

Effect of footrests on the incidence of ulcerative pododermatitis in domestic rabbit does

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Abstract

Ulcerative pododermatitis or sore hocks is a common condition in adult rabbits housed in cages with wire-mesh floors. This study was carried out on a recently-opened commercial farm with 224 breeding cages (112 without footrests [NFR] and 112 with footrests [FR]) to assess the effect of footrests on the incidence of sore hocks (SH) and plantar hyperkeratosis (K) on domestic rabbit does, throughout the first part of their productive lives. The accumulated incidence of SH in the fifth lactation was 71.5 and 15.1% for NFR and FR groups, respectively and the accumulated incidence of K, at the same point, was 100 and 64.5%. The footrests were also found to have a curative effect on 81.3% of affected does. Clinical and epidemiological information obtained in this study revealed that the installation of a plastic platform or slatted footrest on the wire mesh played a significant role in the prevention and cure of sore hocks. Problems specifically related to cage hygiene and cleanliness were not addressed in this study.

Keywords: animal welfare, disease prevention, footrest, rabbit, sore hocks, ulcerative pododermatitis

Introduction

Ulcerative pododermatitis or sore hocks is a common condition in adult rabbits housed in cages with wire-mesh floors (Templeton 1955; Drescher 1993). This type of flooring is favoured as it is deemed to promote hygiene, reducing the risk of coccidiosis and other domestic rabbit diseases (Lebas 2000). Sore hocks (SH) impact on rabbit health and welfare, restricting movement and causing chronic pain and suffering (Webster 2001). This makes them a useful indicator of animal welfare (Broom 2006). SH can be production-limiting, causing increased infertility, pre-weaning mortality and the culling of afflicted does. Meat quality can also be affected due to popliteal ganglion lymphadenopathy and weight loss, necessitating carcass condemnation (Julini & Cava 1993).

SH is significant epidemiologically as it is responsible for high culling rates on commercial farms, ie 0.3% of monthly cumulative incidence in females and males (Rosell and de la Fuente 2009). In terms of morbidity, Rosell *et al* (2000), described mean prevalences of sore hocks of 9.1 and 7.5%, for 103,968 checked females and 15,987 males, respectively, between 1986 and 1996, on 762 intensive production farms in Spain with observed prevalence as high as 60%. Mirabito and Delbreil (1997) found a mean prevalence of 12.4% on 69 farms in France. Plantar hyperkeratosis or callus (K) is an extremely early stage of the disorder, occurring after loss of foot-pad hair. We do not consider this a disorder in itself but a factor to be taken into account during assessment of health;

it is for this reason that we have not recorded this sign for the previous 25 years (Wierup 2001).

SH is multifactorial in origin. For commercial rabbits, predisposing factors, which increase the level of susceptibility in the host, include: animal origin (Rosell & de la Fuente 2004), weight, age, sex, week of lactation, intercurrent diseases, eg mastitis, staphylococcosis, ringworm, moist dermatitis and foot-pad pseudomoniasis (Rosell *et al* 2000), and body condition (Rosell & de la Fuente 2008); enabling risk factors, which facilitate manifestation of a disease (Thrusfield 2005), include: hygiene, cage flooring, diet and climate (Rosell *et al* 2000). The highest risk factor is flooring; Rommers and Meijerhof (1996) pointed out the effect of differing floor types (wire mesh versus slats). However, more science-based information on rabbit housing and, in particular, types of flooring, is necessary (EFSA 2005; Trocino & Xiccato 2006).

In practice, footrests placed on wire flooring are the most widely-used method of control. During 2007, 60% of 177 rabbit farms visited in Spain and Portugal used footrests for all females (Rosell, unpublished data). A variety of differing materials are available (wood, metal, plastic), but plastic footrests or plastic mats tend to be the most common.

This study sought to evaluate: i) the effect of the installation of cage footrests on the incidence of sore hocks and plantar hyperkeratosis during the early stages of the productive life of farmed rabbit does and, ii) the possible curative effect of footrests on sick does.

Figure 1



Females were allocated alternatively in cages with (left) or without a footrest.

Materials and methods

Experimental design

This experiment was carried out in March 2007 on a newly-opened commercial farm in Prades-La Molsosa, Lleida, Spain, containing 224 maternity cages. Experimental groups were assessed from their arrival as two-month old, unbred animals, throughout a 12-month breeding programme and into their fifth lactation. From their arrival on the farm, 112 of the 224 does were housed in cages without footrests (NFR), while the other 112 (control animals) were kept in cages with footrests (FR). Females of both groups were allocated alternatively (Figure 1).

