EFFECT OF FEED RESTRICTION WITH OR WITHOUT FREE ACCESS TO DRINKING WATER ON PERFORMANCE OF GROWING RABBITS IN HEALTHY OR EPIZOOTIC RABBIT ENTEROPATHY CONDITIONS

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ABSTRACT

The aim of the present study was to check the interest of forcing the water to feed ratio at 1.7 when rationing rabbits in good sanitary conditions (without experimental reproduction of Epizootic Rabbit Enteropathy) and in Epizootic Rabbit Enteropathy conditions. Three hundred thirty six rabbits, housed in cages each containing 8 rabbits, were divided into 7 groups controlled from weaning at 32 days of age to 67 days. In the control group, rabbits were given feed and water *ad libitum*. In the second group, feed was restricted, but not water (water/feed ratio >3), and in the last group, feed and water were restricted (water/feed ratio=1.7). In good sanitary conditions, the slaughtering weight was higher for the control group as the compensatory growth was not sufficient to compensate the body weight difference due to restrictions. There was no difference between the two ways of restriction during the fattening period. Except for the 1st week (adaptation to restriction) the feed conversion ratio was improved for groups restricted in feed and/or water. Quantitative feed restriction is interesting in Epizootic Rabbit Enteropathy conditions as it leads to less mortality and morbidity compared to the control group (*ad libitum*). There was no significant effect of the type of quantitative feed restriction (with or without water restriction) on mortality, but feed restriction with water *ad libitum* tended to be more efficient to reduce mortality (from 29.2 to 16.7). Moreover, this restriction did not generate a difference in slaughtering weight compared to the control group and produced more meat (+18%).

Key words: Feed, Restriction, Water.

INTRODUCTION

Feed restriction is a common practice to reduce post weaning digestive disorders in rabbits. Gidenne *et al*. (2003) showed that during feed restriction mortality and morbidity were significantly reduced from a feeding level of 80% and 70% respectively in epizootic rabbit enteropathy syndrome (ERE) conditions.

During an experimental reproduction of ERE syndrome, Boisot *et al.* (2003) demonstrated the interest of a preventive restricted feeding to reduce the negative impact of this disease on the growth performance of rabbits. A feeding level of 60% was more efficient than a feeding level of 80% in ERE conditions.

Feed restriction is time consuming when automatic feeders are not available, but an indirect restricted feeding through hydric restriction can be an alternative and is easier to apply. Boisot *et al*. (2005) demonstrated that a hydric restriction (1 h/day) was as efficient as feed restriction (65% of the *ad libitum* level) to reduce mortality and morbidity in ERE conditions. However in good sanitary conditions, compensatory growth, usually observed after a period of feed restrictions, was limited with hydric restriction when rabbits were back to a free access to drinking water. Part of this result could be explained by a lower water to feed ratio compared to rabbits having no restriction in feed or water

access (1.2 vs. 1.7). This last study also showed that rabbits fed under *ad libitum* level had a higher water to feed ratio of 3.5.

The aim of the present study was to check the interest of forcing the water to feed ratio to 1.7 when rationing rabbits compared to regular feed rationing in good sanitary conditions and in ERE conditions.

MATERIALS AND METHODS

Animals and treatments

This study was carried out between 10th April and 17th May 2006 at the Evialis Research Center in St Nolff (56), France. 336 young rabbits (Hyplus strain) were divided at weaning at 32 days of age into 7 groups (A1, B1, C1, A2, B2, C2 and I) of 48 individuals, homogenous in body weight and sex ratio. Rabbits from each group were placed in cages of 8 rabbits (6 cages per group) in 2 houses with access to the same regular rabbit growing feed (16.6% protein, 16.9% cellulose, 12.2% starch). There was no supplementation in the diet. All the groups were back to an *ad libitum* feeding at 53 days of age.

House 1 : good sanitary conditions

A1 : Control group : feed and water *ad libitum;*
B1 : feed restriction (objective=70% of the *ad libitum* level), water *ad libitum* (water/feed ratio >3);
C1 : feed restriction (objective=70% of the *ad libitum* level), hydric restriction (water/feed ratio =1.7).

House 2 : experimental reproduction of ERE

A2 : Control group : feed and water *ad libitum;*
B2 : feed restriction (objective=70% of the *ad libitum* level), water *ad libitum* (water/feed ratio >3):
C2 : feed restriction (objective=70% of the *ad libitum* level), hydric restriction (water/feed ratio =1.7).
I : Contagious group, *ad libitum*. One rabbit per cage was inoculated (0.5 ml/rabbit) at 34 days of age in order to reproduce the ERE syndrome (inoculum TEC4 from Institut National de la Recherche Agronomique). The aim of this group was to contaminate all house 2, so results from this group will not be discussed.

