World
Rabbit
Science
Association

PROCEEDINGS OF THE 12th WORLD RABBIT CONGRESS

Nantes (France) - November 3-5, 2021

ISSN 2308-1910

This communication was accepted by the scientific committee of the Congress

but was not presented during the Congress itself,
neither face-to-face nor remotely via Internet.

THE EFFECT OF BEGGINING OF FEED RESTRICTION ON BASIC CARCASS CHARACTERISTICS AND MEAT QUALITY IN BROILER RABBITS

Chodová D.[1]*, Tůmová E.[1], Volek Z.[2]

[1]Department of Animal Husbandry, Czech University of Life Sciences Prague, 165 00, Prague -Suchdol, Czech Republic
[2]I Department of Physiology of Nutrition and Quality of Animal Products, Institute of Animal Science Prague, 104 00 Prague – Uhříněves, Czech Republic
*Corresponding author: chodova@af.czu.cz

ABSTRACT

The aim of the study was to evaluate the effect of one week feed restriction applied in different time on pH value, meat colour, freezing and cooking loss and meat tenderness in growing rabbits. Seventy two Hyplus rabbits were weaned at 35 days of age and divided into three groups: AL – fed *ad libitum*, R1 restricted 50% AL from 35 to 42 days of age and R2 with limited feed intake 50% AL from 42 to 49 days of age. Rabbits were fed with commercial pelleted diet for growing rabbits. The experiment period lasted from 35 to 74 days of age. Meat quality characteristics were detected 24 hour *post mortem* in *musculus longissimus lumborum* (MLL) and *biceps femoris* (BF) in 12 rabbits per each group. In the experiment, no effect of feeding regime on dressing out percentage and loin percentage was detected. Rabbits restricted one week after weaning (R2 group) had lower (30.23%; P = 0.041) thigh percentage than AL group (31.06%). From meat quality traits, the pH value and meat colour parameters were not affected by feeding regime in MLL, nor in BF. Likewise, freezing and cooking loss of MLL was similar for all groups. Meat tenderness measured by maximum shear force was higher (P = 0.001) in both restricted groups (26.59 N and 25.65 N for R1 and R2, respectively) compared to AL rabbits (22.47N). In conclusion, most of meat quality characteristics were not significantly affected by feeding regime, moreover, the time of beginning of feed restriction did not alter tested parameters.

Key words: Rabbit, feed restriction, carcass characteristics, meat quality

INTRODUCTION

Feed restriction restriction is applied in growing rabbits as a prevention of digestive disorders at the time of weaning (Dalle Zotte *et al.*, 2005; Gidenne *et al.*, 2012; Maertens and Gidenne, 2016). Other reason is improving of feed efficiency (Gidenne and Feugier, 2009; Gidenne *et al.*, 2009, 2012) and decreasing of fat in carcass (Tůmová *et al.*, 2003, 2007). Feed restriction can be applied in different forms: in the base of qualitative feed restriction, some nutrient or nutrients can be reduced or missed (Khetani *et al.*, 2008). However, the disorder of such type of restriction can be unbalanced chemical composition of the diet. Another type is quantitative feed restriction with reduced feed intake in comparison to the *ad libitum*. The effect of feed restriction depends on the length, intensity and on the time of the beginning. In rabbits, feed restriction is usually applied from one to five weeks (Gidenne *et al.*, 2012) with intensity of 90 – 40% of the *ad libitum* (Di Meo *et al.*, 2007). Feed restriction affects growth that is reduced in the time of its application (Gidenne *et al.*, 2009). In realimentation period when rabbits are fed *ad libitum*, the growth increases and the compensation growth occurs (Tůmová *et al.*, 2003). The compensation growth level is important for the live weight and thus for carcass characteristics. Dressing out percentage decreases in restricted rabbits (Larzul *et al.*, 2004; Gidenne *et al.*, 2009). Together with the effect of feed restriction on carcass traits, meat quality parameters can be influenced.

