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### ► **To cite this version:**

Yayu Huang, Julien Breda, Davi Savietto, Anne-Marie Debrusse, Sylvie Combes, et al.. Part-time grouping of rabbit does in enriched housing: effects on spatial position, performance and lesions. 12th World Rabbit Congress, Nov 2021, Nantes, France. hal-03644887

**HAL Id: hal-03644887**

**<https://hal.inrae.fr/hal-03644887>**

Submitted on 19 Apr 2022

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## **PART-TIME GROUPING OF RABBIT DOES IN ENRICHED HOUSING: EFFECTS ON SPATIAL POSITION, PERFORMANCE AND LESIONS**

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### **ABSTRACT**

Group housing of does is hypothesized to improve animal welfare through favouring positive social interactions. We built a part-time group housing system for does by connecting 4 individual housing units through hatches. The part-time group housing system included a platform, a gnawing block, and a burrow. Spatial position, health and injury frequency of does and kits were evaluated for 32 females and their litters housed in 8 part-time group housing systems. Reproductive performance were compared to a control group (n = 8 females housed individually). The grouping started at D12 (D1 = artificial insemination), it was interrupted after 10 days (at D22) due to increased injuries rates and severity caused by fighting: injured does increased from 25% (D13) to 63% (D22), and severely injured does increased from 0% (D13) to 28% (D22). The weight gain during the experiment was similar between groups. The litter size at weaning was lower in the part-time group housing system than in individual housing (9.2 vs. 10.0,  $P < 0.01$ ). At D22, the proportion of does having injuries was high in part-time housing group (53% of 32 does). The platform were used for 32% of the observation time. Does were observed more frequently on the platform during the last two weeks of the experiment just before weaning their litter (66% and 47% of the total observation,  $P < 0.05$ ), confirming that the platform offered does the possibility of escaping from their kits once they leave the nest box. In conclusion, a partitioned enriched housing with burrow for animal refuge did not permit to reduce fighting between group-housed does, it caused high level of injuries and reduced reproductive performance.

**Key words:** *Oryctolagus cuniculus*, group-housing, injuries, welfare, platform, burrow.

### **INTRODUCTION**

The rabbit is a gregarious animal that frequently expresses positive and negative social behaviours, but the species has a hierarchical organization that is set up after severe fights within a group (von Holst et al., 2002). In rabbit farms, females are raised individually to avoid fights but this also prevents positive social behaviours such as allogrooming or resting side by side. Collective housing of breeding females allows the expression of a natural behaviour, and is hypothesized to improve rabbit welfare. Permanent group-housing system deteriorates reproductive performances (does longevity, kits mortality, double littering; Szendrő *et al.*, 2013). Part-time group housing systems may contribute to solve these problems by allowing individual parturition at the beginning of the reproductive cycle while allowing social interactions when grouping at other times in the cycle (Szendrő *et al.*, 2016). Using removable internal walls in parks, Maertens and Buijs (2016) showed the feasibility and the potential interest of part-time group housing system (9.9 vs 10.2 weaned kits/litter in part-time or individual housing). However the handling of removable walls remains long and painful and aggression, fighting and injured rabbit does after grouping remain unsolved problems (Szendrő *et al.*, 2019). Special management may be required to reduce aggressiveness of group housed does. Some strategies such as providing nest boxes have been proposed (Zomeño *et al.*, 2017). Thus, we studied a housing system enabling grouping of females by connecting 4 individual housing units thanks to a hatch located at the platform level (as illustrated in Fortun-Lamothe *et al.*, 2020). It permits part-time

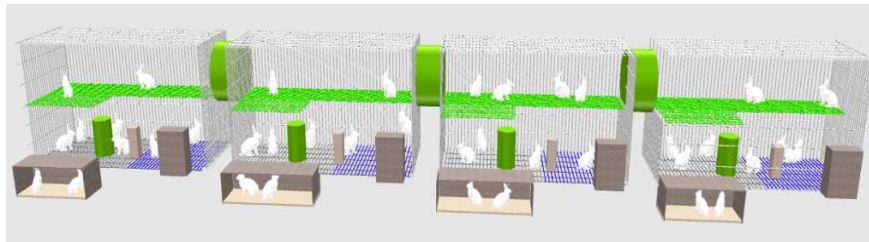
grouping of females in a simple way by opening or closing hatches. Each individual unit was equipped with permanent nest boxes (to provide hiding places as a burrow). The aim was to create a simple to manage fractionated habitat that could offer an individual territory during grouping periods. We investigated the effect of such a temporary grouping system on spatial position, performance and health of reproductive rabbit does.

