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PRESLAUGHTER RISK FACTORS ASSOCIATED WITH MORTALITY AND BRUISING IN RABBITS

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Abstract: The aim of this study was to identify and quantify risk factors associated with the mortality and bruising rate prevalence in 975 commercial batches of growing rabbits delivered for slaughter. The effects of environmental temperature, batch size (number of rabbits delivered per batch), journey and lairage duration on dead on arrival (DOA) and bruising prevalence were investigated and expressed as an odds ratio (OR). This value is equivalent to the relative risk, assessing each specific factor relative to its reference category (OR=1). The overall mortality rate of 0.09% was affected by environmental temperature, batch size, journey and lairage duration. A significantly increased DOA risk was associated with very low (<7.3°C; OR=1.28) and very high (≥22.6°C; OR=1.85) environmental temperatures. In addition, a significantly higher odds ratio (OR=1.70) was observed in the largest batches (≥3681 rabbits). Both increasing journey and lairage duration dramatically increased the risk of death during the preslaughter period. Rabbits belonging to batches either transported or laired for a long time had a roughly threefold higher risk of death. The overall prevalence of bruise percentage was 2.13% and was affected by environmental temperature, batch size and journey duration. Environmental temperatures ranging from 7.3 to 12.4°C decreased the risk of bruising (OR=0.90), whereas temperatures from 17.5 to 22.6°C and higher than 22.6°C exhibited significantly higher OR values (1.22 and 1.34, respectively). Moreover OR values were higher for small (734 to 1716 rabbits; OR=1.21) and very small (<734 rabbits; OR=1.36) batches, but also for very large ones (≥3681; OR=1.10). As for journey time, transport duration from 308 to 411 min and longer than 411 min duration increased bruising risk (OR= 1.15 and 1.19, respectively), while this risk was slightly decreased (OR=0.96) for medium journey duration (205 to 308 min). In conclusion, even though average DOA and bruising rates were quite low compared with chickens and turkeys, further logistics and planning improvements should be made in batch harvesting to reduce transport and lairage duration as far as possible in conjunction with extremely low and high environmental temperatures.

Key Words: rabbits, mortality, bruising, preslaughter time, environmental temperature, batch size.

INTRODUCTION

The farming industry has been concerned by the preslaughter conditions of animals for a long time, as there is considerable potential to ensure good carcasses and meat quality characteristics in the period between removing animals from farms for shipment to the abattoir and the time of slaughter (Grandin, 2007). As in other species, in rabbits the mortality rate, live weight loss, carcass yield and quality grades are particularly affected, especially the proportion of carcasses downgraded due to meat quality and safety defects (Cavani *et al*., 2009).

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Rabbits that have died between catching and the moment of slaughter are termed "dead on arrival" (DOA). No data are available on transport mortality rates in rabbits, but information obtained from commercial practices estimates that mortality rates ranging from 0.1% and 0.4% occurred when the preslaughter fasting period was longer than 12 h (EFSA, 2004). The reported mean percentage of rabbits that arrive at the abattoir with bruises can vary a lot, not only because of great differences due to catching and transport conditions, but also the different methods of meat inspection and carcass grading. Nevertheless, considering that approximately 330 millions of rabbits per year are transported from farm to slaughter in Europe (FAOSTAT, 2010), even low mortality and injury rates can cause considerable economic loss. In addition, the welfare of rabbits during preslaughter time is receiving increasing attention in Europe, resulting in pressure to improve conditions to safeguard animal welfare (Verga *et al*., 2009). As a result of this public concern, the European Commission has adopted several regulations on the protection of animals during transport (EC, 2010). Both mortality rates and quality defects recorded in carcasses and meat after slaughter can provide information on animal welfare together with behavioural and physiological measurements (EFSA, 2004). In this sense, several key factors have been identified and their effects analysed, including deprivation of feed and water (Jolley, 1990; Masoero *et al*., 1992; Bianchi *et al*., 2008), loading method (Mazzone *et al*., 2010), journey duration (Dal Bosco *et al*., 1997; Canali *et al*., 2000; Trocino *et al*., 2003; Lambertini *et al*., 2006), stocking density (De la Fuente *et al*., 2004), crate position on vehicle (Vignola *et al*., 2008; Liste *et al*., 2008, 2009), crate floor type (Jolley, 1990), noise (De la Fuente *et al*., 2007), social disruption and unfamiliar environment (Finzi and Verità, 1980; De la Fuente *et al*., 2007), lairage duration (Ouhayoun and Lebas, 1995; Liste *et al*., 2009; Petracci *et al*., 2009), environmental conditions (Luzi *et al*., 1992; De la Fuente *et al*., 2004; María *et al*., 2006, 2008; Liste *et al*., 2008) and stunning (Anil *et al*., 1998, 2000; Rota Nodari *et al*., 2009).