The aim of the present study was to evaluate the effect of different application time of feed restriction on basic carcass characteristics and physical meat parameters in growing rabbits.

MATERIALS AND METHODS

Animals and experimental design

In the experiment, 72 Hyplus rabbits (male to female ratio 1:1) were weaned at 35 days of age and balanced for initial live weight. Rabbits were housed in wire net cages for 4 rabbits (0.12 m^2 per rabbit) and divided into three groups (6 cages of four rabbits per group): control group fed *ad libitum* (AL), R1 group was restricted from 35 to 42 days of age and the group with reduced feeding from 42 to 49 days of age (R2). Feeding in both restricted groups was reduced to 50% of *ad libitum*. Before and following feed restriction, rabbits were fed *ad libitum, and w*ater was available *ad libitum* throughout whole experiment. The experimental period was from 35 to 74 days of age. The rabbits were fed by the commercial pelleted diet for growing rabbits with following chemical composition: 17.1% crude protein, 20.7% crude fibre and 2.8% ether extract. Throughout the whole experiment, the temperature of 15–17°C, a relative humidity of 55 – 60% and a 12-hour photoperiod were kept. At 74 days of age, 12 rabbits per each group were slaughtered. The weight of selected rabbits was balanced according to the average live weight at this time. The carcass analysis was followed by method of Blasco and Ouhayoun (1996).

Selected chemico-physical meat characteristics

The pH value was measured 24 hour *post mortem* in *musculus longissimus lumborum* (MLL) and *biceps femoris* (BF) muscles using pH meter Jenway 3510 (Jenway, Essex, England) with a glass probe introduced 1 cm deep into the MLL and BF. Meat colour was measured on transversal section of the MLL and BF 24 hours *post mortem* using analyser Minolta SpectraMagic^{TM} NX (Konica Minolta Sensing, Inc., Osaka, Japan) with the CIELAB System (1976). Instrumental meat colour was expressed as L* (lightness), a* (redness) and b* (yellowness). The freesing loss was determined by calculating the difference between the weight of MLL 24 hours *post mortem* and after defrosting of frozen sample (-20 °C) at 4 °C for 24 hours. After defrosting, meat tenderness of MLL was measured by the Warner-Bratzler method. The samples were packaged in zip ties plastic bags and heated in a water bath at 70 °C for 1 hour. Cooled meat samples were cut parallel to the muscle fibres into 2×1 cm^2 cuboids. Meat tenderness was measured using an Instron Model 3342 (Instron, Norwood, USA) with a Warner-Bratzler shear blade with a triangular hole as a maximum shear force. The load cell was 20 N with a crosshead speed of 100 mm/min. The cooking loss was calculated from the difference between the weights of the raw and cooked samples.

Statistical Analysis

Data were processed by one-way analysis of variance ANOVA using GLM procedure of SAS (SAS Institute Inc, 2003). The significance of differences between groups was tested by the Duncan test. P-value $P \leq 0.05$ was considered significant for all measurements.

RESULTS AND DISCUSSION

The rabbits were selected for slaughter based on average live weight as shown in Table 1. From basic carcass characteristics, dressing out percentage was not affected by feed restriction. Similarly, Tůmová *et al.* (2006) showed significant effect of feed restriction on dressing out percentage, On the other hand, other authors reported lower dressing out percentage in restricted rabbits compared to AL (Gondret *et al.*, 2000; Larzul *et al.*, 2004; Gidenne *et al.*, 2009). The different results could be due to different application time or intesity of feed restriction. In our experiment, loin percentage was not affected by feeding regime, which corresponds with the data of Tůmová *et al.* (2006), who showed similar loin percentage in rabbits restricted from 35 or from 42 days of age. However, when the limited feed intake was realized later, rabbits had lower loin percentage than *ad libitum* fed group. Contrary, Ferreira and Carregal (1996) found lower loin percentage in restricted rabbits. Thigh

percentage was the lowest in group restricted from 42 to 49 days of age and differ significantly from AL group. Group R1 restricted immediately after weaning did not differ from other groups from the treatment. In agreement, Matics *et al.* (2008) and Gidenne *et al.* (2009) observed lower thigh percentage in restricted rabbits compared to AL. However, it depends on feed restriction intensity.

