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Original scientific paper

THE EFFECT OF RESTRICTED FEEDING FOR AN EXTENDED PERIOD OF TIME ON THE CARCASS'S FATTENING PARAMETERS OF RABBITS

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The effect of restricted feeding through a longer time period on the performance parameters and carcasses' qualitative traits of the fattening rabbits was studied. 42 rabbits of six weeks old were grouped into three identical groups. The rabbits under the control group were fed ad libitum, while the ones under the two other groups (experimental groups) were fed through some feeding time restrictions, as the following: (7 hours/day) during the two and three first weeks of fattening respectively. Afterwards, up to the age of 18 weeks, all of them were fed ad libitum again. At the end of the trial, it was concluded that both the body weight and daily gain were statistically not influenced by the time duration of the restricted feeding. Although the second group of experiment showed a substantial daily feed intake ($p \le 0.01$), non significant effects on the feed conversion rate was demonstrated. Feed restriction time for two and three weeks didn't show the same effect on the carcasses' parameters. Parallel with the slaughtering age increase, the live weight, the carcass weight, the meat yield and abdominal fat were all increased ($p \le 0.01$), but the percentage of the internal organs vs. the total carcass weight was lower.

Key words: rabbits; carcass; feed restriction; performance; live weight

ЕФЕКТОТ НА ОГРАНИЧЕНА ИСХРАНА ВО ПОДОЛГ ВРЕМЕНСКИ ПЕРИОД ВРЗ ГОЈНИТЕ ПАРАМЕТРИ НА ТРУПОТ КАЈ ЗАЈАЦИТЕ

Беше проучуван ефектот на ограничена исхрана во подолг временски период врз перформансите и квалитативните карактеристики на труповите кај гојни зајаци. 42 зајаци на возраст од шест недели беа групирани во три идентични групи. Зајаците од контролната група беа хранети *ad libitum*, додека оние во другите две групи (експериментални) беа ставени под ограничена исхрана за одреден временски период, и тоа 7 часа/ден за време на првите две и три недели на гоењето, соодветно. Потоа, на возраст од 18 недели, беа повторно вратени на исхрана *ad libitum*. На крајот од опитот беше заклучено дека и телесната тежина и дневниот прираст не беа под статистичко значајно влијание на времетраењето на ограничената исхрана. Иако втората група во експериментот покажа значително дневно примање на храна ($p \le 0.01$), беа утврдени незначајни влијанија врз конверзијата на храна. Временското ограничување на храната во првите две и три недели на покажа ист ефект врз параметрите на труповите. Паралелно со зголемувањето на возраста на колење биле значајно зголемени ($p \le 0.01$) живата мера, масата на трупот, уделот на месото и на абдоминалните масти, но процентот на внатрешните органи наспроти вкупната маса на трупот бил помал.

Клучни зборови: зајаци, труп, ограничена исхрана, перформанси, жива мера.

INTRODUCTION

Since feed accounts for about 60–80% of total production cost of rabbits, the potentials and possibilities to minimize it should be examined and tested in order to increase net income. Reduction of the feed cost can be achieved either through

using cheaper feeds and/or feed ingredients or improving the efficiency of feed, used in rabbits (G. Perrier and J. Ouhayoun, 1996).

Feeding techniques with potential impacts to improve feed efficiency (Tůmova E. et al., 2002) include limiting the intake of energy and protein (qualitative restriction of food) and quantitative feed restriction (Feugier A., 2002; Perrier G., 1998).

Application of feed restriction in growing rabbits starting at the weaning time is interesting in several respects:

- Improves the feed conversion rate (Bergaoui R. et al., 2008; Boisot P., 2003; Dalle Zott A., 2005; Gidenne T. et al., 2003; Perrier G. and Ouhayoun J., 1996; Szendro Z. et al., 1988; Tůmová E. et al., 2002; Yakubu, A. et al., 2007);
- Reduces the storage of fat in the carcass (Ladyn I., 1984; Perrier G., 1998);
- Stimulates a compensatory growth rate in the future, after stopping the feed restriction (Dalle Zotte A. et al., 2005; Foubert C. et al., 2008; Matics Z. S. et al., 2008; Perrier G. et al., 1996; Perrier G., 1998);
- Improves digestion of feed during the feed restriction (Dalle Zotte A. et al., 2005; Di Meo, 2007; Xicatto G. and Cinetto M., 1988)/

Limiting the time of feed consumption and availability can avoid feed losses and consumption of larger quantities by the rabbits. This technique can easily be applied in practice and it has some priorities due to a better growth rate of rabbits and a better use of the feed ingredients.

Feeding the rabbits for only 10 hours/day led to a reduced feed consumption by 20%, while feeding at night only reduced feed consumption by 10% and the growth rate to 5%. Feed conversion was improved only when rabbits were fed during the day (Jerome N. et al., 1998).

Objective of the trial: To test the effect of feed restriction's time duration on the performance indicators and carcass's attributes in fattening rabbits.

