FEED RESTRICTION DURING SUMMER: EFFECT ON RABBIT GROWTH PERFORMANCE

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ABSTRACT

The paper aimed to study the effect of feed restriction applied during the summer season and the whole productive cycle on growth performance of rabbits. Two groups, each of them consisting in 684 Hybrid Hyla rabbits of both genders, were fed from weaning to 60 days of age and from 61 days to slaughter age the same "weaning" and "finishing" concentrate. The group indicated as AL, fed the concentrate *ad libitum*, while the group called RES received a restricted quantity of the concentrate. The level of restriction was 80% and 90% of *ad libitum*, respectively from weaning to 60 days of age and from 61 days of age to slaughter. During the trial, mortality rate was recorded daily, while feed intake and live weight of 24 rabbits per group were recorded weekly in order to calculate daily weight gain and feed conversion ratio. Feed intake of *ad libitum* group was about 13% lower than the values recorded in the same farm during the winter season. No statistically significant differences were found between the groups for weight at slaughter (2.42 vs. 2.50 kg, respectively for group restricted and *ad libitum*), while feed conversion ratio calculated for the whole experimental period was significantly ($P<0.05$) lower for restricted group (3.18 vs. 3.56). Mortality rate during the whole experimental period was significantly ($P<0.01$) higher for restricted group (21.21 vs. 13.93%, respectively for restricted and *ad libitum* group) due to the higher values recorded in particular during the weeks 56-63 d and 63-70 d, when environmental temperature was very high and the maximum values reached 34.7°C. Our results indicate that feed restriction is not advisable during the summer period, in particular when environmental temperature is very high.

Key words: Feed restriction, Rabbit, Growth performance, Hot climate.

INTRODUCTION

Feeding strategy in growing rabbits should be used to produce animals with maximum lean body mass, highest feed conversion ratio and maximum body weight. Continuous genetic selection and improvement in nutrition have led to a very fast growth rate in modern strains. The early-life fast growth rate is accompanied by a number of problems, namely increased body fat deposition, high incidence of metabolic disorders, high mortality, and high incidence of skeletal diseases. To tackle with these problems early nutrient restriction programs were used (Plavnik and Hurwitz, 1985, 1988, 1991; Yu and Robinson, 1992; Skřivan and Tumová, 1991, 1995; Dunnington and Siegel, 1998; Lipens *et al*., 2000; Mazzuco *et al*., 2000; Lee and Leeson, 2001). Limiting feed intake depresses growth during the period of restriction, but reduced growth can be later compensated by re-alimentation (Plavnik and Hurwitz, 1985, 1988; Acar *et al.*, 1995; Zubair and Leeson, 1996; Govaerts *et al*., 2000).

Feed restriction can be used in different ways in terms of time (in general from 1 to 3 weeks post–weaning) or of level (percentage of restriction in respect of the *ad libitum* intake). Di Meo *et al*. (2007) using a feed restriction to 90% from weaning to slaughter, did not found statistically significant differences in mortality rate and in body weight at slaughter in comparison to rabbits fed *ad libitum*. Gidenne *et al*. (2003) found that only a feed restriction lower than 80%, applied from weaning to 54

days of age, can significantly reduce mortality rate in rabbits, but weight at slaughter was significantly lower in restricted rabbits.

Our paper aims to study the effect of feed restriction during the whole productive cycle (from weaning – 35 d – to slaughter – 81 d of age) on the productive performance of hybrid Hyla rabbits. Feed restriction was applied to 80% from weaning to 60 days of age and 90% of *ad libitum* intake from 61 days to weaning. The trial was carried out during summer.

MATERIALS AND METHODS

Animals and experimental design

The study was carried out on a rabbit farm near Benevento (Italy). In the farm, an automatic system is used to distribute the feed to the cages. Immediately after weaning (35 d of age) two groups, each comprising 684 hybrid Hyla rabbits, were housed in bi-cellular cages in the same tunnel. The trial starts in June, 18th 2007. The two groups were fed the same commercial concentrates supplied respectively *ad libitum* (AL group) and restricted to 80% and 90% of *ad libitum* (RES group), respectively from weaning to 60 days of age and from 61 days of age to slaughter. Up to 60 days the rabbits were fed a "weaning" concentrate, subsequently changing to a "finishing" concentrate up to 81 d (slaughter age).

Samples of feed were collected weekly and analyzed for chemical composition (AOAC, 2000). Mortality rate was recorded daily. On 24 rabbits (12 cages) per group (chosen randomly and equally divided by gender), feed intake (daily) and live weight (weekly) were recorded. Thus the daily weight gains (DWG) and the feed conversion ratios (FCR) were calculated.

