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.

CARCASS YIELD AND MEAT QUALITY OF RESTRICTED AND AD LIBITUM FED SLOW- AND FAST- GROWING RABBITS

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ABSTRACT

The aim of the study was to evaluate the effect of *ad libitum* feeding and feed restriction on carcass composition, physical and chemical meat quality characteristics of slow- and fast- growing rabbits. Slow-growing rabbits, Czech White breed, were weaned at 42 days of age, restricted between 63 and 70 days of age and slaughtered at 77 days of age. Hyplus rabbits were fast- growing, weaned at 35 days of age, restriction was applied from 56 to 63 days of age and at 70 days of age slaughtered. Feed restriction was in both genotypes one week and rabbits received 70% *ad libitum* feeding. Before and after restriction rabbits were fed *ad libitum.* Rabbits genotype and feed restriction did not affect carcass composition except percentage of perirenal fat, which was affected by interaction of both factors (P=0.032). In physical meat characteristics, feed restriction increased loin pH (P≤0.001) and texture (P≤0.001). Worse texture of restricted rabbits was confirmed by significantly higher content of hydroxyproline (P=0.033). Significant interaction of feeding regime and genotype was observed in meat crude protein content. The lowest crude protein content (203.9 $g.kg^{-1}$) was in *ad libitum* Czech White rabbits, whereas other groups significantly did not differ. With respect to genotype, Czech White rabbits showed lower percentage of perirenal fat (P≤0.001), better texture (P≤0.001) and lower crude protein content (P=0.036) compared to Hyplus. Results of the study show that short feed restriction did not affect carcass composition and negligibly decreased meat quality of both rabbit genotypes.

Key words: rabbit, genotype, feeding regime, meat quality

INTRODUCTION

In rabbit meat production, fast- growing genotypes have been used because they are able to reach slaughter weight at early age and have better carcass composition. However, in alternative production slow- growing rabbits may better cope with production condition. Blasco *et al*. (2018) reported that genotypes with lower body weight have a higher maturity at slaughter, better dressing out percentage, lower ratio of the fore part, higher ration of the hind part and greater fat depots. On the other hand, authors observed the effect of genotype on meat pH and colour but without a clear pattern, no effect on water holding capacity and that the heavy lines have more tender meat.

Limited feeding regime have been applied in intensive rabbit farming to improve health of weaned kits. Restricted feeding negatively affects growth of rabbits (Gidenne *et al*., 2012; Tůmová *et al.*, 2016) but not greatly carcass characteristics (Gidenne *et al*., 2012; Chodová *et al*., 2019) and have a moderate effect on meat quality parameters (Alabiso *et al*., 2017; Chodová *et al*., 2019).

The effect of feed restriction in different rabbit genotypes has been poorly described. Molette *et al*. (2016) observed the genetic and feeding regime interaction in amount of scapular fat but not in perirenal fat and Metzger *et al*. (2009) stated that genotype never interact with the feeding regime in meat quality traits. Due to of the limited data of interaction of genotype and feeding regime on carcass composition and meat quality, therefore, the aim of the study was to evaluate the effect of *ad libitum* feeding and feed restriction on carcass composition, physical and chemical meat quality characteristics of slow- and fast- growing rabbits.

MATERIAL AND METHODS

Carcass composition and meat quality parameters were evaluated after fattening experiment with 100 rabbits. Slow- growing rabbits, Czech White breed (CW), were weaned at 42 days of age, restricted between 63 and 70 days of age and slaughtered at 77 days of age. CW breed is medium sized breed with adult weight 4-5 kg. Hyplus rabbits (HY) were fast- growing, weaned at 35 days of age, restriction (R) was applied from 56 to 63 days of age and at 70 days of age slaughtered. Feed restriction was in both genotypes one week and rabbits received 70% *ad libitum* feeding. Before and after restriction rabbits were fed *ad libitum*. Rabbits were fed by identical feed mixture used in our previous experiments (Tůmová *et al*., 2016).

At the slaughter age, 10 rabbits of each group, which represented the average weight of the group, were selected for carcass analysis and meat quality assessment. Rabbits were fasted for overnight and slaughtered the following morning by electric stunning and bleeding. The method used for carcass analysis was described by Blasco and Ouhayoun (1996). After dissection, a percentage of the carcass parts (loin, thighs, thigs meat and perirenal fat) from carcass were calculated.
The pH and meat colour were measured 24 h *post mortem* in loin. Meat pH was analysed by JENWAY pH meter (JENWAY Essex, England), meat colour by Minolta chroma meter CR300 (Minolta, Osaka, Japan) measuring lightness (L*), redness (a*) and yellowness (b*) according to CIE L*a*b* system. After pH and meat colour measurement, samples of the loin and thighs were frozen to -20°C and kept until analyses. Cooking loss was detected by method described by Chodová *et al*. (2019). Meat tenderness was measured by the Warner-Bratzler method using an Instron Model 3342 (Instron, Norwood, MA) with a Warner-Bratzler shear blade with triangular hole to detect maximum shear force (F_{max}) with the load cell 20 N and crosshead speed 100 mm/min. The meat chemical composition was analysed in the left hind leg. Dry matter was determined by oven drying at 105°C, free fat content was obtained by extraction with petroleum ether in a Soxtec 1043 apparatus (FOSS Tecator AB, Hoganas, Sweden), protein content was determined by Kjeltec 1030 Auto Analyser and hydroxyproline by acid hydrolysis according to Diemar (1963).

