EFFECT OF RESTRICTED FEEDING AFTER WEANING ON THE PRODUCTIVE AND CARCASS TRAITS OF GROWING RABBITS

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ABSTRACT

The aim of the experiment was to study the influence of feeding medicated or non-medicated diets followed by a feed restriction after weaning on the productive and carcass traits of growing rabbits. Half of the rabbits was fed non-medicated (NOMED: 10.65 DE/kg, CP: 16.9%, CF: 17.3%; n=106) while the other half was fed medicated diet (MED: the same diet was supplemented with 500 mg/kg Oxitetraciclyn and 50 mg/kg Tiamuline; n=108) between 4 and 9 weeks of age, then they consumed non-medicated diet. Within both diet groups half of the rabbits was fed *ad libitum* (ADLIB) while the other half restricted (RESTR). In the latter group rabbits were allowed to consume for 9, 10, 12 or 14 hours between 4-5, 6-7, 7-8 or 8-9 weeks of age, respectively, then they were fed *ad libitum*. The feed intake was 26.7, 18.3 (P<0.001) and 5.3% (P=0.059) lower in the RESTR group at the ages of 4-5, 5-6 and 6-7 weeks, respectively. After 7 weeks of age no difference was found between groups. Body weight gain of RESTR rabbits was 20.9 (P<0.001) and 8.5% (P=0.039) lower at the ages of 4-5 and 5-6 weeks, respectively, while between 6 and 8 weeks of age it slightly increased. Body weight of RESTR rabbits was 9.2% lower at 5 weeks of age compared to ADLIB group (871 vs. 959 g) but this was partly compensated at the end of the experiment (2737 vs. 2799 g, P=0.056). Feed conversion of RESTR group was better compared to ADLIB rabbits: 2.57 vs. 2.64 (P=0.01). No significant difference was found in the mortality (1 vs. 3.6%). Dressing out percentage (59.4 vs. 58.6%, P<0.001) and the proportions of hind part (19.2 vs. 18.8%), hind legs (18.3 vs. 18.0%) and that of the *m. Longissimus dorsi* (7.1 vs. 6.8%) to the body weight were higher in ADLIB rabbits. No difference was found in the proportion of perirenal fat. Production and mortality of MED and NOMED groups were similar however, the feed intake and the body weight gain of MED rabbits decreased during the transition from MED to NOMED diet at 9 weeks of age. Significantly higher dressing out percentage (59.5 vs. 58.5%, P<0.001) and proportion of fore and hind parts of carcass as well as that of the hind legs and *m. Longissimus dorsi* to the body weight were found in MED rabbits.

Key words: Growing rabbits, Restricted feeding, Medication, Production, Carcass traits.

INTRODUCTION

Restricted feeding of growing rabbits could have two advantages: a) using an adequate feed restriction plan the feed intake could decrease without reduction of the body weight; b) the occurrence of enteritis after weaning can be prevented. Whether the portion (Harris *et al.*, 1984; Jerome *et al.*, 1998) or the feeding time (Szendrő *et al.*, 1988, 2001; McNitt and Moody, 1991) is restricted, more than 10% lower feed intake than the *ad libitum* resulted an increase in the growing period.

A new approach was performed by Perrier (1998), Dalle Zotte *et al*. (2005), Gidenne *et al*. (2003) and by Radnai *et al*. (2005) who restricted the feed intake only for the first period of growing, while during fattening the rabbits were fed *ad libitum* for the sake of the growth compensation.

The aim of our experiment was to study the effect of different levels of feed restriction (strict then weak restriction after weaning followed by *ad libitum* feeding) on the productive and carcass traits of growing rabbits depending on whether they consumed medicated or non-medicated diet.

MATERIALS AND METHODS

Experiment was carried out at the rabbit farm of the University of Kaposvár on Pannon White rabbit weaned at 4 weeks of age (n=214). Half of the rabbits consumed medicated (MED, n=108), while the other half consumed non-medicated diet (NOMED, n=106). Composition of diets was similar (DE: 10.65 MJ/kg, crude protein: 16.4%, ether extract: 3.4%, crude fibre: 17.3%, NDF: 35.6%, ADF: 19.9%, ADL: 4.8%, Diclazuril: 1 mg/kg). The medicated diet (between 4 and 9 weeks of age) was supplemented with 500 mg/kg Oxytetracycline and 50 mg/kg Tiamulin. Within both diet groups half of the rabbits were fed *ad libitum* (ADLIB), while the other half restricted (RESTR). Restricted rabbits were allowed to consume for 9, 10, 12 or 14 hours between 4-5, 6-7, 7-8 or 8-9 weeks of age, respectively, then, for 24 hours afterwards.

