



# Effects of communal rearing and group size on breeding rabbits' post-grouping behaviour and its relation to ano-genital distance



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## ABSTRACT

Group housing is becoming the standard for many farm animal species, as it is seen as a more welfare friendly way of keeping gregarious animals. Aggression between female breeding rabbits currently obstructs the implementation of group housing for this species. Lack of social experience during the rearing period may be one reason why breeding rabbits can act (excessively) aggressive when grouped as adults. To study this, we either reared breeding rabbits with their same-litter siblings and mother only ("litter-only") or reared four litters and their mothers together from 18 days of life on ("communal rearing"). The litter-only rabbits were born from individually housed mothers, whereas the communally reared rabbits were born from mothers that were group housed during the last three weeks of gestation. After their first kindling, female rabbits from both rearing strategies were housed in groups of four or eight individuals (at an equal space allowance per doe) to assess rearing and group size effects on post-grouping behaviour. Within both treatments we also measured the ano-genital distance at birth (an indicator of masculinization) and studied its relation to adult agonistic behaviour. Communal rearing and larger groups were expected to decrease agonistic behaviour and wounding, whereas rabbits with a longer ano-genital distance were expected to show more offensive agonistic behaviour. The first two hypotheses were not confirmed. Communally reared and litter-only rabbits did not differ significantly in the frequency of their offensive or defensive agonistic behaviour directly post-grouping, or in the severity of wounds sustained in the first three days after grouping ( $P > 0.10$ ). Communally reared rabbits sniffed/groomed their pen mates less often than litter-only rabbits ( $P < 0.05$ ). A tendency for a higher frequency of offensive agonistic behaviour in larger groups was found ( $P < 0.10$ ) and the decrease in defensive agonistic behaviour over time that was observed for the smaller groups was lacking in the larger groups. The third hypothesis was confirmed: female rabbits with a greater ano-genital distance at birth showed more offensive agonistic behaviour upon grouping as adults ( $r_s = 0.5$ ,  $P < 0.05$ ). When this relation was studied within the separate rearing strategies, it was only confirmed within the communal rearing treatment, possibly suggesting that prenatal social stress increased both ano-genital distance and aggression. To conclude, communal rearing and larger groups did not decrease agonistic behaviour in breeding rabbits, whereas ano-genital distance measurements may be useful when selecting less aggressive breeding rabbits (although this method may be specifically applicable to communally reared rabbits).

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## 1. Introduction

Over the last decades there has been a trend towards group housing for many farm animal species. Adult female breeding rabbits are still almost exclusively housed separately from each other, but the interest in group housing is increasing. However, one of the problems in group housing of breeding rabbits is that they can

be quite aggressive towards each other, leading to a high percentage of wounded animals (Andrist et al., 2013). Semi-group housing systems for breeding rabbits have been developed in an attempt to decrease aggression. In such systems, breeding rabbits are separated shortly before parturition until several weeks later, to be grouped again afterwards until shortly before their next kindling. This means that they cannot fight and wound each other at the time of the reproductive cycle they are most likely to do so. Also, they cannot kill or wound each other's litters when these are still very young, immobile and vulnerable (a behaviour observed both in wild (Kunkele, 1992; Rodel et al., 2008) and commercial breed-

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**Table 1**  
Summary of housing and procedures for the different treatments. During the highlighted phases, communally reared rabbits (or their parent stock) had more exposure to unfamiliar rabbits than litter-only rabbits.

Age (wk)	Treatment		Procedures
	Communal rearing	Litter-only rearing	
–7 to –4	P.stock <sup>a</sup> individual <sup>b</sup>	P.stock individual <sup>b</sup>	Insemination of p.stock
–4 to –1	P.stock in groups of 4 <sup>b</sup>	P.stock individual <sup>b</sup>	Weaning of the litter previous to exp. rab. <sup>c</sup>
–1 to 2	P.stock individual with own litter of exp. rab.	P.stock individual with own litter of exp. rab.	Ano-genital distance exp. rab Birth weight exp. rab Insemination of p.stock
2 to 4	P.stock in groups of 4 with 4 litters of exp. rab.	P.stock individual with own litter of exp. rab.	
4 to 12	Exp. rab in groups of 4 litters	Exp. rab. with same-litter siblings	Weaning by removing p.stock Removal of males
12 to 16	Exp. rab in groups of 4 rabbits	Exp. rab individual	Exp. rab. moved to new pen
16 to 17	Exp. rab individual	Exp. rab individual	Insemination of exp. rab.
17 to 21	Exp. rab in groups of 4 rabbits	Exp. rab individual	
21 to 24	Exp. rab individual <sup>d</sup>	Exp. rab individual <sup>d</sup>	Kindling of exp. rab. Insemination of exp. rab.
24 to 27	Exp. rab in groups of 4 or 8 with their litters	Exp. rab in groups of 4 or 8 with their litters	Behavioural observations Wound scoring

<sup>a</sup> P.stock = parent stock.