Statistical Analysis

The results were analyzed by ANOVA (SAS, 2000) to test the effect of feeding strategy. For mortality rate, the differences between the groups were evaluated by the chi-square test.

RESULTS AND DISCUSSION

The "weaning" and "finishing" concentrates showed, on DM basis, respectively: CP 18.5 and 17.6%; EE 3.9 and 4.6%, NDF 36.2 and 36.4%.

During the experimental period the level of feed restriction was included in the previewed range (Table 1).

Table 1: Feed intake (g/day/rabbit ± sd) of the two groups

	35 – 42 d	42 – 49 d	49 – 56 d	56 – 63 d	63 – 70 d	70 – 77 d	77 – 81 d
RES	76.3±2.54	94.9±2.32	106.2±2.34	99.5±3.39	108.6±3.54	118.3±3.89	131.1±3.63
AL	95.1±2.68	118.6±2.36	131.7±2.67	124.9±1.91	120.7±3.33	133.6±3.08	146.2±5.68
% res	19.8	20.0	19.4	20.3	10.0	11.5	10.3

RES = restricted group, AL = *ad libitum* group; % res = percentage of feed restriction

Feed consumption of AL group during the trial was lower than the feed intake measured in the same farm during the winter period (Di Meo *et al*., 2007). The average feed intake from weaning to slaughter was 124.4 g/d/head vs. the average intake of 144.0 g/d/head recorded by Di Meo *et al*. (2007). In particular, during the first three weeks of the trial feed intake agrees with the values recorded by Di Meo *et al*. (2007), but, from IV to VI week, this parameter decreased progressively and re-increased in the last week of the trial. At the beginning of the trial the rabbits of both group showed a similar live weight (Table 2). During the 80% restriction period, live weight of the rabbits fed *ad libitum* was significantly ($P<0.05$ at 42 d; $P<0.01$ from 49 to 63 d) higher than the restricted rabbits,

but, when the restriction was reduced at 90% (63 days), RES group showed a compensatory growth that induce a progressively decrease in the differences between groups: in fact at slaughter age, live weight was not statistically different between groups.

Table 2: Live weight (kg) (mean ± s.d.) of rabbits during trial

	35 d	42 d	49 d	56 d	63 d	70 d	77 d	81 d
RES	0.81±0.04	0.96±0.09	1.19±0.08	1.41±0.08	1.62±0.12	1.94±0.10	2.26±0.09	2.42±0.11
AL	0.80 ±0.03	1.04±0.07	1.36±0.09	1.68±0.14	1.93±0.15	2.13±0.14	2.35±0.15	2.50±0.17
Significance	NS	*	**	**	**	*	NS	NS

RES = restricted group, AL = *ad libitum* group; * = P<0.05; ** = P<0.01; NS = not significant

This behavior is due to the differences in daily weight gain that was significantly higher for AL group up to 63 d and statistically higher for RES group from 70 to 81 d (Table 3). Compared to the live weights recorded by Di Meo *et al*. (2007) in the same farm during winter, due to the lower feed consumption, weight at slaughter was lower (an average 2.47 vs. 2.74 kg). However, we have to take into account that, in the above mentioned trial, the age at slaughter was 84 days. Gidenne *et al*. (2003), with a 80% of feed restriction from weaning to 54 days of age, found no differences in live weight and significant differences in daily weight gains (40.7 vs. 32.3 g, respectively for *ad libitum* and restricted groups).

Table 3: Daily weight gain (g/day/rabbit) (mean ± s.d.)

	35 – 42 d	42 – 49 d	49 – 56 d	56 – 63 d	63 – 70 d	70 – 77 d	77 – 81 d	35 - 81 d
RES	22.8±1.39	33.7±2.41	36.8±3.23	30.3±2.93	29.9±1.80	39.4±3.15	37.2±2.28	36.1±3.40
AL	34.5±2.38	44.4±3.25	45.9±3.17	36.3±2.64	28.2±2.28	31.1±2.43	32.4±2.73	31.6±2.57
Significance	**	**	**	*	NS	*	*	*

RES = restricted group, AL = *ad libitum* group; * = P < 0.05; ** = P < 0.01; NS = not significant

Feed conversion index (Table 4) was significantly higher for RES group only during the first week of the trial. Starting from 63 days, due to compensatory growth, the parameter was more favorable for RES group and, during the whole experiment, feed conversion index was significantly (P<0.05) lower for RES group.

Table 4: Feed conversion index (mean ± s.d.)