Zootechnical performances collected

Rabbit body weights were controlled individually at 31 days of age (day before weaning), 39, 46, 53 and 67 days of age. Feed intake per cage was controlled when animals were weighed (daily during feed restriction for groups B1, C1, B2 and C2). Water consumption was controlled at different periods (31-39 and 39-53 days of age) for each group (except the contagious group). Individual tanks per cage were used for the control of water consumption. Mortality was recorded daily.

Statistical analyses

Statistical analyses were conducted using SPSS 13.0 software. Body weights, daily weight gains, feed intake and feed conversion ratio were analysed by an analysis of variance using the UNIANOVA procedure and adjusting for treatment in each housing system, sex and the interaction between both. Differences among means were tested with a Duncan test. The death rates between treatments were compared with the Chi-square test.

RESULTS AND DISCUSSION

Death rate

In house 1 (good sanitary conditions) death rate was low (3.5% on average) and no significant difference was observed among groups (Table 1, Figure 1). In house 2, the experimental reproduction of ERE syndrome was successful with a death rate of 29.2% on the control group. Most of dead rabbits showed signs of ERE syndrome.

Table 1: Mortality per group during fattening period

Group	Mortality rate 32-67 days of age (%)	Chi^2 test
A1: fed and water *ad libitum*	6.3	
B1: fed restriction, water *ad libitum*	2.1	NS
C1: fed and water restriction	2.1	
A2: fed and water *ad libitum*	29.2	
B2: fed restriction, water *ad libitum*	16.7	NS
C2: fed and water restriction	25.0	

NS = not significant difference between groups (P>0.05)

During the experimental reproduction of ERE, restricted rabbits had a lower death rate than rabbits fed *ad libitum* and feed restricted rabbits had over mortality than feed and water restricted rabbits

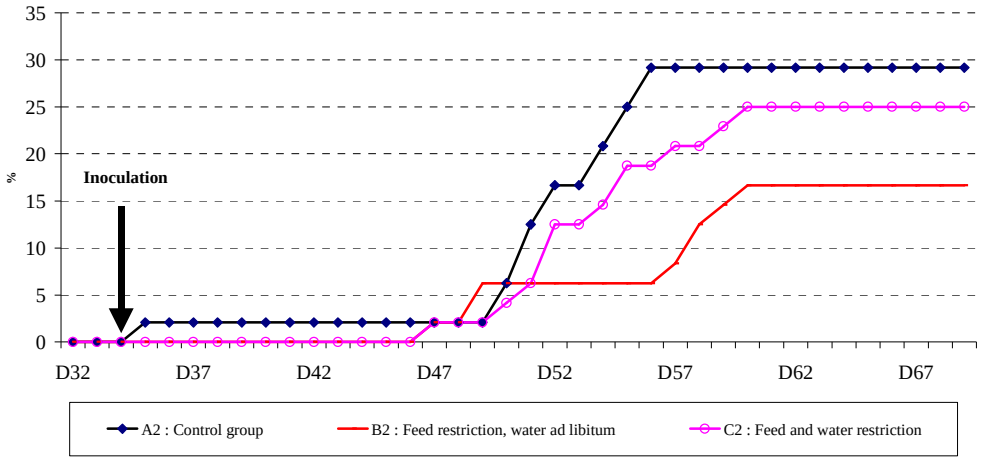

Figure 1: Death rate with the experimental reproduction of ERE

Death rate at the end of the study was not significantly different among groups despite a difference of more than 12 points between groups A2 and B2 (limited number of rabbits per group). However, 3 weeks after the start of the study, the death rate of group B2 (feed restriction with free access to drinking water) was significantly lower than the control. These results are in accordance with results from Boisot *et al.* (2003). The return to *ad libitum* feeding on restricted groups was followed by an increase in the death rate.

Feed intake and feed conversion ratio

In good sanitary conditions, daily intake of restricted groups was significantly different from the control group during the restricted period, but similar for groups B1 and C1 (Table 2). In ERE conditions, feed intakes of the restricted groups were similar to the daily feed intake of the control group throughout the study. In good sanitary conditions, feed conversion ratio deteriorated in the first week of the trial for the restricted groups before a significant improvement in the following weeks. Restricted rabbits needed one week of adaptation to the feed restriction.

