

Communication

[Comunicação]

Injuries in cage-bred wild rabbits (*Oryctolagus cuniculus*) caused by the size of the orifices in the cage floor

[Lesões em coelhos silvestres (*Oryctolagus cuniculus*), mantidos em cativeiro, causadas pelo tamanho dos orifícios no piso da gaiola]

P. González-Redondo

Dpto. Ciencias Agroforestales - EUITA - Universidad de Sevilla
Ctra. Utrera, km 1
41013 Sevilla – Spain

The scarcity of wild rabbits (*Oryctolagus cuniculus*) as a result of myxomatosis and viral hemorrhagic disease has led to restocking in countries such as Spain, Portugal, and France. Part of such restocking requires animals to be bred in captivity, and the game farms breeding wild rabbits in strict captivity normally use cages designed for domesticated breeds. Given the adaptability of the species to management under controlled conditions (Lölinger, 1992; Verga, 2000), the results are satisfactory (González-Redondo, 2003). However, some designs of industrial rabbit-breeding cages do not guarantee the minimum conditions of health and welfare when they are used for wild rabbits because they cause injuries, contravening the main function required of housing: that of securing the animals for prolonged periods free of the risk of producing bodily injuries or diseases (Lölinger, 1992). In the absence of literature on the rearing of wild rabbits in cages, the objective of this work was to analyze the unexpected incidence of hind limb injuries in cage-bred wild kits caused by unsuitably-sized orifices in one type of flooring, and to propose improved designs in order to enhance animal welfare at game farms.

During a trial of growth in captivity performed in Córdoba, Spain, on 96 cage-born wild rabbit kits (*O. cuniculus*), originated from the Southern Iberian Peninsula, unexpected, accidental hind leg injuries occurred. The kits were weaned at 30-day-old, and, until day 86, were housed in grouped litters (average number of kits per cage=2) in metal mesh cages with a 38×51cm

base (Fig. 1), similar to those used for meat rabbits (Lebas et al., 1996). The cages were located outdoors in a Dry Mediterranean-type climate (average temperature=18°C). The cage floor was made using plastic plates¹ for a resting surface with oval, 12×35mm orifices, with a separation of 18mm. Incidents to kits were enumerated and divided into two categories (Table 1): i) accidents to the hind limbs caused by their becoming trapped in the orifices of the cage floor, and ii) other causes (escape; death from myxomatosis, enteritis, cachexia, heatstroke, and sudden death).

In order to propose a more suitable cage-floor design with smaller orifices, minimizing hind limb injuries, the longer cross-section diameter of 50 fecal pellets of meat rabbits (New Zealand White × Californian), and 50 fecal pellets of cage-bred wild rabbits were measured. The rabbits in both groups were one-year-old, and were fed on commercial pelleted feed containing 16.5% crude protein, and 16.5% crude fiber. Statistical analysis was carried out using the SPSS 9.0 program (Manual..., 1999).

Hind limbs became trapped because the body size of the wild rabbit, and therefore limb is much smaller than that of the meat breeds. Wild rabbits in captivity weigh approximately one kilogram (González-Redondo, 2003), whereas meat breeds and lines can weigh 4-5kg (Lebas et al., 1996). This difference in size resulted in 12 rabbits with their limbs becoming trapped in cage floor orifices with their phalanges and calcanea becoming longitudinally wedged in the

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E-mail: pedro@us.es

¹Extrona S.A. Viladecavalls, Spain.

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orifice. The injuries comprised closed bone fractures (in most cases, of the tibia) or open fractures of the calcaneum, vertebral

dislocations, and skin erosions with hemorrhage. Seven (58.3%) of the kits suffering accidents to the limbs died as a result of the trauma.



Figure 1. Cage floor in whose orifices the hind limbs of wild rabbits became trapped.

