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IN NON CONTROLLED ENVIRONMENT FARMS ?**

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IS FEED RESTRICTION AN ALTERNATIVE TO THE USE OF ANTIBIOTICS IN NON CONTROLLED ENVIRONMENT FARMS?

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ABSTRACT

The effect of antimicrobials and feed restriction (as an alternative to the use of the formers) on production performance of growing rabbits reared in a non-controlled environment was estimated. A total of 987 young rabbits from a three way cross were randomly distributed into groups of 8 individuals, which were assigned to one of the following feeding strategies from 35 to 63 days of life: *ad libitum* feeding with medicated feed (antibiotics and a coccidiostatic; AdLibMed), *ad libitum* feeding with no medicated feed (AdLibNoMed), restricted feeding with medicated feed (RestrMed) and restricted feeding with no medicated feed (RestrNoMed). All groups were fed *ad libitum* with no medicated feed from 63 to 70 d. Feed offered to restricted animals was calculated weekly as 80% the feed intake of the batch-mates fed *ad libitum* the week before, increased by 10% to account for the increase in consumption with age. Feed restriction finally applied was on average 84.2%. *Ad libitum* feeding with no medicated feed led to lower average daily gain and relevantly higher but not significantly different mortality with respect to AdLibMed (-1.0 g/d, p-value<0.01; +3.0%, p-value=0.28). Feed restriction did not improve performance, as average daily gain was lower than when animals were fed *ad libitum*, and mortality rate did not improved (-3.8 g/d, p-value<0.01; -0.52%, p-value=0.93; RestrNoMed vs. AdLibNoMed). These results are probably due to the range of variation of actual feed restriction along the trial (72 to 100% of *ad libitum* feed intake) and the low mortality rate in the overall trial (7.62% for *ad libitum*, and 6.12% for restriction). None of the treatments had effect on feed efficiency. Therefore, feed restriction might not be the best alternative to the production without antibiotics when feed intake is highly conditioned by environmental changes and mortality is low, and the use of other alternatives to avoid a decrease in daily gain is required.

Key words: antibiotics, environmental control, feed restriction, mortality, performance, rabbits.

INTRODUCTION

Rabbit production farms are usually affected by digestive disorders, especially since the extent of the Epizootic Rabbit Enteropathy (ERE) in European countries (Licois et al., 2005). This illness causes high levels of morbidity and mortality during the fattening period. The causal agent has not been identified yet and the incidence of the illness has been partially controlled by using antibiotics (Carabaño et al., 2018). In the last decade, the increased emergence of new antibiotic-resistant bacteria has forced the reduction of use of antibiotics in both human health and livestock production. The lower use of these substances might increase the incidence of not only ERE but other illnesses. Feed restriction after weaning has been proposed as an alternative to the use of antibiotics. This management technique has shown to reduce mortality and morbidity under controlled experimental conditions (Gidenne et al., 2012; Piles et al., 2017). However, there are commercial farms rearing in non-controlled environmental conditions, and variations of temperature could influence the feed intake pattern of the animals. The evidence of the efficacy of feed restriction in commercial farms with non controlled environment is scarce. The objective of the study is to analyze the effect of the omission of

antibiotics during fattening and the use of feed restriction as an alternative to antibiotics in rabbits reared in a farm without controlled environment.

MATERIALS AND METHODS

Animals and experimental design

The trial was developed in a Spanish commercial farm without environmental control between August and November 2019. The maximum temperatures registered in the region during the fattening period ranged from 10.2 to 31.4°C, and the minimum from 5.9 to 14.6°C. A total of 250 crossbred females were inseminated with semen from males of five different experimental lines undergoing selection processes to improve their feed efficiency. At 35 days of age, 987 young rabbits were weaned and allocated in groups of 8 individuals. Cages were distributed in four groups (29 to 33 cages per group) with different feeding strategy. From 35 to 63 days of age (initial period) AdLibMed group was fed *ad libitum* with medicated feed; AdLibNoMed group was fed *ad libitum* with no medicated feed; RestrMed group was fed under restriction with medicated feed; and RestrNoMed group was fed under restriction with no medicated feed. From 63 to 70 days of age (final period), all groups were fed *ad libitum* with no medicated feed. Feed medication was Valnemulina 40 ppm, Oxitetra 400 ppm and a coccidiostatic. The quantity of feed offered to the restricted animals was calculated weekly as 80% the amount of food consumed in the previous week by the batch-mates fed *ad libitum*, but increased by 10% to account for the increase in consumption with body weight. The average final restriction was 84.2% of the *ad libitum* intake. Feed intake per cage was controlled weekly from 35 to 70 days of age. Individual body weight was measured at 35, 63 and 70 days of age. Feed efficiency per cage was calculated as weight gain with respect to feed intake in the cage. Mortality was also recorded daily.

