World Rabbit Science

World Rabbit Sci. 2018, 26: 299-305
doi:10.4995/wrs.2018.9587

ARE COMBI PARKS JUST AS USEFUL AS REGULAR PARKS FOR FATTENERS FOR PART-TIME GROUP HOUSING OF RABBIT DOES?

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Abstract: Group housing of lactating rabbit does is desirable from a welfare standpoint, but agonistic behaviour can cause severe skin injuries, which are undesired for animal welfare. Park layout, creating hiding places and escape possibilities, may help redirect attention away from fighting, which could in turn help prevent skin damage. An experiment was performed to test whether more damaging behaviour would occur in a combi park (with nest box panels) after mixing, compared to a regular park for fatteners, as nest box panels would obstruct does when escaping aggressive interactions. In addition, the position of the PVC pipe underneath the platform differed between parks (longitudinal or transversal), resulting in different escape routes. Twenty-two parks were used, in which 5 does per park were grouped at 23 d of lactation until weaning at 36 d of lactation. Skin injuries were scored at 4 d after grouping and on the day before weaning. The presence of nest box panels in a combi park and the position of the PVC pipe underneath the platform did not affect the level of skin damage. Moderate to severe injuries were observed, mostly at the hind quarters, ears and head. Five to 6% of the does were severely injured (wounds). There was a positive relationship between the average skin injury per park at 4 d after grouping and at weaning. On average, average injury score per park increased from grouping to weaning, but there are differences between individual parks. From this experiment it can be concluded that group housing of lactating rabbit does involves animals getting injured. In fact, 5 to 6% of the does were severely injured (wounds). Social dynamics of group housed does are insufficiently understood and might be important to reduce damaging behaviour in group housing.

Key Words: rabbits, lactating does, group housing, skin injuries, social behaviour.

INTRODUCTION

In the Netherlands, there is high public concern about animal welfare in livestock farming. In commercial rabbit production, most fatteners are now housed in welfare improved housing systems, either in welfare cages or in so-called parks. The latter initiative is rewarded with a price premium by the retail. It is foreseen that group housing of rabbit does will be demanded by politicians and NGOs in the future, and might be rewarded by market partners (de Greef *et al.,* 2016).

Aggression between lactating does is the key issue that needs to be tackled before group housing of rabbit does is ready to be implemented in rabbit farms (Rommers and de Jong, 2005, 2010; Hoy and Verga, 2006; Andrist *et al.,* 2013; Szendro *et al.*, 2016). Fights between does mainly take place in the first days after grouping of unfamiliar does, when a dominance hierarchy needs to established. Fights to establish the hierarchy in a group can be seen as adaptive social behaviour of does. However, excessive fighting between rabbits leading to severe injuries and increased mortality is unacceptable in terms of animal welfare. Enrichment in the form of hiding places and escape possibilities helps redirect attention away from fighting, which could help prevent injury. Previous experiments by our group (Rommers *et al.,* 2013) showed that panels and PVC pipes seemed to provide good opportunities for escape.

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https://doi.org/10.4995/wrs.2018.9587

Parks equipped with wooden panels and PVC pipes could enable group housing of rabbit does with fewer injuries. In a previous pilot scheme at 2 commercial farms in the Netherlands (Rommers *et al.,* 2014b), does were part-time group housed successfully in parks for fatteners from 18 d or 21 d of lactation onwards. Only some superficial to moderate injuries were observed. However, mortality of rabbits during the fattening period was high (up to 25%).

In 5 successive pilot studies at a commercial rabbit farm in 2016, a combi park system was used, in which does can be housed individual until mixing. At mixing, the side walls were removed to create a park. Kits performed well in the group housing, as well as after weaning. However, the finding of previous experiments, demonstrating low levels of aggression between does, could not be confirmed. Substantial skin damage events were observed after mixing (Rommers and de Greef, 2017). In the fifth pilot, the combi park was adapted to a layout that is more comparable to a regular park for fatteners, as used in the study in 2014 (Rommers *et al.,* 2014b). This final pilot suggested that the level of aggression in the earlier pilots was caused by the layout of the combi park, and that combi parks thus needed to be adapted to prevent high levels of aggression (Rommers and de Greef, 2017). In all pilots, skin injuries were less severe at weaning than 4 d after mixing, and mortality of the rabbits after weaning was limited (Rommers and de Greef, 2017). Thus, aggression between does after mixing, resulting in skin injuries, seems the main technical issue to be resolved for successful part-time group housing of does with kits.

