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Behaviour, wounds, weight loss and adrenal weight of rabbit does as affected by semi-group housing

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ABSTRACT

Group housing is often assumed to improve the welfare of gregarious species. Whether this is actually the case depends on the advantages (e.g. more opportunity for social and locomotor behaviour) and disadvantages (e.g. increased fighting and wounding) induced by the specific housing type. We evaluated the effects of a semi-group system (grouping four does for half of each reproductive cycle) on welfare by comparing it to single-doe cages. Compared to this control, our semi-group system provided more total space when does were grouped and more space per doe (a confounding deemed necessary to avoid overt aggression). Thus, the results should be interpreted as a systems comparison. In each of the four experimental cycles semi-group does were housed separately for 21 days around parturition and housed in newly assembled groups for the next 21 days. Behaviour was observed in semi-group and single-doe systems immediately after the second time semi-group does were mixed, and during five timeslots divided over the second experimental cycle. Skin lesion and weight loss were determined in each cycle. Adrenal weight was measured post-mortem. Semi-group systems with different floor types were included but floor type effects were scarce and semi-group systems were therefore treated as one category. In the timeslot subsequent to mixing semi-group does spent a greater percentage of their time on locomotion (4.3 vs. 0.7%, $P<0.01$) and social sniffing/grooming (1.4 vs. 0%, $P<0.01$) than does in single-doe cages. Such differences also occurred in later timeslots, but were much smaller (e.g. midnight locomotion D12: 0.8 vs. 0.2%, $P<0.05$, midnight social sniffing/grooming D12: 0.4 vs. 0%, $P<0.01$). Attacking/chasing followed a similar pattern (following mixing: semi-group 5.3% vs. single 0%, $P<0.01$; midnight D12: 0.01 vs. 0%, $P<0.10$). A high percentage of semi-group does were slightly (58%) or severely (20%) wounded. Semi-group does spent a smaller percentage of the timeslot following mixing in bodily contact with adults than does from single-doe housing (who could only make contact through the wire walls, 1.6 vs. 11.8%, $P<0.01$). Even 12 days after mixing the percentage of time semi-groups spent in bodily contact did not exceed that in singles ($P>0.10$). In experimental cycle one only, semi-group does lost more weight during late lactation than singles (192 vs. 10 g, $P<0.01$). Adrenal weights did not differ between systems ($P>0.10$). Further research will be needed to design semi-group systems with a more favourable balance between advantages and disadvantages.

1. Introduction

Group housing of gregarious animals increases opportunities for social behaviour and behaviours facilitated by more total space. However, group housing often means that animals are forced into groups without being able to switch between or retreat from these. Furthermore, animals are often regrouped to facilitate husbandry efficiency. Such forced membership of unstable groups may lead to fighting and social stress (Noller et al., 2013; Paredes et al., 2006). Although providing more (total) space than individual housing, group pens still restrict animals to a much smaller area than used by their wild conspecifics (e.g. home ranges of wild female rabbits are reported to vary between 600 and 8000 m^2, Myers and Poole, 1961, whereas group systems usually offer between 1.5 and 9 m^2, Rommers et al., 2006; Stauffacher, 1992). Whether social and spatial restraints become problematic in group housing depends,

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amongst others, on the reasons for social attraction in the wild, the animals' ability to thrive in any kind of group and the underlying reason for space use in the wild. For instance, animals with a strong motivation to explore or patrol a large home range are likely to suffer when kept in spatial restriction (Clubb and Mason, 2007). However, if a species' space use is mainly driven by acquiring enough nutrients, as for instance in wild rabbits (Lombardi et al., 2007), it is unlikely to reflect space needs in captivity where food is supplied ad libitum. Similarly, group formation in the wild is not always the result of high sociality (Macdonald, 1983) whereas specifically highly social animals are likely to suffer from individual housing. As such, whether or not group housing actually improves welfare depends on the species as well as the system.

Reproduction does used to breed meat rabbits are commonly housed "individually". Such housing is not truly individual, as kits are present most of the time. Therefore it is called "single-doe housing" in this article. Single-doe cages (usually between 2400 and 4000 cm^2) likely to restrict does' locomotion severely, as does can traverse the full cage length in a single hop (EFSA, 2005). They also limit inter-doe physical contact to tactile contact through the wire walls. This contrasts sharply with natural conditions, where does live communally (Mykytowycz and Rowley, 1958). Non-breeding laboratory rabbits prefer large group pens over small individual ones (Held et al., 1995) and can be grouped without causing overt aggression (Fuentes and Newgren, 2008; Held et al., 1995; Turner et al., 1997) or stress (Whary et al., 1993). Designing group systems for breeding rabbits is more difficult, as these are constantly either pregnant or lactating (and often both). Wild rabbits usually kindle and suckle their young away from their social group (Mykytowycz and Rowley, 1958) and breeding rabbits may also want to leave their groups at such times. Furthermore, does are more aggressive when close to their nests (Rödel et al., 2008). Due to space limitations in most group systems does are generally close to their nest, increasing the likelihood of social stress and wounding. Andrist et al. (2013) report that on commercial farms, 34% of group housed does had wounds.

