



Evaluating the effect of semi-group housing of rabbit does on their offspring's fearfulness: can we use the open-field test?



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ABSTRACT

Breeding does are usually housed one doe per cage, but there is an increased interest in (semi-)group housing systems designed to improve welfare. However, there is a lack of information on how such systems actually affect different aspects of rabbit welfare. We aimed to discern differences in fearfulness in female offspring born and raised in conventional single-doe housing (1 doe + litter/cage) and in semi-group housing (1 doe + litter/cage until the litter was 18 days old, 4 does + 4 litters/pen thereafter). To this goal, we used the most commonly used test to assess fearfulness in rabbits: the open-field test. The classic interpretation of this test is that increased locomotion indicates decreased fearfulness. However, other underlying motivations for open-field locomotion have been proposed for other species (e.g. exploration and sociality). The underlying motivation is of great importance to interpret test results in terms of welfare. Therefore, the second aim of this study was to determine if fearfulness was the most likely cause of differences in rabbits' open-field behaviour, by assessing its development over time, repeatability and relationship to other behavioural tests (novel object test, social runway test). Rabbits born in the semi-group environment travelled less distance ($p = 0.03$) and were slower to leave the start corner during the open-field test ($p = 0.001$). They reared less during a novel object test ($p = 0.03$), but were not significantly slower to approach the object than offspring from the single-doe environment, and did not behave differently during a social runway test ($p > 0.10$). Although differences in open-field locomotion were found, the decrease in locomotion over consecutive test sessions contradicts that this behaviour is (exclusively) mediated by fearfulness in the rabbit. Exploratory motivation seems a more accurate interpretation. This greatly limits the usefulness of open-field locomotion as a welfare indicator in this species.

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1. Introduction

Breeding rabbits are usually kept individually, both in laboratory and farm environments. However, this practice is increasingly being scrutinized because of its potential negative impact on animal welfare, because individual cage housing impedes social behaviour and restricts the

possibility and incentive for locomotion (EFSA, 2005). Because continuous group housing can cause problems like infanticide, infertility and excessive fighting in breeding rabbits, attention is currently shifting to semi-group housing systems (Andrist et al., 2012). In such systems breeding rabbits are housed in groups intermittently, separating them prior to kindling until some days after insemination (in this interval doe–doe and doe–kit aggression peaks and kits are most vulnerable to attacks). Because the offspring live in the doe's housing at least until weaning, using a semi-group system alters both their pre-natal and

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post-natal conditions. Considering pre-natal conditions it is known that exposing pregnant rodents to unfamiliar individuals results in more fearful offspring (Kaiser and Sachser, 2005). In semi-group housing, groups are unlikely to be stable (because does that do not become pregnant upon insemination are removed for re-insemination sooner than pregnant ones and added to a new group). Thus, although the semi-group system is designed to improve welfare, the regular regrouping of breeding does may lead to more fearful offspring. Post-natally the offspring from semi-group housed does experience a more complex social environment (as several litters are reared together). Total space allowance is also greater in semi-group housing than in single-doe housing (even if the space per individual remains the same). This may be expected to lead to less fearful offspring, as Trocino et al. (2013) showed that rabbits housed in larger groups post-weaning moved more in the open-field (which was interpreted to indicate that they were less fearful). In this study, we aimed to determine how semi-group housing affected fear levels. As such, the effects presented in this article are the result of a combined pre- and post-natal phase which cannot be disentangled.

The most common test to evaluate fearfulness in rabbits is the open-field test (during which an animal is placed in social isolation in a novel arena). Originally, it has been assumed that greater locomotion reflects decreased fearfulness (Hall, 1934). However, it has since been remarked that the interpretation of this test is complex and species dependent, as more movement may also indicate a stronger motivation to explore the novel surroundings, or to reinstate contact with conspecifics (Forkman et al., 2007; Gallup and Suarez, 1980; Vandenheede et al., 1998). Discerning between these different underlying causes for open-field behaviour is important, because whilst fear clearly has a negative impact on welfare, the impact of a decreased need for exploration or social contact is not so clear. Therefore, the second aim of this study was to determine if fearfulness was the most likely cause of differences in rabbits' open-field behaviour.

