placed on a steel base 120cm high, with a tray containing wood shavings to collect the excreta. The nest was made with sheet steel and had 30 cm of diameter, 48 cm of length and four

steps. It was adapted to a hole made in floor cage (Figure 1-c). The intelligent cage developed for males (Figure 1-a) was built with dimensions of 90 cm (length) x 78 cm (width) x 50 cm (height) and for environmental enrichment was added the same utensils described for the does' cage, except for the nest .

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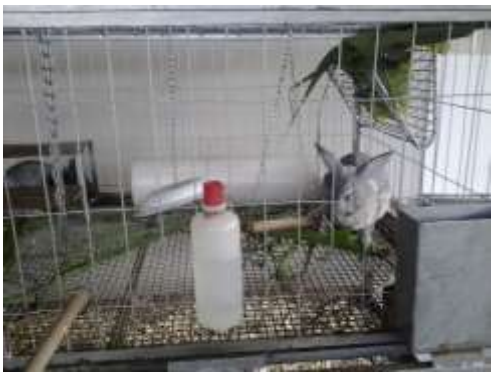
(a)

(b)



(c)

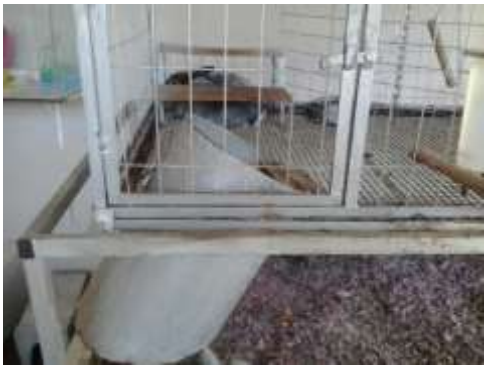


Figure 1 - Intelligent cages for male rabbit (a), for does (b) and a with a nest (c)

The behavior was registered using camera equipped with infrared night vision. The rabbits used were a 14 months Mini Lion Head rabbit doe and a 12 months Fuzzy Lop male. Recordings were made on three different periods of 50 minutes per day during eight days, therefore a total of 24 periods were taken, so that all hours of the day were evaluated. The visualizations were made as a frame every 30 seconds, resulting in 100 visualizations in each period and 2400 per animal. The followings places inside cage were considered: feeder/ drinking area, inside the pipe, cage sides, treat area, on the platform, in the nest (rabbit doe), under the platform and toys zone. For the ethogram the followings kinds of behaviors were considered: to walk, to play with the chain, to play with

the swing, to run, to drink, to bit the cage/tube; to binky (happiness leap), to stand up, to stretch, to sniff, to eat treats, to take off fur (rabbit doe), to make the nest (rabbit doe), cecotrophy, to dig the cage, to eat, to lay, to lick/scratch and to sit. In order to evaluate the use of the nest by the doe, a larger period was considered (one year), and information from four kindlings were taken, being the last three observed after the period of recordings.

The data from the different types of behavior were compared descriptively For the statistical analyses, the day was divided into four shifts as follows: 00:00-06:00, 06:00- 12:00, 12:00-18:00 and 18:00-24:00 and non-parametric tests were taken using Kruskal Wallis and Mann Whitney's tests using the Minitab program.

Results and discussion

Rabbit doe

The most frequent behavior was to lay or to sit, which shows that during most part of time the rabbit doe remained resting. These finding corroborate with Gunn and Morton (1995), Uczay et al. (2015) and Santa Ines et al. (2018) that perceived that rabbits are resting in a considerable portion of time. Also, in nature, rabbits take almost a half of time in resting, mainly during the day when they are hidden (STAUFFACHER, 1992.

Behaviors such as to binky (the term "binky" is used to name a leap of happiness), to bit the cage/tube, to run or to dig the cage were not observed. Exploratory behaviors such as to sniff and to stand up were observed in a total of 3.07% of time, which suggests curiosity of the animal about its environment. This value is similar to that observed by Santa Ines et al. (2018). Only 0.62% of time was taken by doe to play with the items added as environmental enrichment for rabbits maintained in cages. The exploratory and ludic behaviors are very interesting from the welfare's point of view and need to be stimulated inside the cage. The behavior "to lick" (self-grooming), that is related to hygiene, was one of the most practiced by the doe and higher than the value of 3.70% found by Uczay et al. (2015). Rabbits that are housed lonely take much of their time in self-cleaning activities and rabbits who live in groups spend a considerable part of their time in social interactions.

