

DIFFERENCES IN MILK PRODUCTION AND LACTATION-RELATED BEHAVIOURS IN BREEDING DOES HOUSED IN INDIVIDUAL ENRICHED CAGES AND PART-TIME SYSTEMS

Ramón-Moragues A.¹, Martínez-Paredes E.¹, Villagrà A.^{2*}

¹Institute of Animal Science and Technology, Polytechnic University of Valencia, C/ Vera s/n. 46022. Valencia, Spain

²Animal Science and Technology Centre (CITA-IVIA), Polígono La Esperanza 100. 12400. Segorbe, Castellón, Spain

*Corresponding author: villagra_ara@gva.es

ABSTRACT

The effect of collective rearing of breeding does was assessed in terms of milk yield and behavioural patterns. A total of 40 breeding does were used, 20 of them housed in individual cages (50x90x50 cm) and 20 in a collective system in groups of 4 rabbits (200x90x50 cm) since 14 days post-partum until 28 days, in which weaning took place. Milk production was assessed during the 1st and 2nd parturition, finding differences between groups only in the second one, when does from the part-time system produced less milk. Straw was offered to animals as environmental enrichment and its consumption was assessed, finding that does reduced straw consumption in the part-time system compared to individual cages. This effect might be related to the presence of social stimuli. In addition, the number of kits stolen by does from alien nests was higher during the first days after grouping, achieving 60% of the kits.

Key words: behaviour, breeding does, housing system, lactation, milk production, rabbit welfare

INTRODUCTION

Animal welfare is a key aspect in rabbit production and several comparisons between housing systems have been performed (Trocino and Xiccato, 2006; Alfonso-Carrillo *et al.*, 2014; Rommers *et al.*, 2014; Szendrő *et al.*, 2019). Specific characteristics of rabbits and natural behaviours of the wild rabbit are very important to define a proper housing system. In general, there are two types of studies as regards new housing systems in reproducing does: research on individual cages provided with environmental enrichment and continuous or part-time systems. Environmental enrichment consists on adding complexity to the environment in which the animals live by providing different elements, which can allow certain behaviours. One of these behaviours is gnawing, which in a semi-natural environment they satisfy through gnawing roots or branches (Stauffacher, 1992). Normally, sticks of wood are chosen as environmental enrichment for these purposes (Baumans, 2005), but also hay or straw addition has been tested (Berthelsen and Hansen, 1999). As regards group housing systems, during the last years, part-time systems have been investigated in which the does are separated when they give birth and regrouped when the litter is 11 days old or more (Buijs *et al.*, 2015). These systems have been evaluated according to productive traits such as litter performance or feed consumption, but there is a lack of information regarding the effect on milk production.

Thus, the main objective of this work was to evaluate specific aspects related to rabbit welfare in enriched and part-time housing systems in order to provide useful information for the characterization of new potential housing systems for breeding does.

MATERIALS AND METHODS

Animals and housing

This study was carried out in the facilities of the Centre of Research and Animal Technology (CITA-IVIA) located in Castellón, Spain. A total of 40 breeding does were used housed from 12 weeks of age

in 20 individual cages (I) and 20 part-time systems (G). First artificial insemination was at 16 weeks of age and different measurements were taken during 4 parturitions. Individual cages were 50 cm width x 90 cm depth x 50 cm height and they were provided with an external nest and a straw dispenser as environmental enrichment. Part-time systems were 200 cm width x 90 cm depth x 50 cm height with external nests and four breeding does were housed in them (available surface -4500 cm²- and height - 50 cm- were the same both in individual and part-time systems). The mixing of breeding does after parturition in G group was carried out at 14 days post-partum. All the rabbits were inseminated 11 days post-partum, litters were standardized to 9 kits/doe and weaned at 30 days of age.

During the 1st and 2nd parturition, milk production was recorded in all the breeding does, and during the 3rd and 4th ones, the same animals were used for the study of the use of straw. Animals in G group were used for the study of “stealing behaviour” of breeding does, as explained subsequently. Milk production was measured daily from day 7 of lactation to day 25 by double weight (before and after nursing the kits) and avoiding the access to the nest during the whole day. The use of the straw was measured daily ten days before parturition and during lactation, by weighing (100 g were provided to each dispenser), and the following 4-level score was used: 0 for no consumption of straw; 1 for 1/3 of consumption; 2 for 2/3 of consumption; 3 for total consumption. “Stealing behaviour” in G does was assessed by introducing an individual electronic injectable microchip (Felixcan 1.4 mm microchip Glass Tag, Spain) in the right ear of each kit before the does were mixed at 14 days post-partum. Then, chips were read daily from 14 to 20 days of age of the litter and the location of each kit (the females’ nest in which they were) was written down to allow the study of the presence of alien kits in each litter.

