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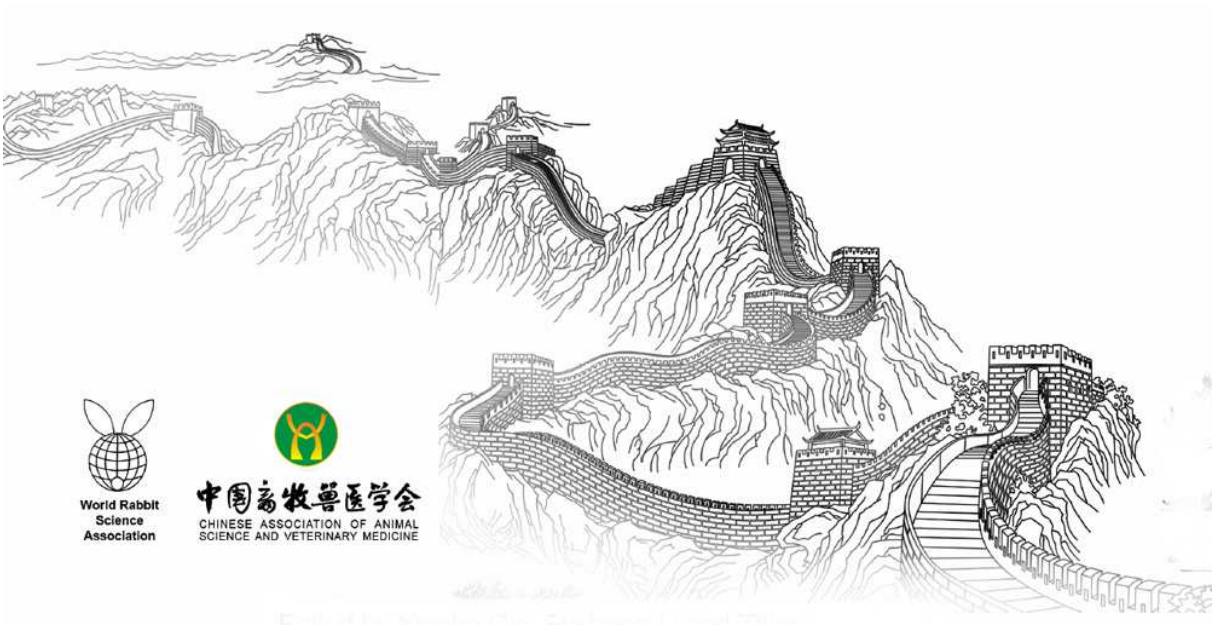

INTEREST AND LIMITS OF ADDING EXOGENOUS HARD FECES IN THE NEST BOX ON THE RABBIT PERFORMANCES AND HEALTH BEFORE AND AFTER WEANING

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ABSTRACT

The natural behavior of coprophagy expressed by the young rabbits can be amplified by the addition of exogenous hard feces in the nest box. The objectives of our study were 1) to describe the feasibility of this practice under commercial conditions, and 2) to study the interests and limits of this practice on rabbit zootechnical performances and health until slaughter. The experiment was conducted on 363 litters, in a professional unit that stop to use antibiotics for more than 10 years, during 5 consecutive batches. Offsprings were controlled from birth to 70 days of age. In the experimental group **F** (**feces added**, n = 183 litters), exogenous hard feces (5 pellets from young females of the farm per day and nest) were manually added to the nest between days 2 and 18 of lactation. In the control group **C** (**control**, n = 180 litters) no hard feces were added to the nest box. Globally the addition of exogenous hard feces in nests did not improve the mortality of the rabbits during the lactation or after weaning but increases the growth and the slaughtering yield. However the results seem to largely depend on the feces that was added. The difference between the results obtained under professional breeding and previously experimental conditions, demonstrates that additional studies regarding the origin of feces, the beginning of the treatment and the period of the day in which the exogenous feces are added in the nest, are necessary to validate this practice in professional conditions.