Statistical analysis

Data of the carcass composition and meat quality assessment were processed by two-way analysis of variance, ANOVA method with interaction of genotype and feeding regime. The significant differences ($P \leq 0.05$) are indicated by different superscripts.

RESULTS AND DISCUSSION

Results of the carcass analysis (Table 1) were not affected by feeding regime, whereas rabbit genotype significantly affected live weight, carcass weight and percentage of perirenal fat. The interaction of genotype and feeding regime affected percentage of perirenal fat (P=0.032). The highest percentage of perirenal fat was in *ad libitum* fed CW and significantly differed from restricted CW rabbits (23%). HY rabbits showed significantly lower perirenal fat content than in CW but without differences between feeding regime. The results are in contrast with Molette *et al*. (2016); however, differences might be related to variable genotypes used in both studies.

Table 1 The effect of *ad libitum* (AL) and restricted feeding (R) on carcass composition

Measurement	Czech White		Hyplus		RMSE	Significance		
	AL	R	AL	R		Genotype	Feeding regime	G x FR
Live weight (g)	2411	2561	2686	2639	206	0.001	ns	ns
Carcass weight (g)	1191	1328	1389	1402	138	0.001	ns	ns
DoP 950	49.4	51.8	51.1	52.4	3.14	ns	ns	ns
HP (%)	50.9	51.5	52.2	51.5	1.40	ns	ns	ns
LP (%)	15.0	15.6	16.2	15.7	1.14	ns	ns	ns
HLP (%)	32.4	32.0	32.0	31.8	0.86	ns	ns	ns
HLMP (%)	24.7	24.8	24.5	24.1	1.10	ns	ns	ns
PRP (%)	1.27^{c}	1.39^{c}	2.07^{a}	1.61^{b}	0.41	0.001	ns	0.032

G x FR = genotype and feeding regime interaction; DoP=dressing out percentage; HP=hind part percentage; LP=loin percentage; HLP=hind legs percentage; HLMP=hind legs meat percentage; PRP=perirenal fat percentage; ns=not significant
^{a,b,c} Values within a row with different superscripts differ significantly at P <0.05

The pH (Table 2) was higher in restricted rabbits (P≤0.001) but meat colour parameters and cooking loss were not affected, which correspond with a minor effect of feeding regime on these parameters described in literature (Alabiso *et al*., 2017; Chodová *et al*., 2019). Meat texture was higher (P≤0.001) in CW and restricted rabbits (P≤0.001). From meat nutritional value, crude protein was affected by interaction of genotype and feeding regime (P≤0.05). With respect to genotype, only crude protein was higher in CW (P=0.036), and regarding feeding regime, lower hydroxyproline was in *ad libitum* fed rabbits (P=0.033).

Table 2 The effect of *ad libitum* (AL) and restricted feeding (R) on meat physical and chemical measurements

Measurement	Czech White		Hyplus		RMSE	Significance		
	AL	R	AL	R		Genotype	Feeding regime	G x FR
pH	5.59	5.74	5.56	5.67	0.12	ns	0.001	ns
Colour								
L*	51.5	51.0	51.1	55.2	5.82	ns	ns	ns
a*	0.72	0.88	0.51	0.04	1.01	ns	ns	ns
b*	9.79	9.61	9.47	9.23	1.31	ns	ns	ns
Cooking loss (%)	30.6	30.6	30.9	30.5	2.29	ns	ns	ns
Texture F_{max} (N)	19.5	25.2	24.4	27.3	5.89	0.001	0.001	ns
DM (g/kg)	249.9	253.7	255.2	256.9	7.65	ns	ns	ns
CP (g/kg)	203.9c	207.0b	208.7a	207.3b	3.62	0.036	ns	0.05
EE (g/kg)	18.1	20.9	18.3	20.6	6.77	ns	ns	ns
HPR (g/kg)	0.97	1.06	1.01	1.11	0.14	ns	0.033	ns

G x FR = genotype and feeding regime interaction; DM=dry matter; CP=crude protein; EE=ether extract; HPR=hydroxyproline; ns=not significant
^{a,b,c} Values within a row with different superscripts differ significantly at P <0.05

CONCLUSION

Overall results of the present study show that interaction of genotype and feeding regime are minor in carcass composition and meat quality traits. Evaluation single effect of feeding regime or rabbit genotype revealed that both factors had similar impact on meat traits. A short feed restriction did not affect carcass composition and negligibly decreased meat quality of both rabbit genotypes.

ACKNOWLEDGEMENT

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

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