Rabbits were housed in pairs. Drinking water was available *ad libitum* from nipple drinkers. The daily lighting was 16 hours. The experiment was carried out in summer. The temperature in the rabbitry varied (daily min. and max.) between 17 and 29°C. At the end of the experiment the average daily temperature was 2°C higher than in the beginning.

Productive and carcass traits were analysed with general linear model of the SPSS 10.0 program package (SPSS for Windows, 1999). The mortality was compared with chi^2-test.

RESULTS AND DISCUSSION

Results are summarised in Table 1.

Significant difference in the daily intake was found only at the ages of 4-5 and 5-6 weeks: it was 26.7 and 18.3% ($P<0.001$) lower in RESTR rabbits. After 7 weeks of age (in case of 12 and 14 hours of eating time) no significant difference was obtained between groups. This could depend on the fact that older rabbits are able to cover the daily requirements within short time (Szendrő *et al.*, 1988). The restriction stop did not result in so increased feed consumption as we had found in our former experiment (Radnai *et al.*, 2005). This could be explained by the higher environmental temperature. During the whole fattening period (between 5 and 11 weeks of age) the average daily feed intake of RESTR rabbits was significantly lower (120 vs. 114 g/day; $P<0.001$).

Daily feed consumption of MED and NOMED rabbits was similar between 4 and 9 weeks of age. Between 9 and 11 weeks MED rabbits consumed 7.2% less feed compared to NOMED animals. This could be caused by the diet changing from medicated to non-medicated pellet.

At 4-5 and 5-6 weeks of age the body weight gain of RESTR rabbits was 20.9 and 8.5% lower, while at 7-8 and 8-9 weeks it was 4.2 and 3.1% (NS) higher compared to ADLIB group. This shows a minor compensatory growth, however, during the whole fattening period (between 5 and 11 weeks of age) significant difference was found in the body weight gain of the two groups (45.6 vs. 44.2 g/day, for ADLIB and RESTR respectively; $P=0.016$).

Significant difference in weight gain of MED (36.1 g/day) and NOMED (39.6 g/day) rabbits were found only between 9 and 11 weeks of age. This can be explained by the lower feed intake due to the diet changing.

Throughout the experiment the body weight of RESTR rabbits was lower than that of the ADLIB animals. Although the difference between the groups decreased during the study (from 9.2 to 2.2%

between 5 and 11 weeks of age), the complete compensation did not take place (2799 vs. 2737 g, for ADLIB and RESTR respectively; P=0.056). The body weight compensation in our study was more considerable than it was found by Perrier (1998) restricted to 70% or by Gidenne *et al*. (2003) restricted to 70 or 80% of the *ad libitum*. While it was similar to the findings of Gidenne *et al*. (2003) restricted to 90% of the *ad libitum* for 3 weeks or that of Radnai *et al*. (2005) used weekly decreasing restriction after weaning (70-80-90 or 60-75-90%). The slightly higher temperature could affect negatively the complete compensation, since this reduced the feed intake in the period of *ad libitum* feeding (Stephan, 1981).

Table 1: Effect of medication and feed restriction on productive and carcass traits