Key words: rabbit, fecal microbial therapy, coprophagy, hard feces, mortality, exogenous

INTRODUCTION

In experimental conditions, the ingestion of hard feces (either exogenous originated or produced by the own mother) favors the microbial colonization of the gut and the health of the young rabbits (Combes et al., 2014). Consequently the addition of exogenous hard feces in the nest could be useful to the improvement of the performances before and after weaning of the young rabbits.

Some experimentation have been carried out in a commercial farm to study in professional conditions the effects of the addition of exogenous feces in the nest box on the performance of young rabbits from the birth to the sale. Some preliminary results concerning the mortality have been previously published (Savietto et al., 2015). The present work presents the complete results emphasizing on the zootechnical performance and the consequences of this practice on the parasitism.

MATERIALS AND METHODS

Animals, experimental design and measures

A total of 363 litters from 80 females were followed during 5 consecutive batches (1-5) between the birth and the slaughter age (70 days), in a professional rabbit farm that banned antibiotics 10 years ago. The experiment began on March 17th, 2014 and has concluded on November 30th, 2014. In the experimental group F (feces added, n = 183 litters from 40 females housed in one side of the room), exogenous hard feces (5 pellets per day and nest) were manually added to the nest between days 2 and 18 of lactation. The exogenous hard feces were obtained from young rabbit females reared in the same farm and were added usually in the morning as detailed by Savietto et al. (2015). In the group C (control, n = 180 litters from 40 females housed in the other side of the room), no exogenous feces was added in nests, but the natural behavior of the hard feces deposited in nests by the mother during lactation was respected. After weaning, the rabbits were put in the fattening room according to the conditions already described (Teillet et al., 2012). Overall, 2 296 pups (n = 1 166 and 1 130 in groups C and F, respectively) were raised until 70 days of age. The numbers of the rabbits born dead or alive, adopted and weaned per litter were registered. The mortality was checked at birth (day 0), day 8 and weaning (day 35), and every day from day 35 to day 70. The weight performance, the feed distribution and the slaughter results were measured according to the method already described (Teillet et al., 2012). *Eimeria* in the feces were quantified and identified (*Eimeria magna* and *Eimeria media*) according to Colin et al. (2013).

Statistical analyses

The statistical analyses were realized with the R software (R Core Team, on 2014). The size of litter (number of the alive born rabbits and the dead born rabbits) was analyzed according to a linear model including the treatment (C vs. F) and batches (from 1 to 5) and their interaction in the model. Mortality was analyzed as described by Savietto and al (2015). The slaughtering yield and the feed conversion ratio (FCR) were statistically studied according to the method described by Lebas (1986).

RESULTS AND DISCUSSION

Health status

The mortality rate before weaning (day 0 – day 35) was 7.3% and similar in the two groups (Savietto et al., 2015). Four litters of the 4th batch were affected by yellow diarrheas. In the batch 3, the presence of yellow secretions during the first 8 days of age in feces distributed in several litters was observed and the mortality of the rabbits was numerically 4 times higher than for the other batches. Between day 36 and day 70, the mortality rate of rabbits was 15.1 %, and resulted especially from the epizootic enteropathy. No difference was observed between the groups C and F (C: 14.6 % vs. F: 15.7 %, $p = 0.43$). However, a significant interaction exists between the effects treatment and batch (Figure 1). The addition of exogenous hard feces in the nest lead to lower mortality rate during the lactation for the batch 2 (C2: 17.7 % vs. F2: 8.2 %, $p < 0.01$), but higher mortality for the batch 5 (C5: 12.0 % vs. F5: 24.6 %, $p < 0.01$). Mortality rate was similar in the two groups for batches 1, 3 and 4. No difference was observed between the total mortality of the two groups (C: 20.6% vs. F: 21.6 %, $p = 0.64$) (Figure 2). However, the mortality of the group F was significantly lower in the batch 2 ($p = 0.002$) and significantly higher for the batch 5 ($p = 0.009$).