Even if several factors have been reported to affect the preslaughter welfare and quality issues, it may be important to evaluate the incidence of DOA and bruises under commercial conditions. In a previous study, Petracci *et al*. (2008) assessed the effect of preslaughter conditions on mortality, live weight loss, slaughter yield and carcass quality. The same dataset was enlarged and used in the present study with the aim of identifying and quantifying risk factors associated with the mortality and injury rate occurring between catching and slaughter of rabbit batches slaughtered at an Italian abattoir.

MATERIALS AND METHODS

Data Collection

A total of 2152211 growing rabbits (9-12 wk old) belonging to 975 batches shipped from 79 farms for slaughter throughout 2006 was considered. Before transport to the abattoir, rabbits were fasted for approximately 5 h prior to crating as scheduled in the abattoir's slaughter protocol and subsequently removed by hand from growing cages, moved in carts out of the farm and loaded into plastic wire crates measuring 100-110×50-60×22-30 cm (length×width×height) placed on the truck. Stocking density varied during the year: 15 and 16 animals/crate loaded during temperate (April to October) or cool (November to March) season, respectively. After crating, rabbits were transported using commercial lorries with 2 or 3 axles and a loading capacity ranging from 500 to 9000 rabbits to one of the main Italian commercial abattoirs located in North Italy. Lorries had a solid headboard and roof, but rear and sides were kept open all year long. Each lorry was loaded with rabbits belonging to a single batch coming from only one farm. After transport, the vehicles were unloaded and the crates were laired in an area fitted with a roof to protect the rabbits against weather conditions. Slaughter shifts started at 5:00 a.m. until 2:00 p.m. Average pooled live weight (mean±standard deviation) measured at abattoir arrival was 2462±16 g. After lairage, the rabbits were removed from crates, electrically stunned and slaughtered using conventional practises.

Table 1: Classification of batch population (n=975).

	Environmental temperature	Batch size	Journey duration	Lairage duration
Category 1 $x < \mu - 1\times SD$	very low <7.3°C (No. 201)	very small <734 rabbits (No. 205)	very short <103 min (No. 209)	very short <75 min (No. 155)
Category 2 $\mu - 1\times SD \leq x < \mu - ⅓\times SD$	low 7.3 to 12.4°C (No. 181)	small 734 to 1716 rabbits (No. 188)	short 103 to 205 min (No. 139)	short 75 to 156 min (No. 250)
Category 3 $\mu - ⅓\times SD \leq x < \mu + ⅓\times SD$	middle 12.4 to 17.5°C (No. 217)	middle 1716 to 2699 rabbits (No. 197)	middle 205 to 308 min (No. 308)	middle 156 to 238 min (No. 255)
Category 4 $\mu + ⅓\times SD \leq x < \mu + 1\times SD$	high 17.5 to 22.6°C (No. 178)	large 2699 to 3681 rabbits (No. 285)	long 308 to 411 min (No. 149)	long 238 to 320 min (No. 177)
Category 5 $x \geq \mu + 1\times SD$	very high ≥22.6°C (No. 198)	very large ≥3681 rabbits (No. 100)	very long ≥411 min (No. 170)	very long ≥320 min (No. 138)

DOA rabbits were removed and counted for each batch at the moment of hanging from shackles on the slaughter line. The bruises of each batch were recorded after chilling at 1 h *post mortem* according to the standards in force for slaughter plants. According to this standard, a bruise is a discolouration under the skin due to the presence of blood splash larger than 1 cm^2. Moreover, the following data were collected for each batch: batch size (number of rabbits/batch), journey (from leaving farm to arrival at abattoir) and lairage (time spent in lairage area at abattoir) duration, and mean environmental temperature recorded at a neighbouring Meteorological Centre (Regional Agency for Environmental Protection, Emilia-Romagna Region, Italy).

