The effect of two genotypes on the dressing value of broiler rabbits

Lukáš Zita, Zdeněk Ledvinka, Ludmila Klesalová, Zuzana Bízková

Department of Animal Husbandry
Faculty of Agrobiology, Food and Natural Resources
Czech University of Life Sciences Prague
Prague, Czech Republic

Abstract

The main product of rabbit breeding has always been and remains rabbit meat, which is one of the most valuable types of meat in terms of its composition. The objective of this study was to evaluate the effect of two different genotypes of broiler rabbit used in intensive production on the basic parameters of fattening performance and selected indicators of carcass value. HYLA and HYPLUS rabbits, which were weaned at 35 days of age and placed in fattening cages, were the subject of this study. Six rabbits of each genotype were selected each week from the beginning of the experiment for determination of carcass value. The overall assessment showed that the HYLA rabbits showed a better growth rate and total liveweight gain in comparison with HYPLUS rabbits under our experimental conditions, though a rather worse average daily gain and feed consumption. In terms of carcass value it is not possible to clearly identify one or other genotype as better or worse, though the HYLA rabbits in our study achieved better results for the majority of carcass value parameters depending on age at slaughter.

Rabbit, HYLA, HYPLUS, dressing out percentage

Introduction

Consumers prefer meat with good dietary properties resulting from, e.g. low fat content and high protein content. Rabbit meat, which remains a supplementary source of meat, satisfies these demands. In spite of this fact, however, consumption of rabbit meat has been falling continually since 2003 (from 3.0 kg/head of population/year to around 1.8 kg/head of population/year in 2010), evidently as the result of the higher price both of whole rabbits and, most importantly, rabbit pieces in comparison with other types of meat on the Czech market.

The advantages of breeding rabbits are the appropriate properties they demonstrate for intensive meat production (they are ready for eating at an early age and have a high growth rate, good feed conversion, better conformation and high reproductive potential). The performance of rabbits is influenced by a number of internal and external factors, of which genotype and nutrition are the most important. Special meat breeds of rabbits or multi-line hybrids of only a number of medium-large breeds (such as the Californian rabbit or New Zealand White) and a number of large breeds (such as the Albino Flemish Giant) can be used for intensive production of rabbit meat (the broiler rabbits HYPLUS and HYLA are widely used in this country).

Assessment of the fattening performance (medium heritability) and carcass value (high heritability) of rabbits with a view to their breed or hybrid has been performed by many authors (e.g. Lambertini et al. 1996; Bielanski et al. 2000; Skřivanová et al. 2000; Dalle Zotte 2002; Vostrý et al. 2008; Mach et al. 2009).

According to the available sources, various ways of terminating fattening may be applied in broiler rabbits. Either fattening is terminated at a predetermined age (Rössler et al. 2003; Seeland et al. 1996; Dokoupilová et al. 2009b) or at a constant weight (Bielanski et al. 2000; Dokoupilová et al. 2009a; Mach et al. 2009).

The assessment of carcass value indicators has been harmonised and determined by the

Address for correspondence:
Ing. Lukáš Zita, Ph.D.
Department of Animal Husbandry
Czech University of Life Sciences Prague
Kamýcká 129, 165 21 Prague 6, Suchdol, Czech Republic

Phone: +224 383 053
Fax: +224 383 065
E-mail: zita@af.czu.cz.
www.maso-international.cz

harmonisation criteria according to Blasco and Ouhayoun (1996). The carcass value is given by the dressing out percentage and the proportions of the carcass. Skřivanová et al. (2000) state a dressing out percentage from 60.9% (for Zika rabbits) to 62.4% (for HY 2000 rabbits). A proportion of hind parts from 45.8 to 47.8% and a proportion of leg from 31.8 to 32.9% are given for hybrid rabbits by Tůmová et al. (1996). Dokoupilová et al. (2006) determined a proportion of loin from 18.99 to 19.39% in a group of hybrids of traditional breeds. Mach et al. (2007) give a figure of from 17.62 to 18.35%, while Skřivanová et al. (2000) did not determine any influence of genotype on the proportion of loin. The proportion of leg muscle is a relatively important indicator. Skřivanová et al. (2000) did not find any significant differences in the proportion of leg muscle (22.0 to 23.8%). The proportion of kidney fat is an important parameter in relation to the content of fat in the body. Metzger et al. (2006) discovered 1.25 to 1.79% kidney fat in hybrid rabbits at an age of 84 days. Dalle Zotte et al. (2009) recorded similar findings.