Combes et al. (2014) have previously shown in experimental station that addition of feces in the nest improves rabbit viability. However, present results indicated that such a practice could lead to contradictory effects when applied in farm. Consequently, this practice need to be standardized and improved, in particular concerning the choice of female producing the feces (Savietto et al 2015).

Causes of mortality and infestation by *Eimeria*

Adding feces did not change the causes of mortality or the abundance of *Eimeria* (Figure 3). The total number of pathological *Eimeria* (*Eimeria magna* and *Eimeria media*) was in the range of the usually observed one in this farm (Colin and al., 2013), and was not linked to the mortality rates. In the group F, the number of *E. magna* and *E. media* was similar (batches 1, 2 and 5), higher (batch 3) and lower (batch 4) than in the group C (Figure 4).

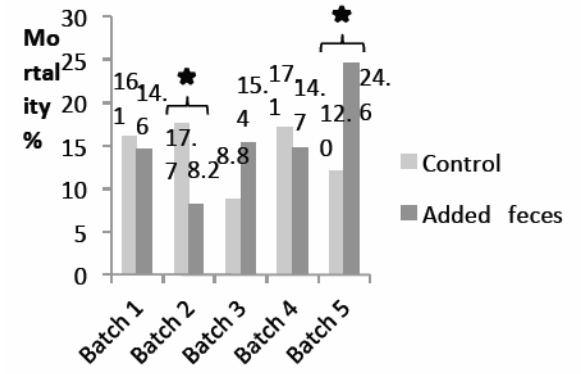

Figure 1 : Mortality between day 35 and day 70 of age for the treatments and the batches

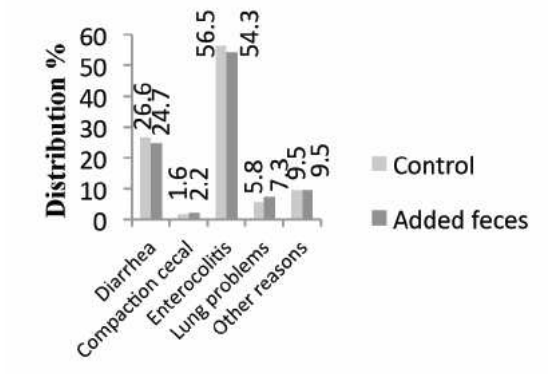

Figure 3: The causes of death in the two groups (pool of the 5 batches)

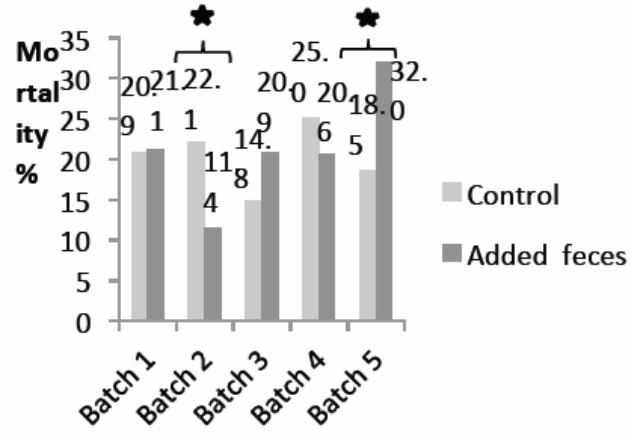

Figure 2: Mortality between day 0 and day 70 of age for the treatments and the batches