In semi-group housing does are separated a few days before kindling to be grouped again 2–3 weeks later. This means that does cannot fight at the time of the cycle they are most likely to do so, and that they cannot destroy each other's young, vulnerable litters (a behaviour observed both in wild (Künkele, 1992; Rödel et al., 2008) and commercial does (Szendro and Mcnitt, 2012)). When regrouped, does have access to more space and adult social partners. Data on how such systems affect welfare are scarce. Repeatedly separation and regrouping may cause social stress, especially when group composition varies (which is likely in practice). Also, separating does around kindling may actually increase aggression at regrouping (Andrist et al., 2013). Rommers et al. (2014) found that 52% of semi-group housed does were wounded.

We studied behaviour, wounding, weight loss and adrenal weight of does in single-doe housing and in semi-group housing. Semi-group housing was hypothesized to increase affiliative and locomotor behaviour, but also to increase agonistic behaviour and wounding. For weight loss and adrenal weight two-sided hypotheses were formulated. These might decrease in semi-group housing due to a more appropriate social situation, or to increase due to forced membership of an unstable group. Weight loss could also increase due to additional exercise or reluctance to feed.

2. Methods

All procedures were approved by the ILVO ethical committee for the use of animals in research.

The study only evaluated doe welfare, without assessing the impact on the welfare of the kits. Effects on kit temperament are described in Buijs and Tuyttens (2015).

Table 1
Overview of husbandry procedures and data collection during the 42-day long reproduction cycles.

Days post-kindling	Procedure
–3	Does moved to new cage or new separate unit of semi-group pen
0	Kindling
11	Insemination[a]
18	Wound scoring and weighing (baseline) Grouping of does in semi-group housing treatments Daytime video recording for behavioural analysis[b]
19	Nighttime video recording for behavioural analysis[b]
22	Nighttime and daytime video recording for behavioural analysis[b] Wound scoring
30	Daytime video recording for behavioural analysis[b]
31	Nighttime video recording for behavioural analysis[b]
32	Weighing and weaning (does moved to other room in existing groups)
39 = –3	

[a] Does were not inseminated in the last cycle.
[b] Cycle 2 only.

2.1. Animals and husbandry procedures

Seventy-two 29-week-old Hycole does (Hycole, Marcoing, France) were allotted randomly to one of three housing treatments (see below) 3 days before their second kindling. The does remained in their treatment for four consecutive reproduction cycles, although they were moved to another cage or pen twice per 42-day-long cycle (Table 1): at 32-days post-kindling they were moved to wean their young (which remained in their native cage or pen at this time), and at 39 days post-kindling they were moved to form new groups of unfamiliar does for the next experimental cycle. These new groups of unfamiliar does were created because not all does became pregnant upon insemination, and these does were replaced with animals from a spare compartment (within treatment). This follows the procedure in commercial rabbit husbandry, where non-pregnant does are moved to different production groups. To prevent heterogeneity in activity between our groups resulting from the replacement of non-pregnant does in some of the groups, all does were moved to a different cage or pen to create new groups of unfamiliar does in each pen each cycle. Animals in single-doe housing were also moved to a new cage at weaning and at 39 days post-kindling (when they were placed next to unfamiliar does) to avoid the incorrect attribution of the effect of moving itself to the housing system. Conditions in the spare compartment were the same as in the experimental room (semi-group housing or single-doe housing on wire or plastic according to each doe's experimental treatment, same space allowance and light and temperature regimen). Does had ad libitum access to a commercial pelleted rabbit feed (17.0% crude protein, 16.2% crude fibre and 10.3 MJ digestible energy). However, non-pregnant, non-lactating animals in the spare compartment were limited to 140 g per day to prevent obesity. Water and a simple cage enrichment (a wooden gnawing block fixed to the side wall of the cage or pen) were available continuously to all does. Underpressure ventilation and a central heating system were used to achieve a stable climate (mean temperature 16.9 ± 2.1 °C SD, mean relative humidity 56 ± 9% SD).

2.2. Housing treatments

Three housing treatments were included in the experiment: single-doe cages with a wire floor, semi-group pens with a wire floor and semi-group pens with a plastic slatted floor. Twenty-four does were housed in each housing system. Bodyweight at the start and end of the experiment did not differ significantly between the treatments (start: $F_{1,70} = 0.03$, $P = 0.85$, mean: 4.7 kg ± 0.4 SD, end: