

Additional or Alternative Sources of Environmental Enrichment for Farmed Blue Foxes

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Introduction

Blue foxes (*Vulpes lagopus*) are currently farmed for their fur in many countries. They are kept in cages with a wire mesh floor, a raised platform and an activity object; a nest box is provided to vixens during the breeding season (Koistinen *et al.*, 2009a). However, critics argue that such an environment lacks enrichment, does not sufficiently meet the needs of the animals, and may be detrimental to their welfare (Nimon & Broom, 2001). This paper will review current studies on environmental enrichment for farmed blue foxes.

Discussion

Recently, using floor materials as an alternative to wire mesh in cages has been investigated. Sand floors may enable blue foxes to demonstrate species-specific behaviours that they cannot perform on mesh floors, such as ground-digging, and permitting such activities may improve welfare (Koistinen & Mononen, 2008). The effect of year-round access to nest boxes by all foxes, rather than access only for vixens during the breeding season, has also been studied. Jeppesen *et al.* (2000) state that this would decrease stress, or glucocorticoid levels, by providing foxes with a hiding place.

Koistinen *et al.* (2009a) investigated how blue foxes valued permanent access to a sand floor and nest box, and the implications of these resources on welfare. Test apparatus comprised a home cage, a resource cage and a control cage. The home cage contained a platform and a wooden block, currently compulsory features of fox cages. A shallow sand tray and a nest box were placed within the resource cage, one at a time, and number and duration of visits to each resource, as well as type of interaction, were recorded. Results revealed that foxes valued both the sand floor and nest box significantly, since they tended to spend most of their time in the resource cage. Foxes spent considerable time interacting with the sand floor by digging and sniffing, demonstrating the enriching nature of the resource. However, most stereotypic activity observed during the study, such as repetitive pacing, occurred on the sand floor, possibly due to the foxes' frustration at not being able to dig true holes because the sand was shallow. This represents a limitation in the experiment, as it prevented the foxes from adequately expressing certain behaviours, and stereotypic activity is regarded as a sign of reduced welfare (Koistinen *et al.* 2009b). When a nest box was available, foxes used its roof more than its interior, both when active and resting, suggesting that they placed greater value in the resource for surveillance purposes than for hiding. Although this would be enriching for the foxes, it is possible that any high place could perform the same function. The conclusion drawn from this study is that, when available to blue foxes, a sand floor and a nest box provide significant environmental enrichment, but further research into more suitable designs is required to maximise animal welfare.

Currently, all farmed foxes must be provided with an activity object that is stimulating and suitable for gnawing (Ahola *et al.*, 2010). Korhonen & Niemi (1999) explain that in the wild, blue foxes would consume food that necessitated considerable chewing, but in captivity, feed is supplied as porridge. Gnawing on objects allows expression of the animals' natural behaviour and also stimulates play and reduces stereotypic behaviour, so welfare is enhanced significantly. Wooden blocks are traditionally used because they are cheap and readily available (Koistinen *et al.* 2009b). However, recent studies have revealed that bones, in place of wooden blocks, also have enrichment and welfare benefits.

Koistinen *et al.* (2009b) investigated the value of bones as an activity object using 16 blue fox pairs, 8 of which were given a defrosted femur bone in their cage while the remainder, the control group, were left without a bone. Results showed that providing bones to foxes induced

more play and less stereotypic behaviour, which are both considered signs of good welfare. Comparing results with previous experiments revealed that foxes interact more with bones than with wooden blocks, suggesting value in the enhanced sensory stimulation bones provide, such as taste and smell. However, aggressive behaviour observed between fox pairs in the bone group suggested that competition for bones might negatively affect welfare.

In another study, Ahola *et al.* (2010) used the same design as the previously mentioned study, but investigated potential health effects of the bones, rather than behavioural effects. One aim of this study was to assess whether using bones instead of wooden blocks could alleviate the incidence of gastric hyperaemia in blue foxes, which possibly arises when splinters are ingested and can markedly impose on animal welfare. Results, however, revealed that all foxes, whether they had access to bones or not, had some inflammation in the stomach. This prevented a reliable conclusion from being made about the effects of bones in improving gastric health in foxes.

Additionally, indices of stress were measured and compared between control and bone groups, and results found an increase in the mass of liver and adrenal glands in foxes of the bone group. Since previous studies have implied that stress can have this effect, the increase suggests that the bone group had higher levels of stress during the experiment, potentially indicating competition for bones between fox pairs, which was also observed in the study by Koistinen *et al.* (2009b). Females in the bone group had more bite marks than males, suggesting that males monopolised the bones. Furthermore, the increase in adrenal mass in foxes of the bone group compared with the control group was greater in females than males, implying that competition for bones was particularly stressful for females. Finally, oral health inspection showed that foxes with access to bones had less severe dental calculus.

Conclusion

Bones improve dental health of blue foxes and are environmentally enriching, but can potentially reduce welfare in pair-housed foxes due to competition, so bones may be best suited for foxes housed individually. All of these studies demonstrate how environmental enrichment can improve the welfare of farmed blue foxes, in terms of both behavioural and health benefits.

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