Animals

The does were a commercial New Zealand white \times California cross, bred typically for meat. The mean weight of the females was 4.01 (\pm 0.30) kg at their first parturition and rose to 4.53 (\pm 0.37) kg by the fifth. Animals

were fed a low-energy, commercial feed (Cunigen®, NANTA, Tarragona, Spain), *ad libitum*. For all the does in the study, breeding was initiated at 132 days of age, in a single batch, and the first kits were seen on 14 June when the females were 162 days old.

Housing

Does were housed in a controlled environment, with dynamic ventilation, cooling and heating; minimum temperature was 20°C during the first week of each lactation and thereafter ranged from 16–18°C. Artificial lighting to achieve 16 h per day was implemented only during the four days immediately preceding each insemination and four days after, to promote bio-stimulation. During the rest of the cycle natural lighting was provided.

The cage was a wire model (Burela, Gómez and Crespo, Ourense, Spain) and measured 60 \times 40 \times 32 cm (length \times width \times height) and had a nest box measuring 40 \times 26 cm (length \times width). The mesh was perpendicular

to the aisle and the wire was 2.8 mm in diameter, forming rectangles (83 × 11 mm), which had no influence on doe behaviour (Petersen *et al* 1996). The footrest (Gómez and Crespo, Ourense, Spain) was plastic and took the form of smooth slats; it measured 37 × 24 cm with 67 × 14 mm holes between each slat (Figure 1).

Management

The does underwent an extensive reproductive cycle with artificial insemination taking place 40–50 days, postpartum. AI was used in 85% of the 177 farms visited during 2007 (median size: 750 does, range: 72 to 5,250). On 81% of the farms, females were serviced (either by mount or AI) at 11 days postpartum (semi-intensive cycle) and kits were weaned at 35 days old (Rosell, unpublished data). In this study, kits stayed with their mothers until they were sold at 55–60 days old, with a maximum of five kits per mother; the rest were housed in separate cages. Does were fed Cunilactal® (NANTA, Tarragona, Spain), *ad libitum*, which contains 60 ppm robenidin and is suitable for breeders, with the exception of the five days prior to being sold when they were given *ad libitum* finishing feed (Cunicebial Retirada, NANTA, Tarragona, Spain). All cages were disinfected after each weaning and does were always kept in the same cages with sick or dead individuals being removed.

Examination of the animals

Every two weeks, following the onset of the first session of AI, a physical examination of all does' legs was performed to assess the incidence of new cases of K and SH as well as maintain the progress of sick does. The examinations were carried out by a single, trained veterinarian who individually assessed 10,609 female rabbits and 869 males in 80 rabbit farms (over 177 visited) throughout 2007, in order to evaluate their sanitary status, including feet condition, following a protocol described previously (Rosell 2003). Marcato and Rosmini (1986) and Harcourt-Brown (2002), provide a detailed description of SH. Despite the fact that Drescher and Schlender-Bobbis (1996) considered K to be a primary stage of pododermatitis, the findings of this study, as well as our general observations, have lead us to believe that lesions such as wounds with exudates, ulcers or necrosis, in one or more legs, are more indicative of SH. A positive case of SH could be a wound on one foot and hyperkeratosis on the other.

When a doe in the NFR group was diagnosed with SH, a footrest was immediately installed and sick does were excluded from groups (NFR, FR). Thus, as well as determining the factors related to sore hocks, we also evaluated whether K was present or absent prior to the appearance of sore hocks and, subsequently, when does were cured. Euthanasia was carried out via stunning, followed by neck (cervical) dislocation and exsanguination.

Statistical analysis

Statistical analysis was performed with SAS® (Statistical Analysis System, 9.1) utilising the LIFETEST procedure. The accumulated incidence of K and SH and statistical analyses were estimated according to the Kaplan-Meier method for analysing survival probabilities.

In the NFR group, healthy does and, therefore, those without a footrest, were considered to be at risk and, in the FR group, healthy does that had not been affected by sore hocks were considered at risk. For both groups, populations at risk during the second to fifth lactation excluded sick does with SH, plus culled and dead females. There were 13 excluded females (dead and culled) in NFR, and 11 in FR. In this study, all the females in each group were checked to determine the incidence of SH.

Results

The evolution of accumulated incidence of SH and K in females housed in cages with or without footrests, in relation to time, is seen in Figure 2 (we considered data of first AI: to be day 0), along with dates of breedings. Examinations were performed every 23 days, from day 0 until day 345.

Sore hocks

The relative and accumulated incidence of sore hocks (SH) for each lactation can be seen in Table 1. These increased in the NFR group between second and fifth lactation with the accumulated incidence reaching 71.5%. These results contrasted with the progression seen in the FR group ($P < 0.001$, from the third lactation, day 240), where accumulated incidence reached 15.1% in the fifth lactation. By the fifth parturition, sufficient information had been collected and the study was ended to avoid unnecessary suffering for the animals and financial damage to the farmer.