	35 – 42 d	42 – 49 d	49 – 56 d	56 – 63 d	63 – 70 d	70 – 77 d	77 – 81 d	35 - 81 d
RES	3.34±0.34	2.82±0.25	2.68±0.25	3.28±0.33	3.63±0.27	3.00±0.69	3.52±.25	3.18±0.15
AL	2.76±0.39	2.67±0.30	2.86±0.36	3.44±0.23	4.28±0.44	4.27±0.39	4.62±0.29	3.56±0.14
Significance	*	NS	NS	NS	*	**	*	*

RES = restricted group, AL = *ad libitum* group; A, B = P < 0.01; a, b = P < 0.05; NS = not significant

Regarding mortality rate, during the whole experimental period, RES group showed a significantly (P<0.01) higher value than group AL (21.21 vs. 13.93 %, respectively for group RES and AL). The result are due, in particular, to the higher mortality for RES group (Figure 1) recorded during the weeks 56-63 d (3.61 vs. 1.56%, respectively for RES and AL group, P<0.05) and 63-70 d (4.72 vs. 1.27%, respectively for group RES and AL, P<0.01). In the other weeks, the differences in mortality rate between the groups were no statistical significant. In particular, during the first and the last weeks of the trial, group RES showed a lower mortality rate than group AL (0.44 vs. 1.32% and 1.78 vs. 2.41%, respectively for the first and the last week).

The lower feed intake and higher mortality recorded during the IV and V weeks of the trial can be partly explained as consequence of heat stress. In fact, IV and V weeks of the trials occur in the period from 9th to 22nd July 2007 that, as can see from the data reported in the archives of the website www.meteo.it, was a very hot period of July, with a maximum temperature of 34.7°C, reached at 18th July. During the weeks before (I, II and III) and after (VI, VII and VIII) this period, maximum reached temperature were 29 and 28°C, respectively. The temperature inside the tunnel was always ~2°C lower than environment temperature.

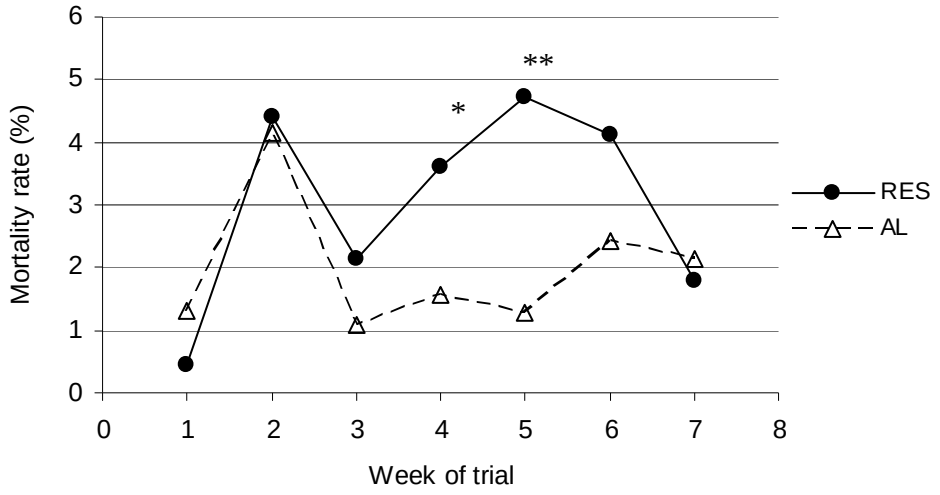

Figure 1: Trend of mortality rate during the seven weeks of the trial (from 35 to 81 days of age). RES = restricted group; AL = ad libitum group; * = P < 0.05; ** = P < 0.01.

At environmental temperatures of 32°C and higher, heat stress occurs, leading to production losses. When temperatures of 35°C and higher persist, the greatest losses from heat stress may result (El-Raffa, 2004). Mortality is the most obvious sign of heat stress. Probably, the combination of heat stress and nutrition stress (due to the feed restriction) induced a higher mortality in RES group. Moreover, during the IV week, in which maximum temperature was slightly lower than V, also the change of diet can contribute to stress of RES group.

CONCLUSIONS

Our results confirmed that a 80–90% of *ad libitum* feed restriction, applied during the whole productive cycle of rabbits, can produce at slaughter age animals with the same live weight of rabbits fed *ad libitum* with the advantage of a reduction on nutrition cost (more favourable feed conversion index) that, as know, affected more than 60% cost production in rabbitries. Moreover, feed restriction for rabbits have to be considered as a stress condition, and applied with attention when other stressors occur. In the case of our study, high temperature during the summer period (heat stress) in combination with feed restriction significantly affected mortality rate.

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