Assessing the development of open-field behaviour in consecutive sessions that are not too far apart in time (e.g. daily) may aid in interpretation of the observed behaviour, as fear would be expected to decrease as the novelty of the situation decreases (i.e. in later tests), thus leading to an increase in movement. In contrast, if increased locomotion in the open-field is the result of a stronger exploratory motivation, locomotion would be expected to decrease in later tests as the surroundings become less novel and thus less worthy of exploration. If open-field behaviour is strongly motivated by the novelty of the situation (whether this causes anxiety or exploration) there may be little correlation between a first and subsequent open-field sessions, as during the second session the situation is no longer completely novel (Forkman et al., 2007). If open-field locomotion is caused by a motivation to reinstate contact with the conspecifics from which the animal is isolated, it could be expected to either remain stable over time (as animals remain just as isolated in subsequent tests) or to decrease (because the animal learns that it lacks the possibility to effectively regain contact).

These predictions are summarized in Table 1. The literature on the development of open-field behaviour over time in rabbits is currently contradictive, with some authors (Buijs et al., 2013; Hernandez, 1985; Klemm and Dreyfus, 1975; Powell et al., 1978) reporting decreased movement or increased movement latencies in later tests, whilst others reported the opposite effect (Daniewski and Jezewski, 2003; Kowalska et al., 2008; Meijsser et al., 1989).

Studying relations between the open-field test and other behavioural tests can also aid in the interpretation of open-field behaviour. Therefore, we studied the correlation between behaviours in the open-field test, the novel object test and the social runway test. Our predictions on the correlations to open-field locomotion are summarized in Table 1. The novel object test resembles the open-field test in that the animal is exposed to a novel stimulus, which may cause fear and trigger exploratory behaviour. Animals that approach the novel object quicker or show fewer signs of immobilization in its presence are considered to be less fearful or more explorative (Forkman et al., 2007). As such, under the assumption that locomotion in the open-field reflects decreased fearfulness or an increased motivation for exploration, it should correlate negatively with the latency to approach a novel object, and positively with activity in the presence of the novel object. During a social runway test (mainly used in poultry) animals are also subjected to novel surroundings. But here they are not placed in social isolation as they can traverse the runway to approach a conspecific. A shorter latency to approach the conspecific and more time spent in the area close to the conspecific are seen as indicators of a greater motivation for social contact (Vaisanen and Jensen, 2003). Thus, if rabbits' open-field locomotion reflects an increased motivation to reinstate contact with conspecifics, it would be expected to correlate negatively with the latency to reach the conspecific in the social runway test, and positively with the amount of time spent near the conspecific. Exposure to a fear-eliciting stimulus will increase the need for social reinstatement, leading to a shorter approach latency and more time spent near the conspecific (Marin et al., 2001). Therefore, if locomotion in the open-field is a sign of decreased fearfulness, it would be expected to correlate positively with latency to approach the conspecifics in the social runway test and negatively with the time spent near the conspecific. If locomotor behaviour in the open-field indicates a stronger exploratory tendency, animals would be expected to explore more in the social runway test as well, which could mean that because they are moving around they are more likely to approach the conspecific on the far side of the runway sooner. Last, if open-field locomotion is driven by the motivation to reinstate social contact, no relation between open-field activity and novel object approach latency would be expected (as the presence of the object does not alter the social situation). However, object presence may be expected to increase the amount of activity, as stressful events are known to increase the motivation for social reinstatement in poultry (Marin et al., 2001).

In this study, we aimed to assess the combined pre-natal and post-natal effects of semi-group housing on rabbits' behaviour in the open-field test, the novel object test and the social runway test. Furthermore, we aimed to

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