Table 1: The effect of feed restriction on carcass characteristics

	AL	R1	R2	SEM	Significance
Live weight (g)	2808	2765	2751	17.82	NS
Dressing out (%)	60.38	60	60.79	0.22	NS
Loin (%)	17.41	17.76	17.52	0.20	NS
Thighs (%)	31.06^{a}	30.47^{ab}	30.23^{b}	0.14	0.041

Means with different letters on the same column differ significantly (P≤0.05)
NS – non significant; SEM – standard error of the mean; AL – *ad libitum*; R1 – 50% AL from 35 to 42 days of age; R2 – 50% AL from 42 to 49 days of age

From meat quality characteristics (Table 2), the pH value of BF and MLL was in normal range and there were not detected differences among groups, which agrees with the results of pH value measured in three types of muscles by Dalle Zotte and Ouhayoun (1998). Higher pH value observed in BF compared to MLL corresponds with higher percentage of oxidative muscle fibres in BF muscle.
Meat colour is important characteristic for consumers. In our experiment, colour of MLL was not affected by feeding regime; nevertheless, lightness of MLL was insignificantly lower in R1 group restricted immediately after weaning. In agreement with our results, Dalle Zotte and Ouhayoun (1998), Dalle Zotte *et al.* (2005) and Gidenne *et al.* (2009) did not detect the effect of feed restriction on colour of MLL or BF.
No effect of feeding regime was observed in freezing and cooking loss. Likewise, Osman (1991) and Gidenne *et al.* (2009) did not detect the effect of feeding regime on cooking loss. Shear force characterizes meat tenderness and was higher in both restricted groups than in AL rabbits with no effect of feed restriction application time. Similarly, Larzul *et al.* (2004) found lower meat tenderness in restricted rabbits. On the other hand, Carrilho *et al.* (2009) did not observe differences between AL and restricted rabbits.

Table 2: The effect of feed restriction on meat quality characteristics

	AL	R1	R2	SEM	Significance
BF					
pH 24	5.8	5.81	5.78	0.02	NS
L*	50.2	51.3	56.0	1.38	NS
a*	0.86	-0.56	-0.57	0.30	NS
b*	8.34	7.93	8.28	0.45	NS
MLL					
pH 24	5.70	5.68	5.70	0.01	NS
L*	50.9	47.4	50.1	1.57	NS
a*	-0.16	-0.04	-0.67	0.24	NS
b*	7.71	7.83	7.24	0.30	NS
Freezing loss (%)	11.38	11.18	11.12	0.18	NS
Cooking loss (%)	29.76	29.60	30.17	0.45	NS
Tenderness (N)	22.47^{b}	26.59^{a}	25.65^{a}	0.42	0.001

Means with different letters on the same column differ significantly (P≤0.05)
BF – *biceps femoris*, MLL – *musculus longissimus lumborum;* NS – non significant; SEM – standard error of the mean; AL – *ad libitum*; R1 – 50% AL from 35 to 42 days of age; R2 – 50% AL from 42 to 49 days of age

CONCLUSIONS

The results showed that one week feed restriction applied from 35 or from 42 days of age did not affect dressing out percentage and loin percentage. On the other hand, restricted rabbits had lower thigh percentage than AL fed group. From meat quality characteristics, no effect of feeding regime on pH or colour parameters in MLL and BF, as well as freezing and cooking loss were determined. Rabbits with limited feed intake had less tender meat than AL group.

ACKNOWLEDGEMENT

The study was supported by the Ministry of Agriculture of the Czech Republic (Project NAAR No. QJ1510192).