MATERIAL AND METHODS

The study was conducted in a rabbit farm in the district of Fier. 42 California Breed rabbits of 6 weeks old were put under the trial. The rabbits were divided into 3 groups of 14 heads each. The control group was fed *ad libitum* throughout the trial's period, while the two other groups were fed within a limited time as following: the first two weeks (6–8 weeks of age) for one/first group and the first three weeks (from age 6–9 weeks) for the other/second group under the trial. After the feed restriction period of time, the rabbits of both groups were fed *ad libitum*. During the feed restriction time, the rabbits were fed daily within the time interval of 8.00 - 15.00 hrs. Every day, at the end of feeding period (after 15.00) in the experimental group the feed troughs were cleaned to be filled in the next morning. The drinking water was available and not limited all the time. At the beginning of the experiment, the average weight of rabbits under the three groups was similar.

Table 1

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Age in weeks	Control	Experiment 1 (E1)	Experiment 2 E2)	
6–14	Ad libitum	6–8 weeks (restricted feeding)	6–9 weeks (restricted feeding)	
		8–14 weeks Ad libitum)	9–14 weeks (Ad libitum)	
14–18	Ad libitum	Ad libitum	Ad libitum	

Rabbits were fed with pelleted feed, containing 17.8% protein and 2890 kcal ME/kg. All the data were recorded and calculated for each week until week 18, such as: body weight, gained weight, feed consumption and feed conversion.

At the age of 14 and 18 weeks from each group were taken 4 rabbits, which after being left under a "forced" hunger state for about 15 hours were individually weighed, were butchered and their skin was removed. The carcasses with the internal organs (liver, kidneys and heart) and without the head were weighed individually and the ratio between the live weight and slaughtered weight (carcasses with the internal organs; liver, kidneys and heart) was calculated. Cleaned carasses were divided into parts: thighs, shoulders & brest, and the caudal part. These parts, the internal organs and the abdominal fat were individually weighed and were calculated as a percentage of their weight in relation to the carcass's weight.

Statistical analyses were run through the SAS program using the following model:

$$Y_{ijk} = \mu + D_i + A_j + (DA)_{ij} + e_{ijk},$$

were:

 Y_{ijk} – observed value for the requested feature;

 μ – overall average for the requested feature;

 D_i – fixed effect due to prolonged hard restraint;

 A_i – fixed effect because of the age;

 $(DA)_{ij}$ – effect of correlation between the duration of feed restriction and age;

 e_{ijk} – random error.

RESULTS AND DISCUSSION

1. Growth performance indicators

Growth performance indicators of the rabbits are presented in Table 2.

The rabbits of the E1 group, demonstrated to have a higher body weight than the other two groups at 14 and 18 weeks, compared with the ones fed *ad libitum* (3.43 and 7.96%) even higher than the ones restricted fed during three weeks (12.84 and 29.99%).

The weight gain demonstrated the same tendency as the body weight. Rabbits under the first group of experiment (E1), of two ages, respectively 14 and 18 weeks gained more than the ones fed *ad libitum* (4.98% and 10.55%) even more than the rabbits under the (E2) second group of experiment (18.66 and 19.66%). The depression in daily gain (in experiment 2) was attributed to the reduction in daily feed intake with increasing the duration of feed restriction. However, for both indicators (weight and gain) differences were statistically non significant (p> 0.05).

The survey data are consistent with literature sources. After the feed restriction period, when

rabbits were fed *ad libitum* again, there was observed a compensatory growth, while the intensity of this growth is related to the intensity of restriction (Gidenne T., et al., 2003). The distinctive capability of rabbits to a compensatory growth after feed restriction period was studied about 30 years ago (Lebas F. and Laplace J. P., 1982; Ledin, I. 1984) and in recent years (Szendro Z. et al., 1988; Matics Z. S. et al., 2008).

Statistically significant differences were verified for the amount of daily feed consumption during the week 14 and 18 ($p \le 0.01$) where the group E2 seems to be more inferior in comparison with the two other groups. During the week 14, the restricted daily feed for the E1 and E2 groups, represents 3.76% and 18.78% of the amount consumed by the *ad libitum* fed group. With the age advancing (age 18 weeks), daily feed consumption of E1 group was almost similar to the control group, but 17.74% higher than the E2 group.

Extension in time, for two and three weeks, of the feed restriction did not show any significant improvement in the feed conversion of these two groups. The optimal feed conversion was observed in the E1 group for both ages, although differences between groups were not statistically significant. The feed consumption of the E1 group during the 14 and 18 weeks of age 8.34% and 8.81% lower/ unit of weight compared with the control group, whereas E2 consumed 8.19% and 7.32% less feed.