Hyperkeratosis

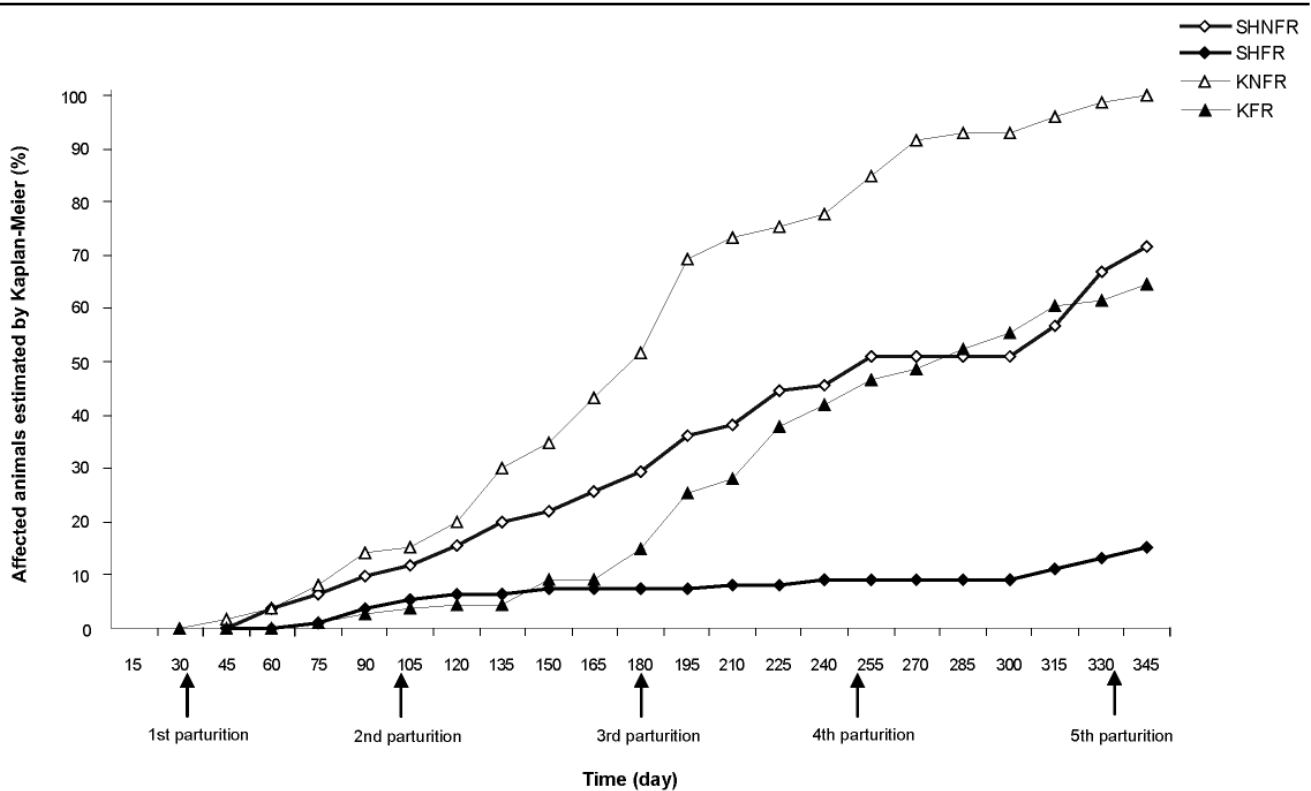
With regard to plantar hyperkeratosis, Table 2 shows the accumulated incidence of K in the group without (NFR) and with (FR) footrests.

The incidence of does affected by K during the first lactation (day 60) was 3.6% in the NFR group and 0.0% in the FR group. At the end of the third pregnancy (day 180), accumulated incidence was 51.8% in the NFR group, compared with 14.8% in the FR group and by the fifth lactation these reached 100 and 64.5%, respectively. The incidence of calluses progressed in a similar way to sore hocks, with considerable differences amongst groups becoming more pronounced during the course of the productive life of the does (37%, $P < 0.001$, from the end of the third pregnancy, day 180).

With regard to the progression of the disorder, 56.9 and 40% of the females with sore hocks in the NFR and FR groups, respectively, previously had calluses (mean = 54%); there were no differences ($\chi^2 = 1.43$, $P = 0.23$). Concerning the progression of K in the NFR and FR groups, 28.5 and 49.0% of the females with K did not progress to SH, respectively.