Statistical Analysis

Data were analysed by computing overall descriptive statistics (SAS Institute, 1990). Time data were converted into a decimal scale. Subsequently, specific classification of the batch population was created to enable statistical analysis of the experimental data. Batches were classified according to each considered risk factor (environmental temperature, batch size, journey and lairage duration) and assigned to one of the five following categories:

- Category 1: batches with a variable value below the mean value minus 1×SD;
- Category 2: batches with a variable value above the mean value minus 1×SD and below the mean minus ⅓×SD (category size = ⅔×SD);
- Category 3: batches with a variable value above the mean value minus ⅓×SD and below the mean plus ⅓×SD (category size = ⅔×SD);
- Category 4: batches with a variable value above the mean value plus ⅓×SD and below the mean plus 1×SD (category size = ⅔×SD);
- Category 5: batches with a variable value above the mean value plus 1×SD.

Limits and observation number for each category within risk factor are summarised in Table 1.

Data were subsequently analysed by Proc GLIMMIX for multilevel analysis (SAS Institute, 1990) based on a similar approach used by Nijdam *et al*. (2004). Both dependent variables (DOA and bruise percentage) showed a non-Gaussian distribution and were consequently normalised by logarithmic transformation. All independent variables and first order interactions were considered in the following preliminary model:

$$y_{ijkl} = \mu + ET_i + BS_j + JD_k + LD_l + (ET_i \times BS_j) + (ET_i \times JD_l) + (ET_i \times LD_k) + (BS_j \times JD_l) + (BS_j \times LD_k) + (JD_i \times LD_k) + e_{ijkl}$$

where y_{ijkl} is observations for DOA and bruising percentage; μ is the overall mean; ET_i is the fixed effect of environmental temperature (i = "very low", "low", "middle", "high" and "very high"); BS_j is the fixed effect of batch size (j = "very small", "small", "middle", "large" and "very large"); JD_k is the fixed effect of journey duration (k = "very short", "short", "middle", "long" and "very long"); LD_l is the fixed effect of lairage duration (l = "very short", "short", "middle", "long" and "very long") and e_{ijkl} is the random residual associated with observation ijkl. Batch size was used as weight variable and rabbit farm was used as random effect. Next, the independent variables and first order interaction terms were removed manually one by one from the model if *P*>0.10 (backward selection).

The effects of the investigated set of explanatory variables on the outcomes were expressed as odds ratios (OR) relative to the chosen reference category, with 95% confidence intervals. In essence, this value is equivalent to the relative risk, assessing each specific factor relative to its reference category (OR=1). Values of OR>1 or OR<1 indicated an increased or decreased probability of mortality or bruise prevalence during preslaughter time. For each factor, a reference category was arbitrarily chosen by assuming the lowest risk exposure interval based on both previous knowledge relative to preslaughter mortality and bruising risk and data found in this study. Accordingly, for environmental temperature and batch size, "middle" category was considered as the reference category, while "very short" category was chosen as reference one for journey and lairage duration factors.

RESULTS

Average mean values of DOA and bruising percentage within each category considered (environmental temperature, batch size, journey and lairage duration) are reported in Table 2. Overall mean mortality was 0.09% ranging from 0 to 1.3%, while incidence of bruised carcasses was 2.13% (from 0 to 9.62%) on average.

In the statistical model for preslaughter mortality, all independent variables were associated with DOA percentage, while none of interactions were significant (Table 3). A significantly increased percentage of DOA rabbits was related with both "very low" (OR=1.28) and "very high" (OR=1.85) environmental temperatures. As for batch size, "very large" batches showed a significantly higher percentage of DOA rabbits (OR=1.70). In addition, journey duration longer than 205 min determined significantly higher mortality risk. Rabbits belonging to batches transported for "long" (308 to 411 min) and "very long" (≥411 min) times had a roughly 3 times higher risk of death if compared with reference category (<103 min). Moreover, an increased mortality trend was found with increasing lairage duration. The DOA incidence risk was tripled (OR=3.19) in batches laired for a "very long" time (≥320 min).