The aim of this work was to assess the influence of two different genotypes of broiler rabbit used in intensive breeding on basic parameters of fattening performance (growth, feed consumption) and, in particular, on selected indicators of carcass value (dressing out percentage, proportions of parts of the carcass).

Materials and methods

Experimental design and conditions

HYLA rabbits (48 rabbits, males from the female line GPD from the Italian company EUROTRAFIC) and HYPLUS rabbits (54 rabbits – hybrid rabbits of the parental line ♂ PS59 × ♀ PS19, with a white coat with black tips from the French company Grimaud Frères, Hypharm) from commercial farms were used in the experiment. The rabbits were placed in cages at the Demonstration and Experimental Stable at the Czech University of Life Sciences in Prague. The granulated feed mixture (Volek et al. 2007) containing 17.09% nitrogenous substances and water were fed *ad libitum*. The experiment was conducted from day 35 to day 77 of age of the rabbits. Before weaning at the age of 35 days, the young rabbits received milk and a feed mixture designed for females. The environmental conditions corresponded to the general requirements placed on the microclimate during the fattening of rabbits.

Parameters monitored

Liveweight (on an individual basis according to genotype) and feed consumption (of groups by genotype) were monitored at regular weekly intervals.

Indicators of fattening performance:

- liveweight (at 35, 42, 49, 56, 63, 70 and 77 days of age) and average daily gain
- average feed consumption per head per day, and per kg of gain (feed conversion)
- mortality

From the day they were placed in at 35 days of age, 6 rabbits of each genotype were selected every week for the purposes of determining carcass value by means of a complete carcass dissection, which was assessed on the basis of the harmonisation criteria according to Blasco and Ouhayoun (1996).

Indicators of carcass value (n=6):

– liveweight
– HCW – hot carcass weight – the weight of the dead rabbit 15–20 minutes after slaughter (the carcass does not include blood, skin, distal parts of the tail, fore and hind legs, gastrointestinal and urogenital tracts; it does include the head, liver, kidneys and the organs located in the thorax and neck (lungs, oesophagus, trachea, thymus and heart)
– CCW – chilled carcass weight – the weight of the carcass after chilling for 24 hours in a ventilated cold room (0–4 °C) about one hour after slaughter
– DLP – Drip loss percentage (%) – the difference between hot carcass weight and chilled carcass weight divided by hot carcass weight x 100
– DoP – Dressing out percentage (%) – chilled carcass weight divided by liveweight × 100
– Proportion of liver to chilled carcass weight – the proportion of the weight of the liver to the chilled carcass weight in percent
– Proportion of skin to liveweight – the proportion of the weight of the skin, including the weight of the ears, the distal parts of the fore and hind legs, without scapular fat deposits, to the liveweight in percent
– Also the proportions of parts of the chilled carcass weight (see below for their specification) to the chilled carcass weight in percent:
– the head – separation of the head between the occiput and atlas vertebra

