A PROTOCOL FOR MEASURING HEALTH AND WELFARE OF REPRODUCING DOES AND LITTERS IN RABBIT FARMS

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ABSTRACT

A standardised protocol was used to evaluate health and welfare of lactating does and their litters on 12 commercial farms of the North of Italy in 36 visits (three per farm) during three productive cycles (autumn, winter, and summer) over one year. Farms used four different housing systems (standard breeding cages, dual-purpose breeding cages, enriched cages, and parks). At late lactation (27-31 d after kindling), 82% of does had adequate body condition score (BCS). The main health concerns were diarrhoea (mean prevalence: 6.6%), ulcerative pododermatitis (3.4%), mastitis (3.0%), and dermatomycosis (2.8%) in does; dermatomycosis (1.6%) and diarrhoea (1.1%) in litters. Regarding the housing system, the females kept in parks and enriched cages were heavier (4968 g and 4914 g vs. 4431 and 4765 g) and had a higher BCS than those in standard and dual-purpose cages ($0.001<P<0.01$). Litter size was higher in parks and enriched cages(9.18 and 8.61) than in standard and dual-purpose cages (8.08 and 8.21); kit weight was higher in dual-purpose cages (575 g) and lower in standard and enriched cages (541 g and 540 g) ($P<0.001$). The prevalence of health concerns in does and litters was similar across all housing systems. Performance and health of the animals also changed according to the productive cycle: doe and kit weight were higher in the autumn and winter cycles than in summer, BCS was higher in the winter and summer cycles than in autumn (1.98 and 2.01 vs. 1.92), and litter size was higher in the winter cycle than in the autumn and summer ones (8.83 vs. 8.24 and 8.19; $P<0.001$). Lastly, a higher prevalence of diarrhoea in does was recorded in autumn and summer than in winter (9.3% and 6.7% vs. 3.5%; $P<0.001$).

Key words: housing systems, season, lactating does, body condition, kits.

INTRODUCTION

Alternative housing systems for meat rabbits are requested to improve animal welfare (European Parliament, 2017), but they are not yet widespread or validated at a commercial level and technical standards for their implementation are not yet available. In addition, alternative systems have shown several weaknesses in terms of health and welfare of reproducing does and kits as recently reviewed by Szendrő et al. (2019). With the exception of a few studies in Spain and Portugal (Sánchez et al., 2012; Rosell and de la Fuente, 2013, 2018), scientific information regarding health and welfare of rabbits under different housing systems in commercial farms is still missing, and no validated protocol to assess animal welfare on rabbit farms is yet available. In this context, a project was funded by Italian Ministry of Health in which a protocol was developed to assess health and welfare of rabbits using animal-based and resource

and management-based measurements for both reproducing does with their litters at the end of lactation and growing rabbits before slaughtering. First results related to one production cycle/season for the reproducing sector were presented by Zomeño et al. (2019). Now, the protocol has been implemented during three productive cycles/seasons throughout one year and the results related to the reproducing sector are hereby presented.

MATERIALS AND METHODS

Farms and recordings

From September 2018 to August 2019, 12 commercial farms located in the North of Italy were visited in three productive cycles (autumn, winter, and summer; three visits/farm; 36 visits in total). Protocol used a sheet form to animal-based and resource and management-based measurements in does and kits during a visit of about 2 hours. All farms were closed-cycle, with a population size from 456 to 3,890 reproducing does. Farms presented four different housing systems for rabbit does (three farms/system): standard breeding cages, dual-purpose breeding cages, enriched cages, and parks (also known as elevated pens). Standard and dual-purpose breeding cages had similar dimensions (38 cm width × 87-95 cm length × 32-35 cm height), but in the former the doe remained in the same cage after weaning and the litter was moved to a new cage, whereas in the latter the doe was moved to a clean cage and the litter remained in the breeding cage until slaughtering. Enriched cages (38 cm width × 95-103 cm length × 62-63 cm height) had a wire-mesh elevated platform (20 cm width). Parks (about 215 cm width × 100 cm length) had plastic-slatted floor and a plastic-mesh platform (20-25 cm width) and were used for 4-5 females. In park systems does were separated with removable walls for 30 days, then farmers removed these walls and moved females in other cages. Farms differed in several other factors, such as animal genotype (Hyla, Grimaud, or Martini), reproduction rhythm (artificially inseminated 11 or 18 d after kindling), weaning age (from 32 to 38 days), building type (indoor or semi plein air), ventilation system (extraction with/without cooling system), and light cycle (natural or artificial photoperiod). A total of 2,300 records were collected from lactating does and their litters the week before weaning (27-31 days after kindling). A random sample of 75 does and their litters were selected at each visit. Briefly, doe body weight, body condition score (BCS), and health were individually evaluated. The BCS was assessed by palpating the fullness of muscle and fat of lumbar and gluteal regions using a five-point scale (0-5) (Bonnano et al., 2005). Symptoms related to respiratory (nasal and/or ocular secretion) and digestive (diarrhoea) problems, mastitis, ulcerative pododermatitis, and dermatomycosis were scored. The litter size and weight and the kit health (respiratory and digestive problems, and dermatomycosis) were also assessed.