Table 2

Indicators	Control group	Experiment 1 th group (E1)	Experiment 2 nd group (E2)
Body weight of rabbits at the beginning of the experiment (kg)	0.638 ± 0.020	0.635 ± 0.020	0.636 ± 0.020
6–14 weeks (56 days)			
Body weight (kg)	2.243 ± 0.420	2.320 ± 0.420	2.056 ± 0.420
Daily gain (g)	28.661 ± 0.76	30.089 ± 0.76	25.357 ± 0.76
Daily feed consumption (g)	114.82 ± 2.45	110.50 ± 2.45	93.260 ± 2.45
Feed conversion	4.006 ± 0.800	3.672 ± 0.800	3.678 ± 0.800
6–18 weeks (84 days)			
Body weight (kg)	2.714 ± 0.08	2.930 ± 0.08	2.554 ± 0.08
Daily gain (g)	24.714 ± 0.88	27.321 ± 0.88	22.833 ± 0.88
Daily feed consumption (g)	117.84 ± 2.24	118.80 ± 2.24	100.90 ± 2.24
Feed conversion	4.768 ± 1.20	4.348 ± 1.20	4.419 ± 1.20

Performance indicators of rabbits by groups (calculated with the average small squares)

These results are close to other sources of literature (Rao D. R. et al., 1978) stating that the time limitation of feed consumption/availability in less than 9 hours/day, for the period 4–12 weeks, led to the reduction of the quantity of daily consumed feed in 6–15%, but feed conversion was improved to the extent of 7–13%, while the rabbits' daily weight gain remained unchanged.

2. Carcass' qualities

Data in Table 3 show a tendency of superiority of the E1 group in comparison with the other two groups, as far as their body weight in the hunger state is concerned at the age of 14 and 18 weeks. However, differences for this indicator were statistically significant ($p \le 0.05$) only for the age of 18 weeks between E1 and E2. Feed restriction during two and three weeks did not uniformly affect the carcass's parts. Percentage of internal organs increased with the length of time feed restriction aged respectively 14 and 18 weeks. Abdominal fat percentage was reduced to the length of time feed restriction at 14 weeks. The opposite was observed at 18 weeks, but values remained lower than in the control group.

Age, had a significant effect ($p \le 0.01$) on the following indicators: body weight in the hunger situation; carcass's weight; meat yield; percentage of the caudal part of the carcass; visceral/internal organs' weight; abdominal fat.

With extension of the fattening period from 14 to 18 weeks, the percentage of caudal part compared with the total weight of the carcass and percentage of the abdominal fat were increased ($p \le 0.01$), while the percentage of the internal organs was decreased ($p \le 0.01$). Also, according to literature recourses' (Abou-Raya, A. K. et al., 1970; Rao D. R. et al., 1978), affirmed that the meat yield and the component parts of the carcass of the fattening rabbits tend to increase while the age advances.

Table 3

Trait	Week	Control group	Experiment 1 (E1)	Experiment 2 (E2)
Body weight in hunger state (g)	14	2140,7389.95	2250.20 ± 45.98	2007.35 ± 84.70
	18	2670.25 ± 87.30	2820.25 ± 35.44	2510.14 ± 85.97
Carcass's weight (g)	14	1193.46 ± 60.21	1251.56 ± 20.73	1110.73 ± 17.20
	18	1547.41 ± 46.50	1640.62 ± 40.41	1456.34 ± 51.94
Meat yield (%)	14	55.75 ± 0.54	55.62 ± 0.85	55.33 ± 1.05
	18	57.95 ± 0.30	58.17 ± 0.84	58.01 ± 1.35
Thighs (%)	14	34.94 ± 0.80	34.11 ± 0.68	34.20 ± 0.82
	18	33.95 ± 0.45	34.37 ± 0.43	33.71 ± 0.82
The front limbs (%)	14	35.28 ± 0.88	35.74 ± 1.04	36.08 ± 0.56
	18	35.39 ± 0.32	35.12 ± 0.50	35.40 ± 0.34
Caudal section (%)	14	19.20 ± 0.80	19.05 ± 0.74	19.10 ± 0.73
	18	20.54 ± 0.65	21.14 ± 0.38	21.05 ± 0.52
Internal organs (%)	14	6.35 ± 0.035	6.75 ± 0.027	7.20 ± 0.27
	18	4.73 ± 0.024	4.89 ± 0.038	5.02 ± 0.30
Abdominal fat (%)	14	4.23 ± 0.082	4.05 ± 0.030	3.02 ± 0.41
	18	5.39 ± 0.104	4.48 ± 0.067	4.85 ± 0.88

Indicators of rabbits' carcass according to the group and age (average small squares + SE)

CONCLUSIONS

- Rabbits fed in a restricted way for a two weeks period, showed a tendency of a higher weight gain.
- Extension of feed restriction's time reduced the feed consumption by the rabbits.

• No significant effect was observed on the feed conversion rate while the rabbits were fed restricted during a 2 or 3 weeks period of time.

• Carcass's indicators were not affected by the time duration of feed restriction, but by the weight of rabbits at slaughter. Only the percentage of hind and front limbs were not statistically affected by the increase in slaughter weight.

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