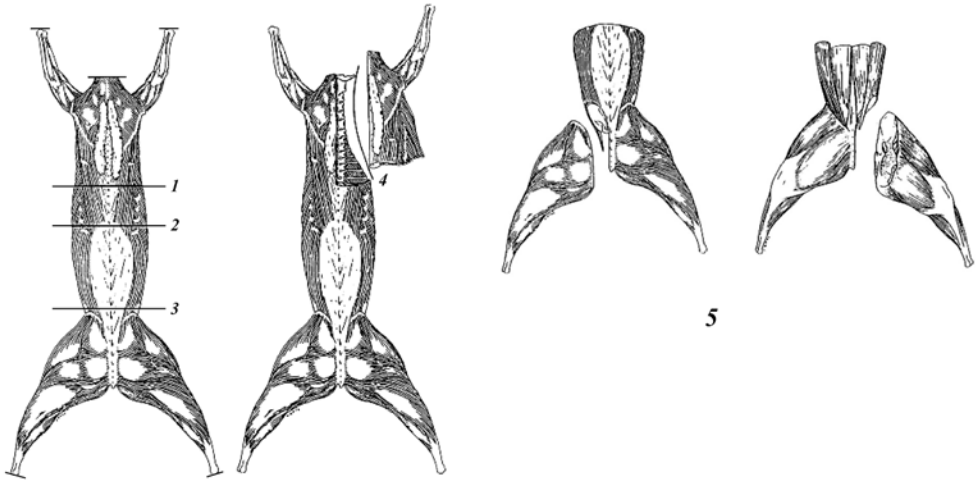

Fig.1. Carcass division - cut points (Blasco and Ouhayoun 1996)
Anatomical division of the carcass – cut points 2, 3
Technological division of the carcass – cut points 1, 3, 4, 5
Separation of the legs – cut point 5

– the fore part – from the atlas to cut point 2
– the intermediate part – between cut points 2 and 3
– the hind part – from cut point 3
– the hind part of the loins without kidneys – between cut points 1 and 3
– fore leg – given by cut point 4
– right leg – given by cut point 5
– muscle of right leg – after boning
– kidney fat – stored between cut points 1 and 3
– proportion of muscle of right leg to right leg in percent
– proportion of bone of right leg to right leg in percent

Statistical evaluation

The results obtained for the individual indicators monitored were evaluated by the variance analysis method (one-way ANOVA) in the SAS 8.2 (SAS Institute Inc., 2010) program. Mutual interactions between genotype and age at slaughter (indicated in the tables as genotype*age at slaughter) were calculated for carcass value characteristics. The significance of differences between groups was tested by the Scheffe's test with the use of the SAS 8.2 program (SAS Institute Inc., 2010). In the resulting tables, the average value and standard deviation are given for the parameters liveweight and gain, while for other indicators studied only average values are given to enhance table readability. No statistical evaluation of feed consumption and mortality was performed.

Results and discussion

The results of the experiment are given in the following tables. The effect of the genotype was seen in practically all characteristics of fattening performance and carcass value, while the effect of age at slaughter was seen in selected characteristics of carcass value.

In Table 1, which is something of a supplementary table, it is clear that the liveweight at 35 days of age was demonstrably influenced by genotype in favour of HYLA rabbits. The same tendency was clear during fattening right up to the end of the experiment at 77 days of age (3.010 g as opposed to 2.658 g). The higher liveweight of HYLA rabbits

Table 1. Summary results of performance parameters

	Genotype		Statistical significance
	HYLA	HYPLUS	
Liveweight (g)¶			
on day 35 (n = 48/54)	1.098[a] ± 129.88	861[b] ± 79.35	***
on day 70 (n = 17/22)	2.721[a] ± 199.84	2.344[b] ± 143.60	***
on day 77 (n = 11/16)	3.010[a] ± 245.98	2.658[b] ± 210.27	***
Gain (days 35 – 77)¶			
total (g)	1.865.00[a] ± 228.91	1.752.19[b] ± 200.57	***
daily (g)	40.70 ± 13.83	41.72 ± 4.76	*ns*
Feed consumption (days 35 – 77)			
per day (g/head)	122.97	104.09	*nd*
per kg of gain (kg)	3.62	3.49	*nd*
Mortality (heads)	1	2	*nd*

¶average values and standard deviations given; $^{***}P \leq 0.001$; *ns* = insignificant difference; *nd* = not statistically assessed

Table 2. Selected parameters of carcass value from day 35 to day 77 of age of rabbits (n = 6)