The current experiment was performed to test whether or not the layout of the combi park was indeed the bottleneck for aggression among rabbit does after mixing at 23 d of lactation. We hypothesised that removing the nest box panels would reduce aggression. In the former nest box areas, does could get stuck and nest box panels would obstruct does in escaping from aggressive interactions. Two different types of parks were tested: parks with nest box panels and parks without nest box panels (park model for meat rabbits)

MATERIALS AND METHODS

Ethical statement

Mixing of animals is known to elicit agonistic interactions, in which animals can cause damage (scratches, biting wounds) to each other. In an earlier pilot in comparable conditions, no substantial damage was observed (Rommers and de Greef, 2014b). Husbandry optimisation is regarded as one of the key factors in minimising negative consequences of agonistic interactions. The housing of the grouped animals provided shelter for animals to evade each other. Management instructions contained directives to monitor problems among animals and instructions to remove damaged animals when necessary.

The work in present project series was classified (23-3-2015) by the Animal Ethical Committee Welfare Body as not being an animal experiment under the law 'Wet op de Dierproeven' (Directive 2010/63/EU).

Animals and housing

The experiment was performed from April until June 2017 using 110 multiparous lactating does (Hycole), which were artificially inseminated 11 d postpartum. The experiment was conducted at a commercial rabbit farm with 600 does and offspring in one compartment. The compartment contained 528 individual welfare pens for does. After weaning, these individual pens were merged into 88 so-called combi parks for fatteners. Parks were set up in the compartment in 8 rows of 11 cages. In the experiment, 2 rows (22 parks) were used.

A combi park is composed of 6 individual pens for lactating does. Each pen was 38 cm wide and 100 cm deep and was open at the top. A slatted platform of 40 cm width was mounted at 25 cm above the floor. The slatted floor and platform were made out of plastic (Meneghin, Italy). A nest box (25×38 cm; long×wide) could be placed in the front part of the pen. Each pen had 2 drinking nipples and a feeder. Roughage was provided by a pressed straw roll that was put in the pen. A combi park was created by taking out the side walls, creating a floor surface of 2.28 × 1.00 m. The combi park was open at the top. Two wooden panels and a PVC pipe were placed beneath the platform, providing the does with possibilities to escape. In the current experiment, we housed 5 does per combi park. At mixing, all does were transferred to another combi park. This was done to avoid aggression among does that may be related to does defending the range where their nest had been, although earlier work did not confirm this behaviour (Rommers *et al*., 2014).

Treatments

1. Effect of nest box panels: The nest box panels remained in or were removed from the combi park (see Figure 1a and 1b). When the panels were removed, the combi park stood as model for a regular park for fatteners, as used in a previous study (Rommers *et al.,* 2014b).
2. Effect of the location of the PVC pipe beneath the platform: The PVC pipe was placed in transversal or longitudinal direction underneath the platform in between the 2 wooden panels. The idea behind this is that the position of the pipe influences escape/hide possibilities.

Table 1 gives an overview of the different treatments and number of replicates.

The experiment was concluded at weaning (36 d of lactation).

Figure 1a: Combi parks with nest box panels.

Figure 1b: Combi parks without nest box panels, standing model for fattening park.

Measurements

Skin injuries: all does were scored for skin injuries the day before mixing, at 4 d after being mixed and at weaning (at 36 d of lactation). A scoring system (Kalle, 1994) was used differentiating: 0=none, 1=superficial, 2=moderate and 3=severe (wound) skin injuries on different parts of the animal (head, ears, body, limbs, tail and genitals). For each doe, the highest score of the rabbit was used for further analysis.

Statistical analysis

The combi park was the experimental unit

Skin injuries: the average injury score per park was calculated and used for statistical analysis. First, we tested whether or not the average injury score per park was normally distributed using the UNIVARIATE procedure of SAS (version 9.4). This was indeed the case and average injury score was analysed using the GLM procedure of SAS (version 9.4) with presence of nest box panels and position of the PVC pipe as factors.

To test whether or not there was a relationship between the average skin injury per park at four days after mixing and at weaning, the Regressive procedure of SAS (version 9.4) was used.

RESULTS

Two does died in the period between mixing and weaning (one doe in the combi park with nest box panels and transversal position of the PVC pipe, and one doe at the combi park without nest box panels and longitudinal position

Table 1: Overview of the treatments tested and number of replicates (group pens with 5 animals each).

Presence of nest box panels/Position of PVC pipe	Absent	Present	Total
Transversal	6	6	12
Longitudinal	5	5	10
Total	11	11	22

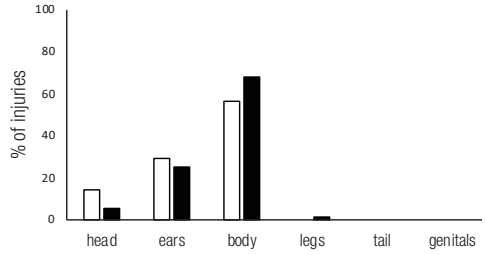

Figure 2: Position of skin injuries on the does. ☐ 4d-mixing; ■ weaning.