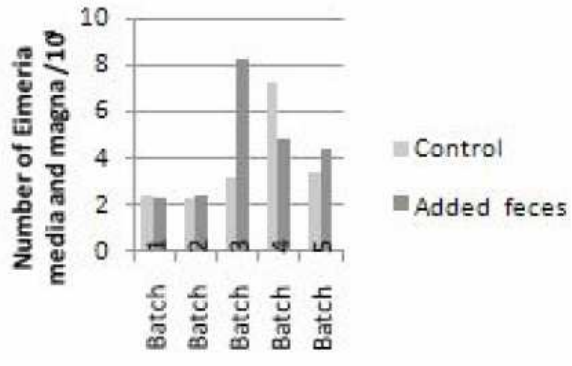

Figure 4: Quantity of *Eimeria media* and *magna* oocysts in feces (10^4/g)

Weight and growth

The weights at weaning were identical. Globally, the weights at 70 days were higher of 27 grams for the group F compared to the control ($p < 0.1$). This weight of the group F is lower than the group C only for the batch 5. For the 5 batches, the average daily gain (ADG) weaning – 70 days is statistically higher (1 g/d) for group F compared to the control ($P < 0.05$). The average daily gain was similar between the two groups for the batches 1, 2, 3 and 5, but 13% higher in the group F compared to group C in the batch 4 ($p < 0.01$). Such a difference could be due to the origin of feces used.

Slaughtering yield and Feed conversion ratio

Globally, the group F had a higher slaughtering yield than the Control group (+1.3 %, $p < 0.001$). This improvement is observed for 3 batches, the third one not showing difference and the 4th a higher slaughtering yield with the control (Table 2). For the 5 batches, the Feed Conversion Ratio (FCR) was globally unchanged with very big differences between the batches.

Table 1: Weight at weaning and slaughter (g), average daily gain between weaning and slaughter (g/d)

	Weight of weaning (g)		Weight of slaughter (g)			Average Daily Gain (g/d)		
Batch	Group Control	Group Added feces	Group Control	Group Added feces	P	Group Control	Group Added feces	P
1	907	912	2152	2197	NS	37.7	38.9	NS
2	932	931	2267	2273	NS	40.5	40.7	NS
3	936	945	2335	2345	NS	42.4	42.4	NS
4	912	900	2156	2302	<0.001	37.7	42.5	<0.01
5	926	906	2182	2109	<0.01	38.1	36.5	NS
Total	920	921	2218	2245	<0.1	39.2	40.2	<0.05

Table 2: Slaughter yield and Feed Conversion Ratio

	Yield at slaughter			FCR		
Batch	Group Control	Group Added feces	P	Group Control	Group Added feces	P
1	56.65	61.19	<0.001	4.59	4.27	<0.001
2	53.93	56.59	<0.001	4.17	3.67	<0.001
3	57.65	57.34	NS	3.80	4.20	<0.001
4	56.25	57.48	<0.001	3.89	3.53	<0.001
5	56.98	55.29	<0.001	4.09	5.05	<0.001
Total	56.3	57.6	<0.001	4.11	4.12	NS

CONCLUSIONS

The present study has confirmed the feasibility of the technique of adding exogenous hard feces in the nest box in the practical conditions of a commercial farm. Adding feces in the nest did not increase Eimeria counts.

Globally, out of the 5 experiments, adding exogenous hard feces in the nest box had positive impact on health one time, a globally positive impact on weight performances and on the slaughtering yield.

Summarizing, the method of adding exogenous hard feces could improve the management of the rabbit farms but the origin of the hard feces, the time of the beginning of the treatment and the period of the day in which exogenous feces are added in nests have to be further studied before using it routinely.

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Take home message

In experimental conditions, the ingestion of hard feces distributed in the nest to the suckling rabbits favored the microbial colonization of the gut and the rabbit health (Combes et al., 2014). It was thus necessary to check the reproducibility of this technique in a commercial farm. We also studied its impact on the *Eimeria sp.* count. The results confirmed the reproducibility of this technique under commercial conditions and demonstrated that adding feces in the nest did not increase the parasite counts.

Introduction

We performed a series of studies to verify, under commercial conditions, the effects of adding exogenous-feces in the nest box of suckling rabbits on their overall performance until the age of sale. Here we emphasize results on the mortality, growth, yield at sale and the consequences of this practice on *Eimeria sp*. count.