Table 2: Daily feed consumption (DFC; g/rabbit/day) and feed conversion ratio (FCR)

	A1 unrestricted	B1 feed restricted	C1 feed & water restricted	Signif.	A2 unrestricted	B2 feed restricted	C2 feed & water restricted	Signif.
DFC (32-39 d)	129.2[a]	78.2[b]	78.2[b]	P<0.001	113.5[a]	78.2[b]	78.2[b]	P<0.001
DFC (39-53 d)	139.1[a]	103.3[b]	103.4[b]	P<0.001	97,6	100,4	104,7	NS
DFC (53-67 d)	163,6	171,1	166,9	NS	222,8	169,0	213,9	NS
DFC (32-67 d)	147.4[a]	126.8[b]	125.1[b]	P<0.01	152,0	124,7	145,0	NS
FCR (32-39 d)	2.00[a]	2.22[b]	2.23[b]	P<0.05	1,94	2,05	2,05	NS
FCR (39-53 d)	3.09[a]	2.20[b]	2.35[c]	P<0.001	3,93	2,67	2,90	NS
FCR (53-67 d)	3.99[a]	3.70[a]	3.39[b]	P<0.01	4,10	3,45	4,29	NS
FCR (32-67 d)	3.11[a]	2.85[b]	2.82[b]	P<0.001	3,48	2,89	3,45	NS

NS = non significant difference between groups (P>0.05). Houses 1 and 2 have been analysed separately
[a,b, c] : on the same raw, means having the same letter are not significantly different at the 5% level (Duncan Test)

Growth

In good sanitary conditions, final body weights were significantly lower in the restricted groups (4.5% for group B1 and –4% for group C1), without differences between both restrictions (Table 3). During the restricted period (32-53d), daily weight gain was significantly lower for groups B1 and C1, linked to feed restriction.

Table 3: Growth performances

	A1 unrestricted	B1 feed restricted	C1 feed & water restricted	Signif.	A2 unrestricted	B2 feed restricted	C2 feed & water restricted	Signif.
BW[1] at weaning	823	823	823	NS	821	824	825	NS
BW at 53 days	1906[a]	1738[b]	1701[b]	P<0.001	1642	1640	1648	NS
BW at 67 days	2505[a]	2393[b]	2404[b]	P<0.001	2378	2378	2375	NS
DWG[2] 31-39 d	56.5[a]	31.3[b]	30.8[b]	P<0.001	51.9[a]	33.8[b]	34.2[b]	P<0.001
DWG 39-46 d	55.5[a]	42.9[b]	39.3[c]	P<0.001	33,1	36,7	38,5	NS (P=0.075)
DWG 46-53 d	35.0[a]	51.1[b]	50.4[b]	P<0.01	30,2	40,4	39,8	NS (P=0.060)
DWG 53-67 d	43.1[a]	46.5[b]	50.6[c]	P<0.001	51,4	53,5	53,0	NS
DWG 31-67 d	46.8[a]	43.8[b]	44.0[b]	P<0.001	43,1	42,9	42,9	NS
Rabbit production (kg)	112,7	112,5	113,0	-	80,8	95,1	85,5	-

NS = non significant difference between groups (P>0.05)
[1]Body weight (g); [2]Daily weight gain (g/rabbit/day)
Houses 1 and 2 have been analysed separately
[a,b,c] : on the same raw, means having the same letter are not significantly different at the 5% level (Duncan Test)

The two last weeks, thanks to compensatory growth, restricted groups had a better daily weight gain. During the whole fattening period, daily weight gain was lower for restricted groups, without differences between both restrictions. In ERE conditions, differences in growth could reflect differences in morbidity. The second and third weeks of the trial, growth on restricted groups tended to be higher than growth of the control group. The two last weeks of the trial, there was no significant difference in daily weight gain.

The calculated rabbit production in kilograms, which takes into account the body weight at the end of the trial and mortality, was a 18% higher for the group with restricted feed compared to the control group in ERE conditions. Feed restriction was also interesting because there was no difference in body weight and more meat was produced than the control group in ERE conditions.

CONCLUSIONS

In good sanitary conditions, restricted groups improved the feed conversion ratio between 8.4 and 9.3% compared to the control group. Feed restriction modified the growing curve of rabbits with a compensatory growth phenomenon at the end of fattening period. However, this compensatory growth

during the two last weeks of the trial was not sufficient to compensate the body weight differences and at 67 days of age restricted rabbits weighed 4 to 4.5% less than rabbits fed *ad libitum*. There was no difference between both types of restriction during the whole fattening period.

In difficult sanitary conditions like ERE, there was no significant effect of the type of restriction (feed only, or feed and water) on death rate. However the feed restricted group had the lowest death rate and reduced significantly the death rate compared to the control group during the expression phase of the disease. Simultaneous water and feed restrictions did not give any convincing results.

ACKNOWLEDGMENTS

The authors are grateful to R. Adelis and F. Haberkorn for their participation in data collection during the study.

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