In the statistical model for bruising percentage (Table 4), environmental temperature, batch size and journey duration variables were associated with the dependent variable, while lairage duration and none of interactions were significant. "Low" environmental temperatures reduced the risk of bruises (OR=0.90), whereas "high" and "very high" temperatures exhibited significant higher OR values (1.22 and 1.34, respectively). Moreover percentage of bruising was higher for "small" (OR=1.21) and "very small" (OR=1.36) batches, but also for "very large" ones (OR=1.10). As for journey time, "long" (OR=1.15) and

Table 2: Mean value of DOA[1] and bruising incidence within each risk category.

	Range	Mean	DOA[1] (%)	Bruising[2] (%)
Enviromental temperature (°C)				
very low	<7.3	4.1	0.091	1.92
low	7.3 to 12.4	9.9	0.078	1.76
middle	12.4 to 17.5	15.2	0.071	1.96
high	17.5 to 22.6	20.4	0.077	2.37
very high	≥22.6	25.2	0.131	2.62
Batch size (No. rabbits/batch)				
very small	<734	477.7	0.073	2.72
small	734 to 1716	1280.8	0.075	2.44
middle	1716 to 2699	2282.5	0.081	2.01
large	2699 to 3681	3106.8	0.073	1.99
very large	≥3681	5463.9	0.138	2.21
Journey duration (min)				
very short	<103	66.2	0.050	2.03
short	103 to 205	149.4	0.042	2.08
middle	205 to 308	252.0	0.079	1.94
long	308 to 411	363.3	0.138	2.32
very long	≥411	488.1	0.136	2.41
Lairage duration (min)				
very short	<75	45.4	0.044	2.16
short	75 to 156	118.3	0.070	2.11
middle	156 to 238	194.6	0.095	2.14
long	238 to 320	270.8	0.107	2.20
very long	≥ 320	417.0	0.140	2.00

[1] DOA: Number of rabbits that have died between catching and the moment of slaughter. [2] Bruising was discolouration under the skin due the presence of blood splash large than 1 cm^2.

"very long" (OR=1.19) duration increased bruising risk, while this risk was slightly decreased within the "middle" category (OR=0.96).

DISCUSSION

The average incidence of DOA rabbits accounted for 0.09% and was lower compared to the range (0.1-0.4%) reported by EFSA (2004). When compared with findings recorded in Italy in other species, preslaughter mortality of rabbits is slightly higher than those recorded in swine (0.01%) and bovine (0.05%) (Nanni Costa, 2007), while it was much lower compared to mortality rates reported in poultry (0.35, 0.38, and 1.22% in broilers, turkeys, and spent hens, respectively Petracci *et al.*, 2006) which are transported using similar procedures and equipment. These data indicate that overall rabbits are fairly resistant to preslaughter stressors. As stated above, data on bruising percentage among studies and abattoirs cannot be easily compared because of the differences in veterinary inspection and carcass grading methods, although in the present study the majority of bruised areas were legs, thoracic muscles

Table 3: Relative risk factors related to percentage of death on arrival rabbits (Odds ratio and 95% Confidence interval).

	Range	Odds ratio	Confidence Interval (95%)
Enviromental temperature (°C)			
very low	<7.3	1.28**	1.11 - 1.48
low	7.3 to 12.4	1.10	0.94 - 1.29
middle	12.4 to 17.5	1	
high	17.5 to 22.6	1.09	0.93 - 1.27
very high	≥22.6	1.85***	1.62 - 2.12
Batch size (No. rabbits/batch)			
very small	<734	0.90	0.70 - 1.17
small	734 to 1716	0.92	0.77 - 1.11
middle	1716 to 2699	1	
large	2699 to 3681	0.90	0.79 - 1.03
very large	≥3681	1.70***	1.50 - 1.93
Journey duration (min)			
very short	<103	1	
short	103 to 205	0.92	0.73 - 1.15
middle	205 to 308	1.74***	1.47 - 2.06
long	308 to 411	3.05***	2.57 - 3.62
very long	≥411	2.98***	2.52 - 3.54
Lairage duration (min)			
very short	<75	1	
short	75 to 156	1.59***	1.31 - 1.93
middle	156 to 238	2.15***	1.78 - 2.59
long	238 to 320	2.44***	2.02 - 2.94
very long	≥320	3.19***	2.64 - 3.86

**: $P<0.01$. ***: $P<0.001$.

and the internal part of the loin. Bruised carcasses were downgraded and cannot be sold as whole carcasses, but are trimmed and used for cut-up or further processed products. In consequence, bruises result in economic damage due to loss of edible parts, labour cost for trimming and general carcass value depreciation (Cavani and Petracci, 2004). Data on journey duration showed a great variation due to location spread of the farms with respect to the abattoir. In a survey conducted in Spain, Buil *et al*. (2004) found that the average transport time was 154 min corresponding to 137.5 km and lairage time was 110 min. The quite high journey duration observed in the present study is because about half of the farms were located at a distance from the abattoir of over 250 km.