REFERENCES

Blasco A., Ouhayoun J. 1996. Harmonization of criteria and terminology in rabbit meat research. Revised proposal. *World Rabbit Sci., 4, 93-99.*

Carrilho M.C., Campo M.M., Olleta J.L., Beltrán J.A., López M. 2009. Effect of diet, slaughter weight and sex on instrumental and sensory meat characteristics in rabbits. *Meat Sci., 82, 37-43.*

Dalle Zotte A., Ouhayoun J. 1998. Effect of genetic origin, diet and weaning weight on carcass composition, muscle physicochemical and histochemical traits in the rabbit. *Meat Sci., 50, 471-478.*

Dalle Zotte A., Rémignon H., Ouhayoun J. 2005. Effect of feed rationing during post-weaning growth on meat quality, muscle energy metabolism and fibre properties of *Biceps femoris* muscle in the rabbit. *Meat Sci., 70, 301-306.*

Di Meo C., Bovera F., Marono S., Vella N., Nizza A. 2007. Effect of feed restriction on performance and feed digestibility in rabbits. *Ital. J. Anim. Sci., 6, 765-767.*

Ferreira R.G., Carregal R.D. 1996. A note caracteristics of rabbit fed on a restricted system. *In: Proc. of 6th World Rabbit Congress, Toulouse, 3, pp. 163-165*.

Gidenne T., Feugier A. 2009. Feed restriction strategy in the growing rabbit. 1. Impact on digestion, rate of passage and microbial activity. *Animal, 3, 501-508.*

Gidenne T., Combes S., Feugier A., Jehl N., Arveux P., Boisot P., Briens C., Corrent E., Fortune H., Montessuy S., Verdelhan S. 2009. Feed restriction strategy in the growing rabbit. 2. Impact on digestive health, growth and carcass characteristics. *Animal, 3, 509-515*.

Gidenne T., Combes S., Fortun-Lamothe L. 2012. Feed intake limitation strategies for the growing rabbit: effect on feeding behaviour, welfare, performance, digestive physiology and health: a review. *Animal, 6, 1407-1419.*

Gondret F., Lebas F., Bonneau M. 2000. Restricted feed intake during fattening reduces intramuscular lipid deposition without modifying muscle fiber characteristics in rabbits. *J. Nutr., 130, 228-233.*

Khetani T.L., Nkukwana T.T., Chimonyo M., Muchenje V. 2008. Effect of quantitative feed restriction on broiler performance. *Tropic. Anim. Health Prod., 41, 379-384.*

Larzul C., Thébault R.G., Allain D. 2004. Effect of feed restriction on rabbit meat quality of Rex du Poitou®. *Meat Sci., 67, 479-484.*

Maertens L., Gidenne T. 2016. Feed efficiency in rabbit production: nutritional, technico-economical and environmental aspects. *In: Proc. 11th World Rabbit Congress - Abstracts, 15-18 June, 2016, Quingdao, China, 131-151*.

Matics Z., Dalle Zotte A., Radnai I., Kovács M., Metzger S., Szendrö Z. 2008. Effect of restricted feeding after weaning on the productive and carcass traits of growing rabbits. *In: Proc. 9th World Rabbit Congress, Verona, Italy, June 10-13, 741-746.*

Osman A.M.A. 1991. Effect of reducing feeding time on the growth performance, carcass traits and meat quality of growing rabbits. *Arch Geflugelkd., 55, 196-200.*

SAS. 2003. SAS/STAT User's Guide (Release 9.1.3). *SAS Inst. Inc., Cary NC, USA.*

Tůmová E., Skřivanová V., Skřivan M. 2003. Effect of restricted feeding time and quantitative restriction in growing rabbits. *Arch Geflugelkd., 67, 182-190.*

Tůmová E., Zita L., Štolc L. 2006. Carcass quality in restricted and ad libitum fed rabbits. *Czech J. Anim. Sci., 51, 214-219.*

Tůmová, E., Zita, L., Skřivanová, V., Fučíková, A., Skřivan, M., Burešová, M. 2007. Digestibility of nutrients, organ development and blood picture in restricted and *ad libitum* fed broiler rabbits. *Arch Geflugelkd., 71, 6-12.*