Effect of feed restriction on performance and feed digestibility in rabbits

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ABSTRACT - Two hundred and fifty-six Hyla rabbits were equally divided into two groups fed the same commercial concentrates supplied ad libitum (group AL) or restricted to 90 % of ad libitum (group RES) from weaning (35 d) to slaughter (85 d). Mortality was recorded daily. On 20 rabbits per group feed intake and live weight were recorded, respectively, on a daily and weekly basis. Samples of concentrates and faeces were collected and chemical composition and acid insoluble ashes were determined, the latter to estimate nutrient digestibility. The moderate feed restriction did not induce differences in slaughter weight (2755.3 vs 2732.2 g, respectively for groups AL and RES) or in the average daily weight gains of the rabbits (40.02 vs 39.54 g/d, respectively for groups AL and RES) while the feed conversion ratios were more favourable for group RES (3.88 vs 3.40, respectively for AL and RES groups, P<0.05). The same rabbits showed significantly higher apparent digestibility for almost all the nutrients (except crude protein and ether extract) in particular for the crude fibre, NDF and ADF, confirming a higher residence time of the feeds in the digestive system.

Key words: Rabbits, Feed restriction, Acid insoluble ashes, Digestibility.

INTRODUCTION - Feed restriction in rabbit is frequently used to prevent gastro-enteric pathologies around weaning which can induce high levels of mortality. 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). Our paper aims to study the effect of moderate feed restriction during the whole productive cycle (from weaning – 35 d – to slaughter – 85 d of age) on the productive performance and nutrient digestibility of hybrid Hyla rabbits.

MATERIAL AND METHODS - 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 128 hybrid Hyla rabbits, were housed in bi-cellular cages in two different tunnels. The two groups were fed the same commercial concentrates supplied respectively ad libitum (AL group) and restricted to 90 % of ad libitum (RES group). Up to 55 days the rabbits were fed a “weaning” concentrate, subsequently changing to a “finishing” concentrate up to 85 d (slaughter age). Samples of feed were collected weekly and analysed for chemical composition (AOAC, 2000). Mortality was recorded daily. Moreover, on 20 rabbits (10 cages) per group the feed intake (daily) and live weight (weekly) were recorded. Thus the daily weight gains (DWG) and the feed conversion ratios (FCR) were calculated. At 77 days from each cage samples of faeces were collected immediately after evacuation to determine chemical composition (AOAC, 2000) and acid insoluble ashes (AIA, Vogtmann et al., 1975). The AIA were determined also on the finishing concentrate in order to calculate the apparent digestibility of the nutrients using the equation proposed by Van Soest (1994). The results were analysed by ANOVA (SAS, 2000) to test the effect of how feed was supplied. For mortality, the differences between the groups were evaluated by the chi-square test.

RESULTS AND CONCLUSIONS - During the trial the feed intake of group RES (Table 1) was an average 11.1 percentage points less than group AL, ranging from 8.1 % in the period 56-63 d to 15.2 in the period 49-56 d. The live weights (Table 2) were significantly higher for group RES at 56 d (1669.9 vs 1713.6 g, respectively for AL
and RES groups, P<0.05) and 63 d (1847.5 vs 1928.5, respectively for AL and RES groups, P<0.01) while at slaughter the rabbits of the two groups showed similar weights.

| Table 1. Feed intake (g/d) of the two groups. |
|-----------------------------------------------|
| 35-42 d | 42-49d | 49-56d | 56-63d | 63-70d | 70-77d | 77-84d |
|---------|-------|-------|-------|-------|-------|-------|
| AL      | 94.5  | 117.2 | 138.1 | 133.1 | 149.4 | 181.7 | 194.3 |
| RES     | 84.3  | 104.1 | 117.1 | 122.2 | 134.9 | 159.2 | 174.7 |