Statistical Analysis

All data were analysed using SAS 9.4 software (SAS, 2013). Doe and litter performance data were analysed using the MIXED procedure and fitting a linear mixed model with housing system, productive cycle and their interaction as fixed effects, and the farm as a random effect to take into account all other factors related to each farm. Health data were coded as binary variables (health problem=YES/NO) and analysed with the PROC GLIMMIX and logit link function with housing system, productive cycle, and their interaction as main effects.

RESULTS AND DISCUSSION

By late lactation (27-31 d after kindling), doe body weight averaged 4,739±542 g, BCS was 1.97±0.50, with litter size at 8.2±1.16 kits and kit weight at 552±161 g. Regarding BCS, 82.4% of does had an adequate condition (score 2), 14.9% presented intermediate scores (8.1% score 1 and 6.8% score 3), whereas few showed extreme values (1.8%: score 0, cachexia; 0.9%: score 4, obesity). These results are consistent with Sánchez et al. (2012) who found that, in 103 commercial farms in Spain and Portugal, about 84% of females (from a population of 18,510) exhibited an intermediate BCS (scores 4, 5, and 6 using a nine-point scale). In our study, the most frequently health problems in lactating does were

diarrhoea, with an average prevalence of 6.6%, followed by ulcerative pododermatitis (3.4%), mastitis (3.0%), dermatomycosis (2.8%), and lastly respiratory signs (0.3%) (Table 1). Other authors reported similar prevalence values for mastitis (4.0%) and ulcerative pododermatitis (6.4%), but higher values for respiratory disorders (22.7%) (Sánchez et al., 2012; Rosell and de la Fuente, 2013; 2018). In our study, on average, 1.6% of litters showed dermatomycosis and 1.1% diarrhoea. Regarding the housing system, does housed in parks and enriched cages were heavier than does in dual-purpose cages (4968 g and 4914 g vs. 4765 g), and these, in turn, were heavier than those in standard cages (4431 g) (P<0.001) (Table 1). The females in parks and enriched cages also exhibited a higher BCS than those in standard cages (2.09 and 2.00 vs. 1.91) (P<0.01). Litters from parks and enriched cages had higher size than litters from standard and dual-purpose cages (9.18 and 8.61 vs. 8.08 and 8.21) (P<0.001). The heaviest kits were found in dual-purpose cages (575 g) and the lightest in standard and enriched cages (541 g and 540 g), with intermediate values in parks (554 g) (P<0.001). The prevalence of health concerns in does and litters was similar across the four housing systems (P>0.05) (Table 1). Comparison with previous studies is difficult due to differences in housing systems and the paucity of data on commercial farms. López et al. (2019) did not find differences between does in conventional cages or larger cages enriched with a plastic-mesh platform in two commercial farms during six reproductive cycles, but kit performance and cage hygiene were worse in enriched cages. Nevertheless, besides housing systems, several factors within a farm, such as genotype, reproduction rhythm or parity order, and even farmer aptitude, can affect health and welfare, as previously evidenced by de la Fuente and Rosell (2012) and Sánchez et al. (2012). Thus, several farms per system are necessary to obtain robust results about the effect of the housing system. In our study, doe and litter conditions were also modified by the productive cycle/season: does were heavier in autumn (visits in September-October 2018) and lighter in summer (July-August 2019), with in-between values in winter (January-February 2019) (P<0.001) (Table 1).

Table 1: Effects of housing system and productive cycle on performance (means) and prevalence of health concerns (number and percentage) of does and litters at the end of lactation (27-31 d after kindling).