The complete ethogram is presented in Table 01. About the shifts, the rabbit doe remained seated for the longest time

(P<0.05) during the periods of 00:00-06:00h and 18:00-24:00h and licked herself with more frequency during the period of 06:00- 12:00h.

Table 01 – Ethogram of rabbits maintained in intelligent cage.

Mini Lion Head rabbit doe		**Fuzzy Lop rabbit male**	
Type of behavior	**Time spent (%)***	**Kind of behavior**	**Time spent (%)***
To walk	3.58	To walk	1.66
To play with chain	0.28	To play with chain	0.21
To play with wood swing	0.13	To play with wood swing	0.11
To playing with plate	0.21	To playing with plate	0.04
To drink	0.74	To drink	0.26
To bit the cage/tube	0.00	To bit the cage/tube	0.80
To take of fur	0.40	To sniff the environment	2.27
To sniff the environment	1.97	To eat treats	3.05
To eat treats	1.57	To do cecotrofy	0.08
To do cecotrofy	0.34	To eat feed	3.13
To eat feed	4.51	To lay	41.47
To lay	47.97	To stretch	0.66
To prepare the nest	3.10	To stand up	0.57
To stretch	0.57	To Binky	0.21
To stand up	1.10	To lick	30.38
To Binky	0.00	To sit	14.87
To lick	12.65	To run	0.19
To sit	20.86	To dig the cage	0.04
To run	0.00		
To dig the cage	0.00		

*For each observed frame was counted 30 seconds for that behavior.

Inside the cage, the rabbit doe preferred to stay on the platform (45.57% of the time), which shows the importance of a second plane inside the animal enclosure. The doe remained 15.10% below the platform, 12.87% in the eating/drinking area, 11.39% at the sides of the cage, 7.45% in the toy zone, 3.85% in the treat region, 3.11% inside nest and 0.66% inside the PVC tube. Therefore, we noticed that the doe explored all the zones of the intelligent cage, maintaining the preference for the elevated platform. The doe used the nest in the second, third and fourth cycles. It prepared the nest in all cycles, pulling out a high quantity of fur. On the 18th day, the rabbit kits started to leave the nest and showed preference for the PVC tube. However, in first cycle the doe gave birth outside the nest. This kind of misconduct is frequent among primiparous rabbit does (Ferreira et al.,

2012) that are sometimes confused about maternal behavior.

Rabbit male

As observed for the rabbit doe, the majority of time the male remained lying and siting, but in 30.38% of the time, this animal licked himself, being this an interesting kind of behavior. This value is very high when compared with Uczay et al. (2015) and shows a specific behavior of this animal that was maintained alone. Also Machado et al. (2018) perceived a high frequency of self-grooming in rabbits housed in enriched cages.

This male rabbit stayed 0.80% of time gnawing on the cage/pipe. This type of behavior suggests stress or anxiety and this was observed mainly in the morning, maybe because the rabbit was waiting for the caretaker to enter the room.

Attention need to be given to the frequency of "binky" behavior (a leap of happiness) that suggests sufficient space for this act, especially height. Exploratory behaviors such as to sniff the environment and stand up were observed in 2.84% which suggests high curiosity of the animal in relation to the environment. Therefore, there was a great variety of interesting behaviors in the intelligent cage.

The animal showed lower frequency of licking/scratching behavior in the 18:00-00:00 period, it walked more in the morning (06:00 to 12:00) and evening (18:00-00:00). Although not evaluated, it was perceived that the male rabbit presented restlessness after humane presence. This fact was favored by the high affinity between the animal and its owner.

The cage zone most frequented by the male rabbit was the side of the cage (61.70%), but one must draw attention to the time the animal spent on the platform (13.53%) licking himself. The animal stayed in the toy zone at 2.11% of time and remained in the pipe only in 0.90% of time. Therefore, it was noticed that the male rabbit explored all areas of the intelligent cage, but showed preference for the sides of the cage. Significant difference ($P<0.05$) was observed between shifts for the toy zone where in afternoon (12:00 to 18:00) the rabbit male did not use this zone, probably because this period was a time for rest, which resulted in less activities, as observed by Machado et al. (2018).

Conclusion

The rabbit doe performed various types of behaviors and some of them are very important from the point of view of

welfare as exploratory and ludic. This animal visited all zones of the cage, showing higher preference for above the platform. The nest was well prepared and used by the doe on the second and subsequent kindlings.

For the male, the cage provided interaction with the structure as well as environmental enrichment. A large variety of exploratory and ludic behaviors were observed. Furthermore, this animal visited every cage zone, showing preferences for the sides.

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