Genotype	Age at slaughter (days)	Parameter						
		Liveweight (g)	HCW (g)	CCW (g)	Drip loss (%)	DoP (%)	Liver to CCW (%)	Skin to live weight (%)
HYLA	35	884	471	447	5.16	50.38	7.38	16.34
	42	1159	616	589	4.30	50.72	6.12	15.24
	49	1463	752	715	4.84	48.88	5.50	15.12
	56	1738	945	911	3.75	52.29	5.95	14.38
	63	1993	1088	1045	4.03	51.98	5.64	13.61
	70	2732	1638	1574	3.86	57.62	6.22	13.78
	77	2948	1783	1697	4.80	57.56	5.20	14.49
HYPLUS	35	748	387	367	5.0	49.10	9.30	14.88
	42	885	417	394	5.45	44.56	5.92	12.43
	49	1035	487	464	4.82	45.03	6.51	12.83
	56	1305	680	647	4.90	49.53	5.48	13.37
	63	1672	944	901	4.62	53.80	6.47	14.24
	70	2343	1350	1283	4.95	54.79	6.80	15.59
	77	2638	1551	1479	4.60	56.09	6.24	15.39
Statistical significance	genotype	***	***	***	*ns*	***	**	**
	age at slaughter	***	***	***	*ns*	***	***	**
	genotype *age at slaughter	***	*	*	*ns*	*ns*	*ns*	***

HCW – hot carcass weight, CCW – chilled carcass weight, DoP – dressing out percentage; $^{*}P \leq 0.05$; $^{**}P \leq 0.01$; $^{***}P \leq 0.001$; *ns* = insignificant differences

corresponds to the results produced by Skřivanová et al. (1995) and Tůmová et al. (1996), who discovered a higher liveweight in HYLA rabbits at the end of their experiments in comparison with Zika, HYPLUS and Cunistar rabbits. The average daily gain during the fattening period was not influenced by genotype in our study. Tůmová et al. (1996) state an inconclusively higher average daily gain in HYPLUS rabbits. Feed consumption was monitored for each genotype, and was higher in HYLA rabbits. A similar trend was also seen for feed conversion, which was more than 3 kg irrespective of genotype. Feed conversion fell with age. An improved feed conversion is given for HYPLUS rabbits in comparison with other genotypes by, for example, Skřivanová et al. (1995) and Tůmová et al. (1996), though, in contrast, for HYLA rabbits by Skřivanová et al. (2000). Mortality was recorded in our study in a period from week 63 to week 70 for HYLA broiler rabbits, and from week 42 to week 49 and from week 56 to week 63 of age for HYPLUS rabbits.

Table 3. Selected parameters of carcass value from day 49 to day 77 of age of rabbits (n = 6)

Genotype	Age at slaughter (days)	Parameter										
		Proportion of CCW (%)									Proportion of right leg (%)	
		head	fore part	intermediate part	hind part	hind part of loins without kidneys	fore legs	right leg	muscle of right leg	kidney fat	muscle of right leg to right leg	bone of right leg to right leg
HYLA	49	9.94	32.71	16.23	31.21	23.11	6.89	14.56	10.07	0.52	69.17	30.94
	56	10.01	31.56	16.70	31.59	23.96	6.58	14.56	10.34	1.29	70.96	28.09
	63	10.15	30.54	17.10	32.24	25.46	6.83	14.77	10.77	0.83	72.99	26.08
	70	8.51	30.96	17.87	31.74	26.39	7.16	14.70	11.55	1.42	78.62	20.87
	77	7.41	32.72	18.35	31.70	26.80	7.60	14.48	11.30	1.85	78.07	20.95
HYPLUS	49	14.15	29.60	13.38	31.25	21.05	6.15	14.37	8.81	0.51	61.28	37.56
	56	12.41	29.24	15.28	32.45	23.06	6.16	15.04	10.51	0.48	69.89	29.57
	63	10.04	29.61	17.32	32.32	25.11	6.59	15.02	11.19	0.70	74.56	24.82
	70	8.80	29.71	17.98	31.77	25.44	6.81	13.37	11.56	1.52	74.21	25.59
	77	8.73	30.76	18.20	31.95	27.35	6.68	14.69	11.62	1.23	79.13	20.43
Statistical significance	genotype	***	***	**	*ns*	*	***	*ns*	*ns*	**	*ns*	*
	age at slaughter	***	***	***	*ns*	***	***	*ns*	***	***	**	***
	genotype *age at slaughter	***	*ns*	**	*ns*	*ns*	*ns*	*ns*	***	*ns*	*ns*	*ns*