Table 1. Incidents in caged wild rabbits (*Oryctolagus cuniculus*) from 30 to 86-day-old

Type of incident	Number of kits	Percentage with respect to the total of kits present	Percentage with respect to the kits suffering incidents
No incident	70	72.9	-
Kits with incidents:	26	27.1	-
- Accidents to limbs	12	12.5	46.2
- Other causes	14	14.6	53.8
Total	96	100.0	100.0

Accidents involving hind limbs becoming trapped in the orifices of the cage floor were relatively high and accounted for approximately half the incidents (12.5% of the individuals; Table 1) reducing even further the scarce productivity of cage-bred wild rabbits (González-Redondo, 2003). Apart from the kits that died as a result of this type of accident, the limb injuries sustained made the survivors unfit for use either as animals for future breeding or in restocking. For this reason, and in order to prevent them from suffering unnecessarily, injured rabbits were euthanized immediately

after their accidents. Concussion followed by exsanguination was performed by an experienced operator, according to the European Commission Recommendations for the euthanasia of experimental animals (Close et al., 1997).

The findings of this study are consistent with those of other authors (Rommers and Meijerhof, 1996), who have shown that the type of cage floor affects the incidence of limb injuries in domesticated rabbits. It has been found that New Zealand White does trapped their limbs in the meshes of a plastic floor with oval orifices

measuring 20×48mm, a similar though slightly larger size to those of this study, and suffered bone fractures (Rommers and Meijerhof, 1996).

In meat breeds, the use of a resting surface is recommended to prevent footpad injury (sore hocks or *ulcerative pododermatitis*) and other limb anomalies, mainly in does (López, 1998). Certain types of cage flooring, mainly grids, are linked to the occurrence of this health problem (Morton et al., 1993). It is also known that the incidence of footpad injuries is lower in domesticated females housed on non-wire flooring such as a solid surface or perforated plastic (Rommers and Meijerhof, 1996). No cases were observed of sore hocks in the wild rabbit kits, possibly because they are much lighter than domesticated breeds, whose weight can be four times that of wild animals. Another factor contributing to the absence of sore hocks is the floor used in the experiment, which was designed to reduce the incidence of sore hocks, and constructed with resting surface plates.

No quantification has been made concerning the effect of floor design (with regard to orifice distribution and size) on the welfare of the kits, but it is known that this factor particularly affects young kits because of their smaller body size. It has been observed in meat breeds, as well as in this study, that the greater the distance between slats, the more the kits made unsure movements (Petersen et al., 2000).

From a joint consideration of behavioral, clinical, and hygiene criteria, it has been proposed that to both safeguard the health and welfare of the rabbits and to enable proper removal of the feces, plastic floors with 10mm wide slats with a 14mm separation, similar to those used in this study, are acceptable for both does and kits of meat breeds (Petersen et al., 2000). In this study, the solid part of the cage floor between orifices had a width of 18mm, and a 12mm separation between slats, similar to what has been proposed by others (Petersen et al., 2000). However, a relatively high incidence of injuries to the hind limbs occurred because the cage floor orifices were large enough to allow the introduction of the hind limbs, a logical result of the smaller body size of the wild kits. This revealed that the design and size of the orifices in the floor of this study, typical of industrial meat rabbit cages, are not suitable for use with wild rabbits, at least in

the first post-weaning months. Since restockings are increasingly performed using rabbits bred in strict captivity (González-Redondo, 2003), it is a minimum requirement that the cages do not cause injuries to the animals. From the viewpoint of safeguarding their health and welfare, the animals should not be able to penetrate, or remain trapped by, the cage floor orifices. There should be no sharp edges and the area of the resting surfaces should be ample (Lölinger, 1992).