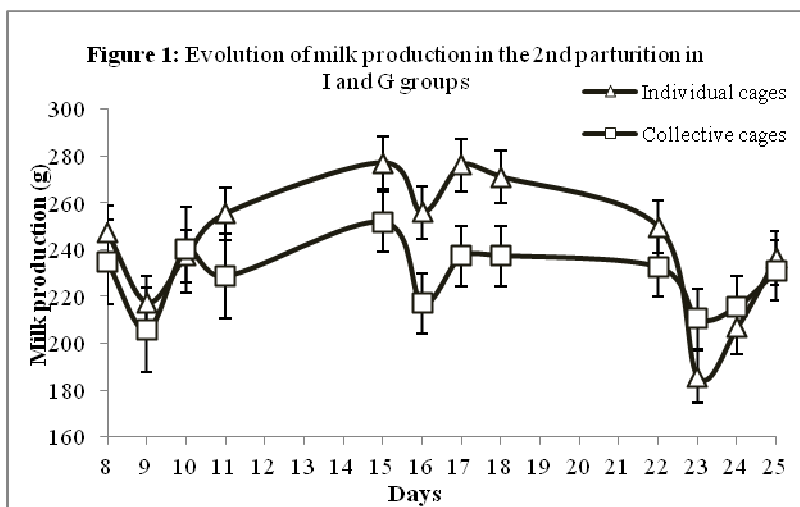
Statistical Analysis

Data were analyzed using Statgraphics® Centurion XVII, including type of cage and days in lactation (milk production) or days of observation (straw use) as main factors. For “stealing behavior” data, only a descriptive analysis was provided.

RESULTS AND DISCUSSION

Effects on milk production

Effects of the type of cage on milk production were significant only at the second parturition ($p < 0.005$). The pattern of milk production was the same in individual cages and part-time systems as seen in Figure 1.



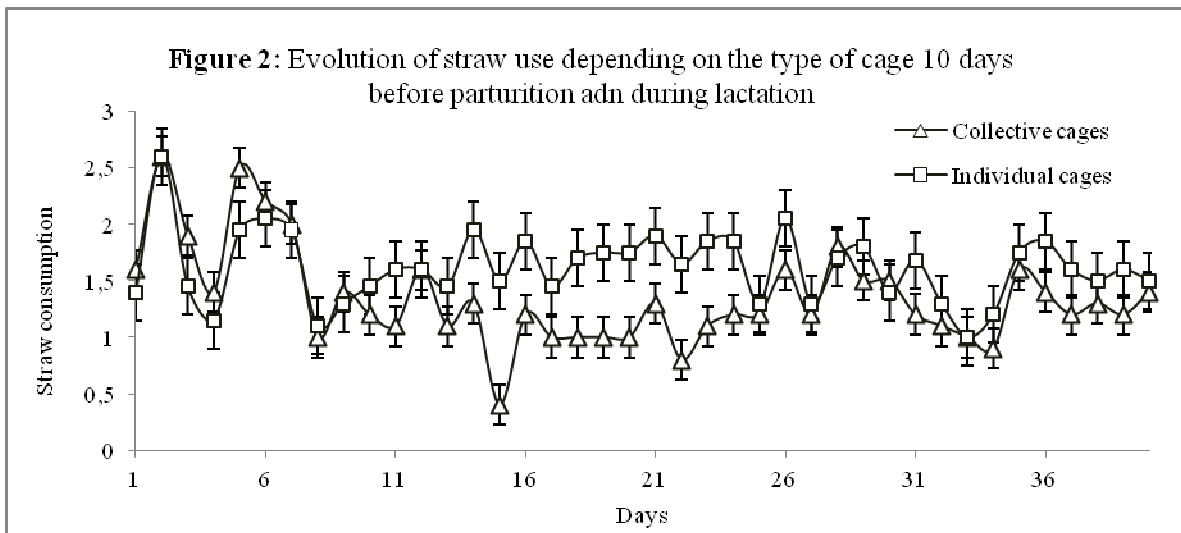
During the first four days of milk production assessment (from day 8 to 11), all the breeding does were caged individually, even the G group, as mixing was produced at 14 days after parturition. As it is observed, milk production during these days did not differ between housing systems, but as soon as the does are mixed it significantly drops (day 15). This drop is also observed on

day 11, although it is not statistically significant. The reason might be the high variability of data in this day in the part-time systems. On the other hand, the milk drop which is observed on days 9, 16 and 23 is due to the experimental procedure of collecting data, in which nests remained opened during

3 das, leading to an underestimation of milk production during those cited days. According to this data, it seems clear that milk yield decreases when rabbit does are housed in part-time systems. This can be due partly to the potential emotional stress they suffer in these systems, which affects the ejection of milk and the release of oxytocin (Bisset *et al.*, 1970).