It has been observed that both "very low" (<7.3°C) and "very high" (>22.6°C) environmental temperatures increase the DOA percentage. Most importantly, "very high" temperatures exhibited almost double the mortality risk in comparison with the reference category (12.4 to 17.5°C). Indeed, Mediterranean countries display large differences among seasons. During summer, temperatures reach values higher than 30°C, while in winter the temperature may be around 0°C. So, it can be said that potential stressors associated

Table 4: Relative risk factors related with percentage of bruised rabbit carcasses (Odds ratio and 95% Confidence interval).

	Range	Odds ratio	Confidence Interval (95%)
Enviromental temperature (°C)			
very low	< 7.3	0.98	0.95 - 1.01
low	7.3 to 12.4	0.90***	0.87 - 0.93
middle	12.4 to 17.5	1	
high	17.5 to 22.6	1.22***	1.18 - 1.25
very high	≥22.6	1.34***	1.28 - 1.41
Batch size (No. rabbits/batch)			
very small	<734	1.36***	1.30 - 1.42
small	734 to 1716	1.21***	1.17 - 1.26
middle	1716 to 2699	1	
large	2699 to 3681	0.99	0.97 - 1.02
very large	≥3681	1.10***	1.07 - 1.13
Journey duration (min)			
very short	<103	1	
short	103 to 205	1.03	0.99 - 1.07
middle	205 to 308	0.96*	0.93 - 0.99
long	308 to 411	1.15***	1.11 - 1.18
very long	≥411	1.19***	1.16 - 1.23

*: $P<0.05$, ***: $P<0.001$.

with ante mortem time are different among seasons. It is important to note that the vehicle setup was the same irrespective of the time of year without using side tarpaulins as protection during winter season, while stocking density varied according to environmental conditions with 15 and 16 animals/crate loaded during temperate (April to October) or cool (November to March) periods of the year, respectively. The results obtained in this study showed that heat stress due to high environmental temperatures can be a major risk factor in death of rabbits during preslaughter time (in the rabbit farm during catching and loading, on the vehicle during transport, and in the lairage area at the abattoir). This was true even if the majority of the batches were harvested and transported during the night or early morning (59.2%) and slaughtered during the morning, reducing the exposure of rabbits to the maximum temperatures during the hottest daytime hours. Rabbits have a limited capacity for heat loss by sweating and panting (evaporative heat loss); moreover, panting is an inefficient mode of heat loss when the environmental temperature is above 30°C (Fayez *et al*., 1994). Rabbits partly rely on changes in body position to adjust heat losses, but overcrowding in crates may interfere with this ability to adapt to changes in environmental temperature (Jolley, 1990). The high probability of thermal stress being suffered by some rabbits in transit has been documented by De la Fuente *et al*. (2004, 2007), who found that rabbits transported in summer rather than winter showed signs of severe heat distress, since they had higher blood cortisol, lactate and glucose, creatine kinase and lactate dehydrogenase enzymes, and evidenced more dehydration, with greater osmolarity. On the other hand, there is little information on the rabbit reaction to low temperatures, but practical experiments have shown that they are quite resistant to cold (EFSA, 2004). However, the present study also showed that temperatures lower than 7.3°C can increase the risk of death by 28% during preslaughter. De la Fuente *et al*. (2004) observed that winter transport increased muscle activity, as evidenced by the lower liver and muscle glycogen content. In contrast with these findings, Liste *et al*. (2008) found higher corticosterone levels in rabbits transported for long periods (>7 h) in winter compared with the summer season.