Statistical Analysis

Average daily gain, feed intake, and feed efficiency were analyzed by ANOVA using a model with the feeding regimen (two levels; *ad libitum*, or restricted), medication (two levels; medicated, non-medicated), the paternal line (5 levels) as fixed effects. No significant effect of interactions on the traits analyzed were observed, therefore they were not finally included in the model. Differences between groups were statistically tested using the Tukey honest significant differences method (Tukey HSD). Differences in mortality between groups were statistically tested using chi-square tests.

RESULTS AND DISCUSSION

Least square means of average daily gain, daily feed intake and feed efficiency, and the percentage of mortality in the different groups are shown in table 1. During first post weaning period (35 to 63 days of age), rabbits fed *ad libitum* with non-medicated feed (group AdLibNoMed) had lower average daily gain than animals fed *ad libitum* with medicated feed (group AdLibMed). The differences turned at the end of the fattening period (63 to 70 days of age), when both groups are fed without medication, due probably to a worsening of health status in AdLibMed, but the results during the overall fattening period were similar to those observed during the first period. Therefore, removing antibiotics without the application of any alternative strategy would worsen productivity of the rabbits. The mortality during the whole period did not significantly differ between groups although the difference could be considered as relevant (-3.0 AdLibMed vs. AdLibNoMed).

Feed restriction during the first period of fattening has been proposed as an alternative to improve gut health in rabbits (Gidenne et al., 2012). The restriction has been shown to reduce morbidity and mortality in other studies, even when the restriction period is lower than the period applied in the present study. However, no reduction of mortality was observed in our trial, due probably to the lower mean values of mortality observed (7.62% for *ad libitum*, and 6.12% for restriction) compared to the ranges obtained in other studies about feed restriction (from 12.5 to 21.6% in animals fed *ad libitum*; Gidenne et al., 2012). Moreover, animals fed under restriction have been seen to have higher feed efficiency when they are lately fed *ad libitum*, but this improvement did not always allow the rabbits

to achieve similar weights as those fed *ad libitum* during the whole period. This reduction of daily weight gain in some studies of animals restricted after weaning was also observed in RestrNoMed group. The lack of compensatory growth could be due to changes in the pattern of mortality between the initial and final period of fattening. Animals fed *ad libitum* showed higher mortality than animals fed under restriction from 35 to 63 days of age (6.25% vs. 2.95%, respectively), but these differences varied between groups during the period from 63 to 70 days of age (1.46% vs. 3.26%, respectively), when all the animals were fed *ad libitum*.

Table 1. Least square means (standard errors) for average daily gain, daily feed intake, and feed efficiency, and percentage of mortality (standard errors) in fattening rabbits reared in a non-controlled environmental farm under different feeding strategies.

	AdLibMed	AdLibNoMed	RestrMed	RestrNoMed
Average Daily Gain (g/d)				
35 to 63 days of age	38.7(0.38) ^d	36.9(0.38) ^c	34.6(0.39) ^b	32.8(0.39) ^a
63 to 70 days of age	35.0(0.55) ^b	37.3(0.55) ^c	33.0(0.56) ^a	35.3(0.57) ^b
35 to 70 days of age	38.3(0.29) ^d	37.3(0.28) ^c	34.5(0.29) ^b	33.5(0.29) ^a
Daily Feed Intake (g/d)				
35 to 63 days of age	105(1.1) ^b	102(1.1) ^b	88(1.2) ^a	86(1.1) ^a
63 to 70 days of age	133(2.3)	134(2.3)	132(2.4)	132(2.3)
35 to 70 days of age	111(1.1) ^b	109(1.1) ^b	97(1.2) ^a	95(1.1) ^a
Feed Efficiency (g/g)				
35 to 63 days of age	0.37(0.006) ^a	0.36(0.006) ^a	0.39(0.006) ^b	0.38(0.006) ^b
63 to 70 days of age	0.25(0.008)	0.26(0.009)	0.24(0.008)	0.25(0.008)
35 to 70 days of age	0.34(0.004)	0.34(0.004)	0.35(0.004)	0.34(0.004)
Mortality (%)				
35 to 63 days of age	4.7(1.34) ^a	8.1(1.70) ^b	1.7(0.86) ^a	5.0(1.40) ^a
63 to 70 days of age	1.7(0.82)	1.3(0.73)	2.2(0.97)	3.9(1.28)
35 to 70 days of age	6.3(1.53) ^{ab}	9.3(1.81) ^b	3.9(1.27) ^a	8.7(1.81) ^b

AdLibMed: *ad libitum* with medicated feed from 35 to 63 days of age; AdLibNoMed: *ad libitum* with non-medicated feed from 35 to 63 days of age; RestrMed: under restriction with medicated feed from 35 to 63 days of age; RestrNoMed: under restriction with non-medicated feed from 35 to 63 days of age. All groups fed *ad libitum* with non-medicated feed from 63 to 70 days of age. Data with different superscripts in the same row are statistically different ($p < 0.05$).