## MATERIALS AND METHODS

The experiment received a French agreement (experiment permit number 16330-2018072716211212).

### Animal and experimental design

A total of 40 rabbit does (10% of PS19 from HYPHARM, 30% of INRA1777; 73% primiparous and 27% multiparous) were used for experiment. The animals had *ad libitum* access to commercial pelleted diet and fresh water through nipple drinkers. The experiment started at artificial insemination (AI, at D1) and ended at weaning (35-37 days of age; D69). The litter size was set to 10 kits at birth. The individual housing units were made of wire mesh ( $102 \times 47 \times 60$  cm,  $w \times l \times h$ ) and contained a platform ( $38 \times 45$  cm,  $w \times l$ , including a corridor  $21.5 \times 62$  cm,  $w \times l$ ) made with plastic-mesh fixed at 30 cm from the ground and a compacted forage block and wood stick (20 cm) both as gnawing blocks. A box ( $28 \times 45 \times 32$  cm,  $w \times l \times h$ ) was located on the front of the housing to form a burrow which was equipped with a nest box before parturition (Figure 1). The parity (average 2.8) and weight of does (average 4332 g at AI) were similar between the two groups: individual housing (IH group,  $n=8$  housings), where does and their litters were housed individually (one doe per housing,  $n=8$  females) throughout the experimental period; Part-time group housing (PGH group,  $n=8$  housings), where 8 combinations of 4 individual units could be connected together via connection hatches between two units ( $n=32$  females). In this group, multiparous and primiparous females were mixed and the does were housed collectively (hatches were opened) from D13 to D22 and individually for the rest of the experiment.



**Figure 1.** The connection of four housing units in PGH group.

### Measurements

The does were weighed at artificial insemination (D1), at end of grouping period (D22), at parturition (D34) and weaning of their litters (D69). The litter was numbered at birth and at weaning and weighed at weaning. Animal mortality was recorded daily. Presence of injury in all animals was recorded daily, using a 4 points scale to evaluate their severity (0 = no damage, 1 = minor injury with scratching on the ear or torn hairs, 2 = moderate injury with torn nail, or scratch on the eye or back, or damaged epidermis, or hair torn off by tufts, 3 = serious injury with damaged dermis, raw flesh, or rapid evolution of a wound that passes from class 1 to class 2 within 24 hours). Spatial position of does and their kits was evaluated by direct observation twice daily (at 10:00 am and 3:00 pm) two days per week (9 weeks in total) to record the location of the female in the housing and the number of kits in each area of housing (floor, platform and burrow).

### Statistical analyses

All analyses were performed by using statistical software R version 3.4.0 (R Core Team, 2017). Performance of does and their litters were analysed by linear mixed effects model including housing system, parity of does and their interaction as fixed effect, animal was considered as a random effect. Two qualitative variables were created for each female: "Injury" during the grouping period (presence

or absence) and “Health evolution” (degraded or not at D22 compared to that at D1). The effect of housing system, parity, weight (of does) at artificial insemination as well as interactions was analysed using binomial logistic regression. The effect of housing system, parity, time and week of observation, as well as interactions on frequency of does on platform or in burrow was analysed using a binomial logistic regression.