	Housing system					Productive cycle				MSE
	Standard	Dual-purpose	Enriched	Park	Prob.	Autumn	Winter	Summer	Prob.	
Rabbits, no.	675	625	700	300		875	750	675		
Days after kindling (mean±SD)	29.4±1.20	28.0±0.69	28.6±0.68	28.5±0.50		28.7±0.85	28.9±0.54	28.9±1.29		
Doe body weight (g)	4431^{a}	4765^{b}	4914^{c}	4968^{c}	<0.001	4841^{c}	4775^{b}	4566^{a}	<0.001	480
Doe BCS	1.91^{a}	1.94^{ab}	2.00^{b}	2.09^{bc}	<0.01	1.92^{a}	1.98^{b}	2.01^{b}	<0.001	0.50
Litter size (no.)	8.08^{a}	8.21^{a}	8.61^{b}	9.18^{b}	<0.001	8.24^{a}	8.83^{b}	8.19^{a}	<0.001	1.04
Kit weight (g)	541^{b}	575^{a}	540^{b}	554^{ab}	<0.001	616^{b}	641^{c}	369^{a}	<0.001	97.6
Doe health concerns										
Diarrhoea	52 (7.7%)	34 (5.4%)	47 (6.7%)	19 (6.3%)	0.09	81 (9.3%)	26 (3.5%)	45 (6.7%)	<0.001	-
Pododermatitis	16 (2.4%)	54 (8.6%)	7 (1.0%)	0 (0.0%)	1.00	41 (4.7%)	34 (4.5%)	2 (0.3%)	0.87	-
Mastitis	20 (3.0%)	42 (6.7%)	8 (1.1%)	0 (0.0%)	0.08	33 (3.8%)	12 (1.6%)	25 (3.7%)	0.99	-
Dermatomycosis	19 (2.8%)	19 (3.0%)	19 (2.7%)	8 (2.7%)	1.00	0 (0.0%)	3 (0.4%)	62 (9.2%)	0.99	-
Respiratory signs	4 (0.6%)	2 (0.3%)	1 (0.1%)	0 (0.0%)	1.00	3 (0.3%)	2 (0.3%)	2 (0.3%)	0.99	-
Litter health concerns										
Diarrhoea	6 (0.9%)	5 (0.8%)	5 (0.7%)	9 (3.0%)	1.00	22 (2.5%)	1 (0.1%)	2 (0.3%)	0.99	-
Dermatomycosis	15 (2.2%)	23 (3.7%)	0 (0.0%)	0 (0.0%)	1.00	5 (0.6%)	29 (3.9%)	4 (0.6%)	0.99	-

BCS, body condition score. Means with different letters on the same row differ significantly within housing system or productive cycle (Bonferroni test).

However, BCS was higher in winter and summer than in autumn (1.98 and 2.01 vs. 1.92) (P<0.001). Litter size was higher in winter than in autumn and summer (8.83 vs. 8.24 and 8.19), and kit weight was higher in winter (641 g), lower in summer (369 g), and intermediate in autumn (616 g) (P<0.001). In addition, the prevalence of diarrhoea in does was higher in autumn (9.3%), intermediate in summer (6.7%), and lower in winter (3.5%) (P<0.001). Over the variable conditions of the Iberian Peninsula, other authors did not

find significant variations in doe BCS according to the year (from 2007 to 2010) or the months within a year (12 levels) (Sánchez et al., 2012). Nevertheless, a higher prevalence of respiratory disorders has been found during the hot seasons (Rosell et al., 2009; Sánchez et al., 2012) besides a greater overall morbidity index (associated with any clinical sign of coryza, mastitis, pododermatitis, or any other disease) in summer and fall months. Indeed, under the North Italian conditions, based on literature and our results, body condition and performance concerns were associated with the hottest months since during this period reducing indoor temperature can be difficult and animals are likely to reduce their feed intake. On the other hand, health concerns increased especially during autumn when outdoor conditions are quickly changing, and the indoor environmental control is more challenging.

CONCLUSIONS

The protocol was successfully implemented in all farms regardless from the housing system. It showed differences in performance of rabbit does and their litters according to the housing system, whereas animal health was consistent across the housing systems currently present in Italian commercial farms. The season also affected health and welfare, with summer and autumn being the worst periods. Nevertheless, because of the large variability of rabbit farms related to animals (e.g. genetics, parity order) and management (e.g. reproduction rhythm, biosecurity measures, feeding plans), a higher number of farms would be necessary to confirm results according to the housing system and/or identify the main risk factors for rabbit health and welfare.

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