When we consider does with SH in the NFR group, in the course of the first four parturitions (prior to day 333), in terms of the possible therapeutic effect of footrests, 81.3% were seen to recover (excluding relapses) after footrests had been introduced permanently. In the FR group, 58% of affected does progressed favourably. These differed but not to the extent of becoming significant ($\chi^2 = 2.91$, $P = 0.09$).

Figure 2



Accumulated incidence of sore hocks (SH) and plantar hyperkeratosis (K) in female rabbits subjected to a 12-month extensive breeding programme, housed in cages with (FR) or without (NFR) footrests.

Table 1 Relative and accumulated incidence of sore hocks in does with (FR) and without (NFR) a footrest throughout a 12-month extensive breeding programme.

Group	Criterion	Number of days after first AI					
		60th	120th	180th	240th	300th	360th
NFR	Does at risk	112	108	91	73	53	43
	Affected (n)	4	13	15	16	5	18
	Relative incidence (%)	3.6	12.0	16.5	21.9	9.4	41.9
	Accumulated incidence (%)	3.6	15.4	29.5	45.5	50.9	71.5
FR	Does at risk	112	112	101	98	94	94
	Affected (n)	0	7	1	2	0	6
	Relative incidence (%)	0	6.3	1.0	2.2	0	6.4
	Accumulated incidence (%)	0	6.3	7.3	9.2	9.2	15.1
	Differences of accumulated incidence amongst groups	3.6	9.1	22.2	36.3	41.7	56.4
	χ^2 test log-rank	0.08	0.52	7.64	28.55	42.97	66.09
	P-value	0.77	0.46	0.01	< 0.001	< 0.001	< 0.001

Discussion

Useful epidemiological information is provided by the prevalence of SH but incidence needs to be added to determine a more precise assessment of the problem. From a technical perspective, carrying out the study on one farm was an advantage as the presence of footrests was the only variable factor. In fact, other determinants, such as lactation or gestation stage need not be analysed as the results are so

conclusive. The study shows that a footrest on the wire-mesh floor of the cage enables the doe to cope with its environment (Broom 2006), thus achieving a balance between welfare (condition of the legs and behaviour) and hygiene (Trocino & Xiccato 2006).

No particular problems arising from the cleanliness of footrests were observed during the study. The amount of food that does ingest increases between days seven and 21, post-

Table 2 Relative and accumulated incidence of hyperkeratosis in does with (FR) and without (NFR) a footrest throughout a 12-month extensive breeding programme.

Group	Criterion	Number of days after first AI					
		60th	120th	180th	240th	300th	360th
NFR	Does at risk	112	108	86	50	20	5
	Affected (n)	4	18	34	26	12	5
	Relative incidence (%)	3.6	16.7	39.5	52.0	60.0	100.0
	Accumulated incidence (%)	3.6	19.9	51.8	77.5	93.0	100.0
FR	Does at risk	112	112	103	90	60	46
	Affected (n)	0	5	11	28	14	9
	Relative incidence (%)	0.0	4.5	10.7	31.1	23.3	19.6
	Accumulated incidence AC (%)	0	4.5	14.8	41.7	55.3	64.5
	Differences of accumulated incidence amongst groups	3.6	15.4	37.0	35.8	37.7	35.5
	χ^2 test log-rank	9.83	5.22	24.73	37.39	56.60	65.83
	P-value	0.75	0.02	< 0.001	< 0.001	< 0.001	< 0.001

partum; as does the amount of dry faeces excreted. In practice, producers that have not installed footrests in cages housing adult rabbits cite problems with the cleanliness and useful life of such apparatus. This problem can be significantly reduced by choosing a suitable model and placing it closer to the nest than the feeding trough. Securing the footrest on one side only, so that it can be moved slightly by the doe, is also recommended as it represents a mild form of enrichment. Princz *et al* (2008) demonstrated that kits prefer plastic-slatted floors to metal ones; in fact, they even compete with the doe to rest on the footrest. Producers who follow a 'dual system' on their farms (ie the weaned kits live in the building where they were born and the mothers are taken to a clean, disinfected building for parturition) install footrests in all cages, even in those housing growing rabbits, and have not experienced problems related to hygiene.

There can be little argument about the welfare, production or financial benefits of using footrests. This study reinforces the opinion of rabbit farmers who use footrests and also shows how most of the affected does were cured after they had been installed; we installed footrests as soon as we detected a sick doe, rather than waiting for the lesion to become severe, by which point the prognosis may perhaps have been different.

Conclusions and animal welfare implications

The clinical and epidemiological information obtained in this experiment highlights the benefits of installing slatted footrests on the wire-mesh floor of rabbit cages to prevent and cure sore hocks.

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