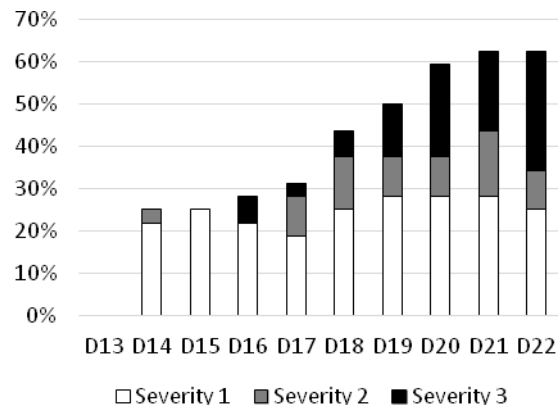
## RESULTS AND DISCUSSION

### Performance of does and their litters

The body weight of part-time group-housed does was 10% lower than those individually housed at separation (D22, 4287 vs 4662 g,  $P < 0.001$ ), at parturition (D42, 4176 vs 4509 g,  $P < 0.001$ ) and at weaning (D77, 4500 vs 4728,  $P < 0.05$ ). The mortality rate (10.3% vs 0% for PGH and IH group respectively, *NS*) and parturition rate (68.8% vs. 75.0% for PGH and IH group respectively, *NS*) of does were not significantly affected by housing system. Litter size at birth and the mortality of kits during lactation were similar between groups, but litter size at weaning was lower in PGH than IH group (9.2 vs 10.0,  $P < 0.01$ ). Dal Bosco et al. (2019) also observed a slight decrease of litter size at birth (8.90 vs 7.95) and of litter size at weaning (7.85 vs 7.20) in PGH compared to IH group.

### Injuries during grouping period

The present study confirmed the aggression between group-housed does. Percentage of injured does in PGH group continually increased from D13 to D22 (**Figure 1**). At the end of the grouping period (D22), 25%, 9% and 28% of group housed does (n=32) had injury of severity 1, 2 and 3 (mainly located on face and hindquarters). In total, 63% of does were injured in the PGH group, while no injury were observed in IH group. This is in line with results of Rommers *et al.* (2014) who reported 52% of part-time group housed does (grouping from 18 d to 35 d of lactation) had injuries on the body and ears. The parity of does also influenced the injury of does ( $P < 0.05$ ), since more primiparous were injured (62% of 29 does) compare to multiparous (18% of 11 does). This agree with results of Mikó *et al.* (2013) who observed that the oldest doe attacked more often the younger females. In current study, the does have always been housed individually before experiment (mean parity 2.8 at D1), they may react to the new space, noises, smells or others animals (Morton et al., 1993), which could have favoured the continuous fighting.



**Figure 1:** Percentage of injured does in PGH group (n=32) during the grouping period.

Within the PGH group, the weight was lower in injured compared to healthy does at D1 (4151 vs. 4494 g,  $P < 0.05$ ), at D22 (4124 vs. 4558 g,  $P < 0.05$ ), at D34 (3984 vs. 4480 g,  $P < 0.05$ ) and at D69 (4347 vs. 4752 g,  $P < 0.01$ ). On the opposite, the litter size at birth (8.8 vs. 10.0, *NS*) and at weaning (9.1 vs. 9.3, *NS*), the kindling rate (65% vs. 75%, *NS*) and mortality of suckling rabbits (10.0% vs. 8.3%, *NS*) were similar between injured and non-injured females of PGH group.

### Use of platform and burrow by does

The platform provides more opportunities for movement and exercise thanks to the increased functional area. The percentage of does observed on platform was 32%, which was higher than in a previous study of ours (4%, Huang *et al.*, 2020). This could be explained by improvement of the platform design (positioned on the side and not in the middle of the housing; greater area) and age of does (parity averaged 2.8 in the current study vs. 6.4 in the previous study). In our study, primiparous does were observed more frequently on the platform than multiparous ones (35% vs. 23%;  $P < 0.001$ ). The moment in the reproductive cycle also affected the frequency of does on platform, more does

were observed on the platform during the last two weeks than the two first weeks of the trial (45.9% and 46.6% vs 28.1% and 21.3%;  $P < 0.001$ ). This confirmed that the platform offered does to distance from their kits once they leave the nest (Mikó *et al.*, 2012). The burrow was weakly used (2.2 vs 1 % in PGH and IG group;  $P < 0.001$ ), but in the PGH group, it was more used during the grouping period (3.1 vs 2.1%;  $P < 0.05$ ).

## CONCLUSIONS

The part-time group housing of reproductive does, by connecting 4 individual housing units through hatches located at the platform level resulted in aggressive behaviours, high level of injuries and decreased litter size at weaning. Thus, a fractionated habitat with a burrow providing hiding places for animal refuge did not prevent fighting between does nor injuries. The continuous fighting between does may be explained by the period of previous individual housing and the mixing of multiparous and primiparous does. Further studies are necessary to better manage the part-time group housing to reduce the aggressive interactions and maintain performance. Grouping familiar females is a way to explore.

## ACKNOWLEDGEMENTS

The authors thank the staff of GenPhySE rabbit experimental unit for the daily care of animals, members of 3L consortium for critical debates and Occitania region and EU (FEDER) for financial support.

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