Although wild rabbits raised on game farms are not normally housed in biomedical research facilities, an analysis of laboratory rabbit cage flooring may offer an additional insight, due to the fact that they are highly effective in ensuring animal welfare. However, the regulations and guidelines regarding the protection and husbandry of rabbits used for experimental purposes do not establish any recommendations concerning the dimensions of the cage floor orifices (Directive..., 1986; Morton et al., 1993). Indeed, the only recommendation is that attention should be paid to cage floor design and that this should vary according to the species and age of the animals. This is aimed at preventing the animals from injuring themselves and, furthermore, they should be designed to facilitate the removal of excreta (Directive..., 1986). Moreover, given the fact that the cages can be fitted with several different types of flooring such as grids, dimples, bars, and slats, it would appear that grid floors may be uncomfortable for the animals and that dimpled patterns are preferable (Morton et al., 1993).

The diameter of the feces of the wild rabbits (7.9 ± 0.140 mm; mean \pm SE) was smaller ($t = -22.44$, $P < 0.001$) than that of the domesticated ones (13.3 ± 0.197 mm; mean \pm SE). Thus, as the mean diameter of the feces of the domesticated rabbit is approximately 60% greater than that of the wild animal, the slat separation in the cage floor designed for wild rabbits can be substantially reduced. Such a separation could be of some 8mm, although research under real conditions would be necessary in order to ascertain if this would both solve the problem of trapped limbs and enable feces to be efficiently eliminated.

Although not tested, a better result, in terms of both animal welfare and of fewer injuries caused by accidents from hind-limb entrapment, may be

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obtained by using floors comprising a perforated sheet with circular orifices (Fig. 2), design that is present in some models of rabbit-breeding cages used in small-scale farming. Moreover, a dimple floor has been proposed as the most suitable alternative for keeping rabbits in the laboratory by the BVAAWF/FRAME/RSPCA/UFAW Joint Working Group on Refinements in Rabbit Husbandry (Morton et al., 1993). In fact, most of the commercially-available laboratory rabbit cages are provided with plastic floors whose orifices measure 13-15mm in square diameter^{2,3}. However, due to the small size of the hind limbs of the kits, this diameter would be too large for use in a cage floor when keeping young wild rabbits. A suitable size for cage floor perforations might have a diameter of about one

centimeter. With regard to the floor material, it is clear that a plastic floor may feel warmer than metal (Morton et al., 1993). However, the use of galvanized sheet metal (20 gauge or 1mm thick) (Fig. 2) is proposed due to the fact that during this experiment, it was observed that the wild rabbits gnawed the plastic floor of the cages. In conclusion, a galvanized sheet metal cage floor design with circular 10mm diameter perforations may eliminate the hind limb injuries and would improve the welfare of the wild rabbits reared on game farms. Further research is needed to confirm the fitness of this proposal.

Keywords: wild rabbit, *Oryctolagus cuniculus*, animal welfare, hind limbs injuries



Figure 2. Galvanized sheet metal cage floor with circular 10mm diameter perforations, proposed to eliminate the hind limb injuries.

RESUMO

*Estudou-se a incidência de lesões nas patas traseiras de láparos de coelhos selvagens (*Oryctolagus cuniculus*) criados em cativeiro, causadas por inadequação do piso das gaiolas, nomeadamente a dimensão dos orifícios. Propõem-se pisos com dimensões mais adequadas. As gaiolas tinham piso de plástico com orifícios de 12×35mm separados em 18mm. Dos 96 láparos estudados, 12 (12,5%) sofreram*

²Allentown Caging Equipment Co. - Allentown, NJ, USA.

³Tecniplast S.p.a. Buguggiate, Italy.

traumatismos causados pela introdução das patas traseiras nos orifícios do piso, e sete deles (58,3%) morreram. Considerando que o diâmetro das fezes do coelho selvagem é cerca de 60% menor que o das fezes do coelho doméstico de corte, é possível reduzir em 8mm a separação entre os orifícios do piso das gaiolas. Como alternativa, o piso poderá ser constituído por orifícios circulares de 10mm de diâmetro, o que eliminaria os acidentes causados pela inadequação do piso, melhorando também o bem-estar animal.

Palavras-chave: coelho silvestre, *Oryctolagus cuniculus*, bem-estar animal, lesões nas patas

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