Effects on the use of the straw dispenser

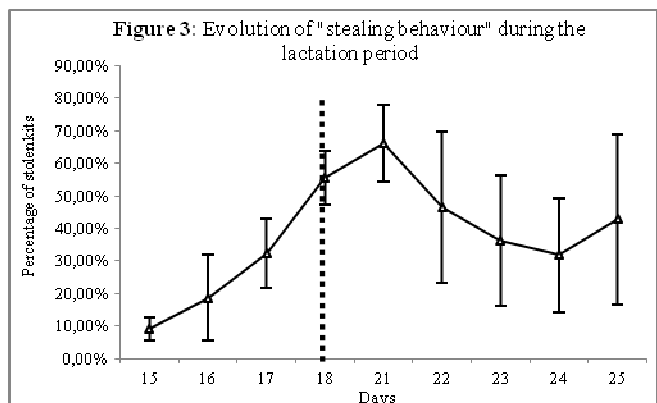
Regarding the use of the straw, both days of exposure to straw (since the first day) and housing system resulted statistically significant ($P \leq 0.00001$), as well as their interaction ($P \leq 0.05$). Results are shown in Figure 2: when the breeding does are all individually housed (days 1 to 13), there are no differences in the use of the straw. After they are mixed, differences between G and I group appear as statistically significant and does housed in I use more straw than those housed in G, especially during the first days (statistically significant differences appear on day 4 after mixing and last approximately until day 15 post partum – day 25 in the Figure). The disappearance of the differences from day 25 onwards can be related to the age of the kits and interactions between mother and kits, although behavioural studies are needed to this regard.



These differences seem to be related to the social behaviour of breeding does. They use the straw in a specific level and once they are mixed they decrease the use because of social interactions. This drop in straw use is especially remarked on day 15, when the hierarchies establishment was in progress, so during these days animals were likely more devoted to aggressive and defensive behaviours than to any other.

“Stealing behaviour”

As seen in Figure 3, kits’ stealing events increase as days in lactation progress until achieving a maximum at day 21 (more than 60% of kits are a nest different from their original one). However, these data would be only valid until the moment in which the kits leave the nest by themselves (on day 18 in the present study), as from this moment they return to their nest on their own or spend the major part of the day in the rest of the cage. This may enforce the option of mixing the breeding does in part-time systems when the litter is 18 days old, as previously reported by Buijs *et al.* (2015).



In addition, it has been found that it was always a doe who stole (dominant doe, presumably) on average, more than 50% of kits until day 18. Consistently, it was identified a second dominant doe who was responsible, on average, of over 25% of stealing events. This means that this type of behaviour may help to know the hierarchical rank in a group avoiding other more traditional systems, but it can also be hypothesized that milk production level of the individual doe can affect the number of kits moving from one litter to another. Thus, this type of behaviour has to be accurately studied and related to aggressions and lesions levels of the rabbits, as well as individual doe milk production.

CONCLUSIONS

In brief, this work has resulted helpful in the characterization of some traits related to the lactation period of the breeding does housed in part-time systems. Milk production has been measured in part-time systems and it is impaired under this housing system. On the other hand, environmental enrichment by a straw dispenser has a limited effect on groups as compared to individual housing, and the stealing behaviour can become a tool to explore hierarchies definition and ranks in breeding does, although specific behaviours of the does and the kits have to be observed.

ACKNOWLEDGEMENTS

The authors wish to thank to Spanish Ministry of Agriculture, Fisheries and Food, as well as to the Animal Health and Welfare Era-Net for their funding of this project (RABHO Rabbit Housing).

REFERENCES

- Alfonso-Carrillo C., Martín E., de Blas C., Ibáñez M.A., García-Rebollar P., García-Ruiz A.I. 2014. Effect of cage type on the behavioural pattern of rabbit does at different physiological states. *World Rabbit Sci.*, 22, 59-69.
- Bisset G.W., Clark B.J., Haldar J. 1970. Blood levels of oxytocin and vasopressin during suckling in the rabbit and the problem of their independent release. *J. Physiol.* 206(3), 711-722
- Baumans V., Van Loo P. 2013. How to improve housing conditions of laboratory animals: the possibilities of environmental refinement. *Vet. J.*, 195, 24-32.
- Berthelsen H., Hansen L.T. 1999. The effect of hay on the behaviour of caged rabbits (*Oryctolagus cuniculus*). *Anim. Welfare*, 8, 149-157.
- Buijs S., Maertens L., Hermans K., Vangeyte J., Tuytens F.A.M. 2015. Behaviour, wounds, weight loss and adrenal weight of rabbit does as affected by semi-group housing. *Appl. Anim. Behav. Sci.*, 172, 44-51.
- Rommers J., Reuvekamp B.J.F., Gunnink H., de Jong I.C. 2014. Effect of hiding places, straw and territory on aggression in group-housed rabbit does. *Appl. Anim. Behav. Sci.*, 157, 117-126.
- Stauffacher M. 1992. Group housing and enrichment cages for breeding, fattening and laboratory rabbits. *Anim. Welfare*, 1, 105-125
- Szendrő Zs., Trocino A., Hoy S., Xiccato G., Villagrà A., Maertens L. 2019. A review of recent research outcomes on the housing of farmed domestic rabbits: reproducing does. *World Rabbit Sci.*, 27, 1-14.
- Trocino A., Xiccato G. 2006. Animal welfare in reared rabbits: a review with emphasis on housing systems. *World Rabbit Sci.*, 14, 77-93.