Under the conditions of our study in which animals were exposed to wide ranges of temperatures, feed restriction does not seem to improve clearly production performance. In the present experiment, the average level of restriction was 84.2% of the *ad libitum* intake but it ranged from 72 to 100% along the trial due to changes in the environmental temperature that made difficult to set the amount of food for the animals on restricted feeding based on information from the week before. In addition, the positive effect of restriction on mortality might not have been observed due to the low overall mortality along the trial. This could indicate that feed restriction might increase profit only in conditions where feed intake is not highly influenced by changes in the environmental temperature and mortalities are high. As expected, the lowest mortality was obtained when both medication and restriction were applied.

Feed restriction followed by an *ad libitum* period has been associated by some authors to a compensatory growth at the *ad libitum* period and an improve of the feed efficiency both in the *ad libitum* and the overall fattening period (Boisot et al, 2003; Gidenne et al., 2009a). However, there are some evidences of worsening of the health status when rabbits change from restriction to *ad libitum* diet (Gidenne et al., 2009b). Thus, the lack of compensatory growth in our study during the final

period in restricted. Therefore, results could vary if longer final periods are used, and more evidence of the effect of extend of both periods in different scenarios is needed. Nevertheless, these results expose the need of environmental control to obtain the expected benefits of the different management techniques applied. On the other hand, results also highlight that not only restriction but also other alternatives are needed, as the use of different feed composition, additives and biosecurity protocols, if antibiotics are avoided during the fattening period (Carabaño et al., 2018).

CONCLUSIONS

The use of non-medicated feed during the whole fattening period reduces daily gain in rabbits. The application of feed restriction followed by a short period of *ad libitum* feeding did not improve daily gain or mortality under non-controlled conditions. The effect of other range of periods of restriction and *ad libitum* under the Spanish commercial conditions needs to be studied. Moreover, other alternative techniques than restriction have to be applied.

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Is feed restriction an alternative to the use of antibiotics in non controlled environment farms?

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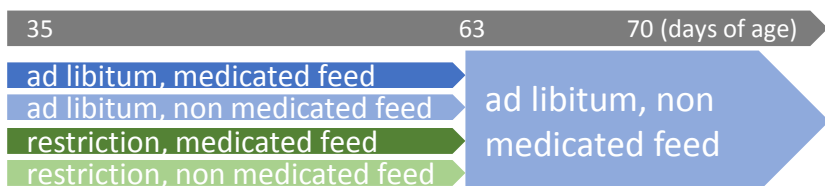
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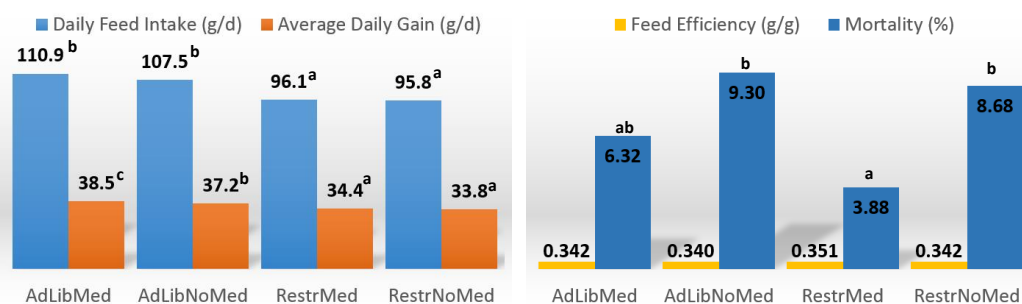


Context : information about the effect of the feed restriction as an alternative to antibiotics to preserve gut health in growing rabbits in commercial farms without environmental control is scarce.

Methods : 987 growing rabbits divided in four groups with different feeding regimen, in a farm without environmental control.



Results: non medicated feed reduced average daily gain; feed restriction did not improve average daily gain or mortality, probably due to a too short final ad libitum period and to an overall low mortality.



Productive performance of the rabbits from 35 to 70 days of age

Take home message : the convenience of the use of feed restriction during the fattening period must be studied in each commercial farm.