Age, weeks	Diet		Feeding regime		SEM	Prob.		
	MED	NOMED	*ad libitum*	Restricted		Diet	Feeding	Interaction
n	108	106	102	112				
			Feed intake (g/day)					
4-5	61.4	58.5	69.7	51.1	1.28	0.135	<0.001	0.440
5-6	89.9	87.2	98.0	80.1	1.51	0.264	<0.001	0.283
6-7	111 b	108	113	107	1.82	0.470	0.059	0.002
7-8	146	141	146	141	1.94	0.184	0.238	0.916
8-9	158	162	160	160	1.14	0.109	0.884	0.018
9-10	133	142	135	139	1.24	0.001	0.066	0.776
10-11	125	136	129	131	1.29	<0.001	0.423	0.205
5-11	116	118	120	114	0.91	0.491	<0.001	0.816
			Weight gain (g/day)					
4-5	42.3	42.9	47.8	37.8	0.65	0.501	<0.001	0.568
5-6	42.4	43.4	44.9	41.1	0.91	0.554	0.039	0.724
6-7	48.8	47.5	47.1	49.1	0.94	0.526	0.311	0.019
7-8	55.5	55.3	54.5	56.2	0.70	0.847	0.225	0.069
8-9	47.6	48.1	48.2	47.5	0.49	0.683	0.491	0.031
9-10	41.7	45.2	42.7	44.0	0.68	0.009	0.339	0.234
10-11	30.5	34.1	31.3	33.2	0.62	0.003	0.104	0.342
5-11	44.4	45.40	45.6	44.2	0.28	0.062	0.016	0.507
			Body weight (g)					
4	565	570	566	569	5.67	(0.733)	(0.848)	-
5	904	913	959	871	9.14	0.576	<0.001	0.889
6	1201	1217	1263	1159	12.1	0.454	<0.001	0.931
7	1542	1553	1593	1506	13.3	0.679	0.001	0.253
8	1930	1936	1974	1896	15.5	0.851	0.011	0.589
9	2265	2273	2312	2230	15.4	0.794	0.007	0.923
10	2557	2589	2611	2538	16.0	0.309	0.022	0.798
11	2740	2794	2799	2737	16.2	0.094	0.056	0.638
			Feed conversion					
4-5	1.46	1.36	1.46	1.37	0.02	0.003	0.008	0.851
5-6	2.15	2.06	2.22	2.00	0.04	0.154	0.002	0.293
6-7	2.34	2.33	2.48	2.20	0.04	0.853	<0.001	0.761
7-8	2.64	2.64	2.72	2.57	0.03	0.983	0.008	0.036
8-9	3.34	3.40	3.33	3.40	0.04	0.425	0.356	0.883
9-10	3.28	3.18	3.20	3.25	0.05	0.323	0.666	0.259
10-11	4.25	4.12	4.26	4.12	0.08	0.450	0.419	0.912
5-11	2.62	2.59	2.64	2.57	0.01	0.129	0.010	0.414
			Mortality, %					
5-11	1.9	2.8	1.0	3.6				
			Ratio of carcass parts to the body weight (%)					
Dressing percentage	59.5	58.5	59.4	58.6	0.12	<0.001	0.001	0.885
Perineral fat	0.66	0.65	0.67	0.65	0.01	0.711	0.522	0.733
Head	5.06	5.02	4.98	5.10	0.02	0.319	0.003	0.168
Fore part	13.9	13.4	13.7	13.6	0.05	<0.001	0.539	0.214
Intermediate p.	16.7	16.5	16.7	16.4	0.08	0.254	0.103	0.337
Hind part	19.2	18.8	19.2	18.8	0.06	<0.001	<0.001	0.533
Hind legs	7.15	6.80	7.11	6.85	0.05	<0.001	<0.001	0.749
M. *long. dorsi*	18.4	17.9	18.3	18.0	0.05	<0.001	0.005	0.755

MED: rabbits consumed medicated diet from weaning to 9 weeks of age; NOMED: rabbits consumed non-medicated diet

The little difference in the body weight of MED and NOMED at 11 weeks (2740 vs. 2794 g) was not significant.

Rabbits in the RESTR group had significantly better feed conversion between 4 and 8 weeks of age as well as during the whole fattening period.

Neither restriction nor diet medication had significant influence on mortality. Xiccato *et al.* (2000) and Kovács *et al.* (2003) also reported very low mortality even in case of early weaning. The reason could be the good sanitary conditions of the experimental farm combined with the well-balanced feed. This call attention to that healthy rabbits can be raised not only with feed restriction or medication. Dietary fibre content and fibre fractions (high proportion of hemicellulose in the weaning period) also play a great role.

Carcass data show that feed restriction mainly affected the muscle development. ADLIB rabbits had significantly higher dressing out percentage ($P<0.001$), and higher proportion of hind part, hind legs and *m. Longissimus dorsi* to body weight as well as lower proportion of head. The ratio of perirenal fat to liveweight did not differ. It seems that feed restriction after weaning mainly reduces the development of tissues which develop intensively at this time. According to the findings of Cantier *et al.* (1969) intensive development of muscle tissue lasts up to 2.45 kg while that of the fat tissue starts from 2.1 kg body weight (highest allometric coefficient). On the contrary, in case of stricter restriction Perrier (1998) found lower dressing out percentage but higher hind part ratio within reference carcass and lower proportion of fat depots. Radnai *et al.* (2005) also found lower dressing out percentage and higher proportion of hind parts to carcass in restricted groups. The amount of perirenal fat decreased only in the strictly restricted group.