**AL = ad libitum; RES = restricted.**

| Table 2. Average live weight (g) of the two groups of rabbits. |
|---------------------------------------------------------------|
| 35d   | 42d   | 49d   | 56d   | 63d   | 70d   | 77d   | 84d   |
|-------|-------|-------|-------|-------|-------|-------|-------|
| AL    | 792.6 | 1112.5| 1333.9| 1669.9| 1847.5| 2138.3| 2426.0| 2755.3|
| RES   | 804.7 | 1100.6| 1374.3| 1713.6| 1928.5| 2154.5| 2412.2| 2732.2|
| MSE   | 1523.7| 2813.3| 2077.6| 1975.1| 2235.2| 2201.9| 1605.8| 2610.4|

**AL = ad libitum; RES = restricted; MSE = mean square error; a, b: P < 0.05; A, B: P < 0.01.**

The DWG (Table 3) showed a particular trend: significantly higher for group AL in the periods 35-42 d (P<0.05) and 63-70 d (P<0.01) and for group RES in the periods 42-49 d (P<0.01) and 56-63 d (P<0.05). As expected, worse FCRs (Table 3) were recorded almost always for group AL. Only in the period 63-70 d did RES group show a higher FCR than group AL but the differences are not statistically significant.

The worst FCR was recorded in the period 56-63 d for group AL and in the period 70-77 d for group RES. Considering the entire trial, according to Gidenne et al. (2003), DWG was not statistically different between the groups, while FCR was significantly (P<0.05) lower for the RES group. DWG values were in agreement with Gidenne et al. (2003), while FCR values were higher. However, the latter used feed restriction only in the period from weaning to 54 days of age.

Apparent digestibility (Table 4) of the nutrients was always higher for group RES. Indeed, feed restriction is known (Maertens and Peeters, 1988; Ferrier and Ouhayoun, 1996; Tumova et al., 2003) to improve nutrient digestion due to the longer residence time of the feeds in the gastro-intestinal tract (Gidenne, 1993). The significant differences in dry and organic matter digestibility were due to the cell walls: apparent digestibility of crude protein and ether extract was similar for both groups, though slightly higher for group RES. These values were higher than those reported by Ledin (1984) who found an average digestibility of 74.5% for crude protein and 72.1% for ether extract but close to those indicated by Fernandez et al. (1994) in California x New Zealand (77.9% for CP; 83.1% for EE). For crude fibre, the digestibility was about ten percentage points less for group AL (25.1 vs 15.8%, respec-
tively for groups RES and AL, P<0.01); also NDF and ADF were digested more efficiently in group RES (NDF: 41.7 vs 34.1%, respectively for RES and AL, P<0.01; ADF: 24.5 vs 19.1%, respectively for RES and AL, P<0.01).

Finally, hemicellulose digestibility was 57.2% for group RES and 47.8% for AL (P<0.01) while the differences were lower for slowly fermentable structural carbohydrates (cellulose: 31.3 vs 25.4%, respectively, for groups RES and AL, P < 0.01).

In comparison to the findings of Ledin (1984), ADF digestibility was similar and that of NDF higher. The digestibility coefficients of ADF and CF were in agreement with Fernandez et al. (1994). Possible differences with the above authors could be due to the different systems for determining digestibility coefficients. Mortality did not statistically differ between groups, though it was higher (22.6 %) for group AL than RES (18.7 %).

Our results suggest that at least where automatic systems for feed distribution are present, moderate feed restriction (about 10 %) during the whole productive cycle of rabbit improves the digestive efficiency of the nutrients and does not modify the health status or growth of the animals.

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Table 4. Apparent nutrient digestibility (%).

|       | DM | OM | CP | EE | CF | NDF | ADF | Cell | Hemicell |
|-------|----|----|----|----|----|-----|-----|------|----------|
| AL    | 62.7B | 63.5B | 79.8 | 89.0 | 12.8B | 34.1B | 19.1B | 25.4B | 47.8B |
| RES   | 65.2A | 66.0A | 79.9 | 89.5 | 25.1A | 41.7A | 24.5A | 31.4A | 57.2A |
| MSE   | 3.3 | 3.1 | 3.3 | 9.9 | 8.2 | 6.6 | 11.8 | 16.2 | 12.4 |

AL = ad libitum; RES = restricted; MSE = mean square error, A, B: P < 0.01.