Overall, this study suggests that a wide range of temperatures from 7.3 to 22.6°C seems to guarantee a low incidence of preslaughter mortality in rabbits. However, close environmental control in the crates or modules on the vehicle is difficult, mainly because vehicle ventilation is passive and is impeded by the close stacking of adjacent crates. When lorries are full of rabbits, the ventilation inside tends to be poor, particularly when the truck stops, either during the journey to or on arrival at the abattoir, so rabbits on the inside of a load may suffer hyperthermia, whereas those on the outside may experience hypothermia (Jolley, 1990; Verga *et al*., 2009). On the other hand, it would be easier to improve the environmental conditions during lairage. The lairage area at the abattoir considered in this study was located outside and equipped with a roof to protect the rabbits against sunlight, so control of environmental temperature and humidity was lacking. In modern poultry plants, lairage areas are usually located in an enclosed zone and fitted with forced ventilation and water-misting sprays as a control strategy for adverse environmental conditions. It is noteworthy to observe that "high" and "very high" temperatures also increased the risk of bruise prevalence (OR= 1.22 and 1.34, respectively), while temperatures ranging from 7.3 to 12.4°C reduced this risk (OR=0.90).

In regard to the effect of batch size, the considerably higher mortality risk (OR=1.70) found in "very large" batches (>3681 rabbits) can be attributed to the fact that larger batches mean an increased catching time, which can affect the crew's ability to take care during this practice. This was partially confirmed by the slight increase in bruising risk (OR=1.10) observed in "very large" batches. In addition to the human factor which influences the mortality in larger batches, the longer feed withdrawal time, due to the increase in catching time, might have an influence on mortality (Cavani *et al*., 2007). However, higher bruising risk was also associated with "very small" (OR=1.36) and "small" (OR=1.21) batches.

Both increasing journey and lairage durations dramatically increased the risk of death during preslaughter time. Rabbit transported and laired for longer times had a threefold higher risk of death. Indeed, death risk was significantly augmented if transport lasted more than 205 min and lairage duration was longer than 75 min. These results agree with Jolley (1990), who pointed out that the risk of death during ante mortem time increases enormously as time between crating and slaughtering increases. It should be noted that rabbits had feed withdrawn about 5 h prior to catching and afterwards had no access to feed and water until slaughter. This means that concomitant longer journey and lairage times determined extreme fasting duration of more than 12-15 h. Luzi *et al*. (1992) conducted a survey in Northern Italy studying preslaughter transports from farms located at different distances (25, 50, 100 and 150 km) over one year. They observed that the most critical conditions for rabbits are when they are transported for over 4 h. Other studies confirmed that longer transport duration negatively affected weight loss and modified some meat quality parameters (Trocino *et al*., 2003; Lambertini *et al*., 2006; María *et al*., 2008; Petracci *et al*., 2009). In addition, Canali *et al*. (2000) and Mazzone *et al*. (2010) found that rabbits after a transport of 6-7 h had higher serum steroid hormones and blood glucose levels and greater creatine phosphokinase, aspartate aminotransferase enzyme activities, which overall indicate higher stress as well as muscle damage and fatigue. Moreover, Jolley (1990) observed a significant reduction of glycogen stores in liver and muscle of rabbits transported without access to feed. With regard to lairage duration, recently Liste *et al*. (2009) observed that holding the rabbits after transportation for 8 h led to lower corticosterone level and based on this, they recommended a lairage duration of 6-8 h to enable the rabbits to adapt to the new environment and recover their homeostasis. However, the present study demonstrated that this might be allowed only if suitable environmental conditions are guaranteed for the rabbits during the lairage period and the total fasting period is not excessive.

In conclusion, even though average mortality and bruising rates were quite low because of the good production chain batch harvesting organisation, which allowed the journey and lairage periods to be reduced as far as possible and scheduled during the night and early morning, further improvements in logistics and planning in batch harvesting are needed. In fact, changing management at the processing plant can reduce the effects of some risk factors that impact mortality and/or percentage of bruises. Particular care should be taken to reduce transport and lairage duration, and predominantly concomitant longer journey and lairage times which can determine extreme fasting duration of more than 12-15 h. Controlling microclimate inside the transport truck may reduce the effects of both extreme low and high environmental temperatures on mortality. Furthermore, it is essential that lairage areas should be provided with an enclosed area equipped with forced ventilation and water-misting sprays as a control strategy for extreme environmental conditions. Regardless of this, to reduce DOA rabbits during cold times of year it is recommended that slaughtering should begin later in the morning rather than very early in the morning, in order to reduce exposure to low temperatures during the transport and lairage phases, while in the warmer season transporting and lairing rabbits during daytime should be avoided.

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