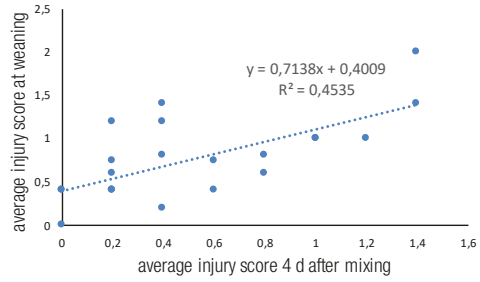

Figure 3: Relationship between average injury score per park four days after mixing and at weaning based on the highest injury score of the rabbit.

of the PVC pipe). No visual signs of aggression were noticed on their bodies. No dissection was applied, so the reason for death is unclear.

Skin injuries

Most of the injuries (71%) are observed on the body, mostly at the hindquarters, 22% at the head and 7% at the ears (Figure 2). At the legs, tail and genitals almost no injuries were observed. The injuries at the ears were only observed in does housed in the combi parks with nest box panels, whereas at the combi parks without nest box panels no injuries at the ears were observed. For the other limbs, there were no differences observed between treatments.

Table 2 presents the analysis of the average injury score per park. There were no differences between treatments. So, no effect of nest box panels or position of the PVC pipe underneath the platform on skin injuries was found.

A significant ($P<0.001$) relationship between the average injury score per park at 4 days after mixing and at weaning was found (Figure 3). The trend line (y=0.7138 x+0.4009) indicates that higher scores at mixing generally coincide with higher scores at weaning. Comparing this trend line with the y=x-line reveals that the trend line is higher than the y=x-line for the whole data range. This indicates that later damage scores (at weaning) are systematically higher than earlier scores (4 d after mixing).

Injured does per park

Besides the average skin injury scores, the number of does that were injured per pen was also calculated. Table 3 shows the number of does with skin injuries, 4 d after mixing (see Table 3a) and at weaning (Table 3b). Four days after mixing, 65% of the does were uninjured, 20% had only superficial injuries (scratches), 8% had moderate injuries, and 5% had severe injuries (wounds) as the highest injury score. At weaning these percentages were increased. Thirteen per cent of the does were moderately injured and 6% had wounds.

DISCUSSION

The hypothesis of this experiment was that part-time group housing in combi parks results in more agonistic interactions by does getting stuck in the former nest box areas and this would obstruct does in escaping from aggressive interactions. Therefore, in parks with nest box panels more skin damage would occur than in group

Table 2: Average injury score (least squares means±standard error) for parks with or without nest box panels and PVC pipe transversal (trans) or longitudinal (long) placed underneath the platform.

Nest box panels	with	with	without	without	*P*-value panels	*P*-value pipe	*P*-value Panels×pipe
PVC pipe	trans	long	trans	long			
4 d after mixing	0.63±0.19	0.44±0.21	0.49±0.19	0.64±0.21	0.93	0.91	0.29
At weaning	0.89±0.20	0.60±0.22	0.66±0.20	0.95±0.22	0.77	0.98	0.18

Table 3a: Number and percentage of injured does for the different treatments at 4 d after mixing according to the severity of injury (based on the highest injury score per doe).

Nest box panels	with		without		
Position PVC pipe	transversal	longitudinal	transversal	longitudinal	Total
Number of does:					
Score 0	17 (56%)	17 (68%)	23 (77%)	16 (64%)	73 (66%)
Score 1	9 (30%)	6 (24%)	3 (10%)	4 (16%)	22 (20%)
Score 2	2 (7%)	1 (4%)	3 (10%)	3 (12%)	9 (8%)
Score 3	2 (7%)	1 (4%)	1 (3%)	2 (8%)	6 (5%)

housing in regular fattener parks. However, in the present experiment we found that neither the nest box panels nor position of the PVC pipe reduced skin damage. In both park types, moderate to severe skin injuries were observed.

In a former pilot study, removal of the nest box panels in a combi park, creating a layout more comparable to that in regular fattening parks, reduced the severity of the skin injuries. Presence of the nest box panels walls in the combi park was thought to hinder does escaping from aggressive interactions after mixing, resulting in more skin damage.

According to the former study, in which we studied the agonistic behaviour among does during group housing (Rommers *et al.,* 2011), we observed that does could seek each other out to fight. Somehow the ranking order needs to be established, even though there are escape possibilities present. This implies that damage due to social conflicts will occur. Previous experiments at our institute (Rommers *et al.,* 2005, 2010, 2014), as well as from others (Andrist *et al.,* 2013; Maertens and Buijs, 2016), show that group housing repeatedly resulted in moderate to severe skin injuries.