<sup>b</sup> With their own litter previous to the experimental litter for part of this period.

<sup>c</sup> Exp. rab = experimental rabbits.

<sup>d</sup> With their own litter for part of this period.

ing rabbits (Szendro and McNitt, 2012)). However, post-grouping aggression and wounding are still common in these semi-group systems (Buijs et al., 2015; Rommers et al., 2014).

One reason why female breeding rabbits show high levels of aggression when grouped may be that the breeding rabbits used for group housing experiments are generally bred in individual systems themselves. This means that during their pre-reproductive phase they are only exposed to their own mother and same-litter siblings. This may not prepare them sufficiently for regrouping with unrelated animals at a later age. However, if group housing is combined with current management practices, this will lead to frequent regrouping as does that do not become pregnant upon insemination are currently moved to different production groups (in order to inseminate them again at an earlier time than those that did become pregnant). Even the introduction of one unfamiliar individual in an otherwise stable group can lead to an increase in aggression towards both the unfamiliar animal and the resident rabbits (Farabollini et al., 1991). In pigs it has been shown that exposure to non-littermates prior to weaning can decrease post-weaning aggression, accelerate post-weaning hierarchy formation and decrease skin lesions (D'Eath, 2005; Kutzer et al., 2009). It is unknown if similar effects can be achieved for rabbits, but if so, rearing them in a communal system (thus exposing litters to each other at an early age) could facilitate the successful implementation of group systems for adult breeding rabbits. Pre-weaning exposure to non-littermates is unlikely to cause conflict between young rabbits as these are generally non-aggressive (Verga et al., 2006) and show a strong tendency to huddle rather than to avoid each other (Princz et al., 2008).

Alterations in group size may also affect aggressive behaviour. If space allowance per animal is kept constant, larger groups will have more space available in total, which would allow individuals to withdraw further from aggressive conspecifics. This could be expected to reduce agonistic behaviour. Conversely, larger groups have more hierarchy positions to resolve, which may call for increased agonistic behaviour in larger groups (Arey and Edwards, 1998). Research on the effects of group size on aggression in captive breeding rabbits is currently lacking and therefore we formulated our group size hypothesis based on existing knowledge obtained in a highly experimental and wild setting, respectively. Non-breeding

adult laboratory rabbits tested in pairs are less aggressive when their first pairing occurs in a larger pen (Valuska and Mench, 2013) and research on wild populations suggests that female rabbits are more aggressive in smaller groups (Myers et al., 1971). Together, this would suggest that in larger groups breeding rabbits should be expected to show less aggression, assuming that behaviour in highly experimental and wild settings can be extrapolated to breeding rabbits in a husbandry setting.

A third way to reduce aggression could be to select less aggressive animals for group housing. To do so, a reliable pre-grouping indicator of adult aggression would be required. In this study, the use of ano-genital distance at birth was evaluated for this purpose. This was based on the knowledge that masculinization of female rabbits due to their intra-uterine position increases ano-genital distance (Banszegi et al., 2010) and that in other species the same process leads to increased adult aggression (Cohen-Bendahan et al., 2005; Gandelman, 1980).

To study the effects of previous social experience on the behaviour of adult female breeding rabbits, two rearing strategies were used. "Litter-only" rabbits were reared with littermates and their mother only and housed individually as sub-adults (as is commercial practice). "Communally reared" rabbits were reared in groups of four litters and their mothers from 18 days of age on and were housed in groups as sub-adults. After their first kindling, rabbits from both rearing strategies were housed in groups of either four or eight rabbits and their litters, at an equal space allowance per breeding rabbit. The communally reared rabbits and rabbits from larger groups were expected to show fewer agonistic interactions and sustain fewer wounds than litter-only rabbits and rabbits from smaller groups. Individuals with a shorter ano-genital distance at birth were expected to initiate fewer agonistic interactions when grouped as adults.

## 2. Methods

All procedures were approved by the ILVO ethical committee for the use of animals in research. Table 1 gives an overview of housing and procedures which are clarified further in the next sections.

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