Method

A total of 363 litters from 80 females pertaining to 5 consecutive batches (1-5) were followed up from birth to the age of sale (70 days). In the experimental group, we added exogenous hard-feces to the nest (5 per day) of 138 litter between the 2nd and 18th of lactation. No feces were added in the control litters (n=180). At birth we checked the numbers of offspring born dead, alive and adopted. We checked the mortality rate during the whole period and assessed the overall growth performance, as well as the yield at age of sale. We also checked the count of *Eimeria sp.* in the feces of growing rabbits.

Results

Globally, the addition of hard-feces in the nest did not affected the mortality rate before and after weaning. However, the mortality rates varied from batch to batch (Figure 1). Count of *Eimeria sp.* did not increased with this practice. Growth rate significantly increased by 1 g per day among rabbits of the experimental group and thus they were, on average, 27 g heavier than rabbits of the control group at sale age (Figure 2). The yield at sale was also better (+1.3%) for rabbits receiving hard-feces during suckling.

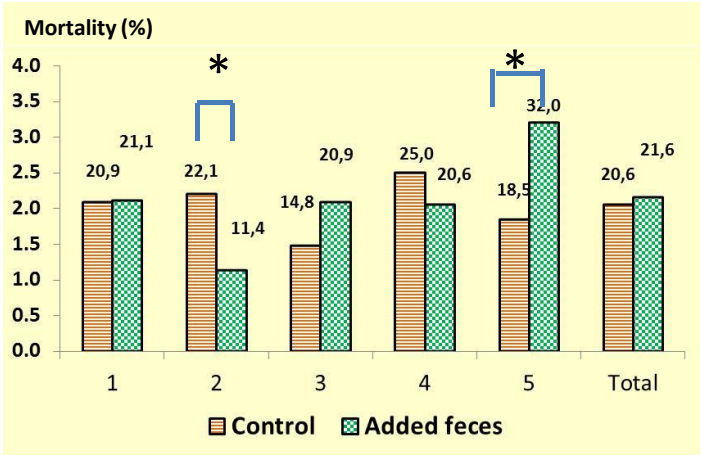

Figure 1: Overall mortality.

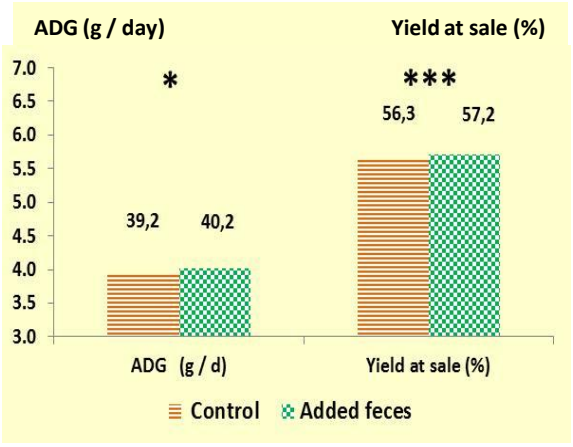

Figure 2: Average daily gain (ADG) and yield at sale.

*: P<0,05 - ***: P<0,001

Conclusions

The technique of adding exogenous hard-feces in the nest is reproducible under the practical conditions of a commercial farm.

This practice did not increase the count of *Eimeria sp.* and thus did not impaired the health status of the experimental group, at least for this parasite .

Globally, out of the 5 batches, the addition of exogenous hard-feces in the nest box seem to have a positive effect on the average daily gain and yield at sale without impairing health.

Summarizing, the proposed practice seem to improve the results of this commercial farm. However, other aspects as the origin of the hard-feces, the beginning of the treatment and time of the day in which the feces are added to the nests need further investigations in order to obtain a systematic improvement so that it can be routinely applied in other commercial farms.