Significantly higher dressing out percentage was found in MED rabbits. The proportion of fore and hind parts as well as hind legs and *m. Longissimus dorsi* was also higher in MED group. It seems that in spite of good health status of NOMED rabbits, carcass traits are influenced positively by medication.

CONCLUSIONS

Effect of feed restriction was independent of that rabbits consumed medicated or non-medicated diet. Restricting the feeding time could be a suitable method for reducing feed intake and improving feed conversion. Body weight compensation was almost complete; however, the environmental temperature has an important influence. Concerning carcass traits, the observed decrease in dressing out percentage and in carcass meatiness is disadvantageous. Thus, further experiments are necessary to found a more suitable way of feed restriction.

REFERENCES

Cantier J., Vezinhet A., Rouvier R., Danzier L. 1969. Allométrie de croissance chez le lapin (Oryctolagus Cuniculus). 1. Principaux organes et tissus. *Ann. Biol. anim. Bioch. Biophys., 9, 5-39.*

Gidenne T., Feugier A., Jehl N., Arveus P., Boisot P., Briens C., Corrent E., Fortune H., Montessuy S., Verdelhan S. 2003. Un rationnement alimentaire quantitatif post-sevrage permet de réduire la fréquences des dierrhées, sans dégradation importante des performances de croissance: résultat d'une étude multi-site. *In: Proc. 10émes Journ. Rech. Cunicole, 2003 November, Paris, France, 29-32.*

Harris D.J., Cheeke P.R., Patton N.M. 1984. Effect of full versus restricted feeding diets with and without added copper on fryer rabbit performance. *J. Appl. Rabbit Res., 7.1, 22-24.*

Jerome N., Mousset J.L., Messager B., Deglaire I., Marie P. 1998. Influence de différentes méthods de rationnement sur les performances de croissance et d'abattage du lapin. *In: Proc. 7émes Journ. Rech. Cunicole, Lyon, France, 175-178.*

Kovács M., Szendrő Zs., Bóta B., Donkó T., Bencsné K.Z., Pintér K., Fébel H., Csutorás I., Orova Z., Fodor J. 2003. Digestive physiological investigations in early weaned (at day 21) rabbits. *In: Proc. 15th Hung. Conf. Rabbit Prod., 2003 May, Kaposvár, Hungary, 97-103.*

McNitt J. I., Moody G.L. 1991. Effect of length of feeding time on performance of fryer rabbits. *J. Appl. Rabbit Res., 14.1, 9-10.*

Perrier G. 1998. Influence de deu niveaux et deux durées de restriction alimentaire sur l'efficacité productive du lapin et les caractéristiques bouchéres de la carcasse. *In: Proc. 7émes Journ. Rech. Cunicole, Lyon, France, 179-182.*

Radnai I., Szendrő Zs., Romvári R., Matics Zs., Wolf N. 2005. Effect of restricted feeding on productive and carcass traits of rabbits. *In: Proc. 17th Hung. Conf. Rabbit Prod., 2005 May, Kaposvár, Hungary, 39-45 (in Hung.).*

SPSS for windows 1999. Version 10.0, *Copyright SPSS Inc*.

Stephan E., 1981. Influence of environmental temperature on rearing rabbits on different meat breeds. *Kleintier-Prax. 26.5,s 313-317.*

Szendrő Zs., Mihálovics Gy., Milisits G., Biróné Németh E., Radnai I. 2001. Effect of reduction of feeding time on production in growing rabbits. *Hung. J. Anim. Prod., 50.3, 257-263 (in Hung.).*

Szendrő Zs., Szabó S., Hullár I. 1988. Effect of reduction of eating time on production of growing rabbits. *In: Proc. 4th World Rabbit Congress, 1988 October, Budapest, Hungary, 104-114.*

Xiccato G., Trocino A., Sartori A., Queaque P.I. 2000. Early weaning of rabbits: effect of age and diet on weaning and post-weaning performance. *World Rabbit Sci., 8 (Suppl. 1), 483-490.*