Minor injuries like scratches will heal within a couple of days (Kalle, 1994) and do not need that much attention. However, this is not the case with moderate and severe injuries, as deeper tissue is damaged. In our study, 5 to 6% of the does were severely injured (score 3, wounds). According to Andrist *et al.* (2013), skin injuries can vary between farms; our data were collected at one farm.

In an earlier work, less moderate to severe injuries were observed at weaning compared to few days after mixing (Rommers and de Greef, 2017), which is in agreement with other studies (Andrist *et al.,* 2012; Zomeño, 2017). However, in the current experiment the severity of the skin injuries increased from four days after mixing until weaning, as shown by the significant trend lines. There is no obvious explanation for this. From an ethological point of view, this is not expected, as damaging aggressive interactions should be reduced after a social hierarchy is set. It also contrasts with the results of the mentioned 5 earlier pilots (Rommers and de Greef, 2017). In this dataset, the later scores were generally lower than the scores 4 d after mixing, with a trend line amounting to 0.4168 x+0.4124 (r2=0.22). Thus, there is considerable variation among parks, but the general (significant) trend in this variability is different in the present experiment (increasing damage in time) than expected from social interactions and observed in earlier work (decrease of damage in time). Social dynamics in the parks with relatively high incidences of wounds deserve deeper analysis.

The question arises of whether management measures can be taken to minimise negative social interactions. Buijs *et al.* (2016) tried to access the character of a doe by using the ano-genital distance in young rabbits and studied its relation to adult agonistic behaviour. Female rabbits with a greater ano-genital distance at birth showed more

Table 3b: Number and percentage of injured does for the different treatments at weaning according to the severity of injury (based on the highest injury score per doe).

Nest box panels	with		without		
Position PVC pipe	transversal	longitudinal	transversal	longitudinal	Total
Number of does:					
Score 0	10 (35%)	14 (56%)	16 (53%)	11 (46%)	51 (47%)
Score 1	13 (45%)	8 (32%)	9 (30%)	7 (29%)	37 (34%)
Score 2	5 (17%)	2 (8%)	4 (13%)	2 (8%)	13 (12%)
Score 3	1 (3%)	1 (4%)	1 (3%)	4 (17%)	7 (6%)

offensive agonistic behaviour upon grouping as adults. They concluded that the ano-genital distance measurements may be useful when selecting less aggressive breeding rabbits, which may be helpful to breed rabbits suitable for group housing systems.

There are indications that group stability has an effect on agonistic interactions and skin lesions (Andrist *et al.,* 2012). Group composition could be another factor providing an intervention tool to minimise agonistic interactions. In our experiment we used a homogeneous population of lactating does. They were all multiparous and pregnant of the following litter. This might not be the optimal group composition compared to a stable group hierarchy. To our knowledge, there is only little information about group composition. Pilots performed by Maticz *et al.* (2017) indicated that mixing young does with a multiparous doe resulted in fewer skin injuries as compared to mixing does of similar age.

Earlier grouping before kindling, so that does become acquainted, might also be a factor that can be taken into account. According to Zomeño *et al.* (2017), aggressive interactions were reduced when does were grouped beforehand, from eight to 2 d before kindling. Group housing during rearing, in order to prepare the does for group housing in production, might be worthwhile investigating. Finally, there could be genetic differences in social behaviour which are as yet unknown.

Part-time group housing of lactating rabbit does also has some positive effects. Positive social interactions can be observed, such as grooming of group mates and resting in close body contact with each other (Rommers *et al.,* 2011). In group housing systems, animals have more space to move and can perform normal locomotion, like hopping and running. In addition, more enrichment material, such as pipes and panels can be offered. Nevertheless, it seems inevitable that with the current rabbit breeds, group housing will result in moderate to severe injuries. It remains an ethical discussion whether or not the positive effects of group housing outweigh the presence of severe injuries that have a clear negative impact on rabbit welfare.

CONCLUSIONS

1. Part-time group housing of lactating rabbit does is associated with occurrence of moderate to severe skin damage. In our study, 5 to 6% of the does were severely injured and had wounds.
2. There was a positive relationship between the average skin injury per park at four days after grouping and at weaning. On average, the mean injury score per park increased from grouping to weaning, but there were differences between individual parks.
3. The presence of nest box panels in a combi park as well as the position of the shelter pipe underneath the platform did not affect the level of skin damage.
4. Social dynamics of group housed does is insufficiently understood to further reduce damaging behaviour.

Acknowledgement: This study was financed by the PPS "Duurzame konijnenhouderij" (TKI-AF-15234) and the Ministry of Economic Affairs. We thank Mr and Mrs Slegh, at whose farm the experiment was conducted. Without their help this experiment would not have been possible.

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