$^{***}P \leq 0.001$; $^{**}P \leq 0.01$; $^{*}P \leq 0.05$; *ns* = insignificant differences

Selected characteristics of carcass value are given in Tables 2 and 3. The average weight at slaughter of the rabbits, the hot carcass weight and the chilled carcass weight were demonstrably influenced by both genotype and age at slaughter. Higher values were found for these parameters in HYLA rabbits than in HYPLUS rabbits, and these values increased with age. A higher weight at slaughter was also found in HYLA rabbits by Skřivanová et al. (1995) and Tůmová et al. (1996).

The drip loss percentage was not significantly influenced by either genotype or age at slaughter. Drip loss was higher in HYPLUS rabbits, with the exception of rabbits slaughtered on days 35, 49 and 77 of age, on which these losses were higher in HYLA

rabbits. The drip loss cannot unambiguously be said to fall with age at slaughter. The dressing out percentage was higher in HYLA rabbits (with the exception of day 63 of age at slaughter), and the dressing out percentage can generally be said to increase with age (though certain deviations were seen).

The proportion of head to chilled carcass weight was demonstrably lower in HYLA rabbits, and the proportion of head tended to fall with age at slaughter. The proportion of fore part and fore legs was significantly higher in HYLA rabbits, though the proportion of hind parts was lower. It is more complicated to compare the proportions of fore part, hind part or other parts of the carcass with the results produced by other authors in view of the differences to the non-harmonised methods for dividing the carcass previously used. The proportion of right leg to chilled carcass weight was insignificantly higher in HYPLUS rabbits as compared with HYLA rabbits in practically all cases, and this was matched by the proportion of muscle in the right leg, which increased slightly with age at slaughter. Insignificant differences were seen in the proportion of muscle in the right leg to the right leg in terms of genotype, with this proportion being higher in HYLA rabbits in the majority of cases, and the proportion of muscle in the right leg to the right leg in rabbits of both genotypes showed a significant, though slight, increase. The proportion of kidney fat to chilled carcass weight is an important indicator from the viewpoint of the total fat content, and was conclusively higher in HYLA rabbits (with the exception of 70 days of age).

Conclusions

Overall, it is clear that the HYLA genotype showed better growth and total liveweight gain, though in contrast slightly worse average daily gain and feed consumption under the conditions of our study. In terms of carcass value, neither genotype can be considered clearly better or worse. Certain rather negative results seen for certain characteristics in relation to genotype should be seen in context with the relatively small number of rabbits included in our study.

It must be said, in conclusion, that the selection of a suitable genotype of broiler rabbit depends on the specific rearing conditions, with a given genotype perhaps showing better performance parameters, though only under the condition of provision of optimal conditions.

Acknowledgement

The study was supported by a grant from the Ministry of Education, Youth and Sports of the Czech Republic (project no. MSM 6046070901).

References

Bielanski P, Zajac J, Fijal J 2000: Effect of genetic variation on growth rate and meat quality in rabbits. In: 7th World Rabbit Congress, Valencia, Španělsko, 561–566

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

Dalle Zotte A 2002: Perception of rabbit meat quality and major factors influencing the rabbit carcass and meat duality: a review. Livestock Prod Sci **75**: 11–32

Dalle Zotte A, Princz Z, Metzger S, Szabó A, Radnai I, Biró-Nemeth E, Orova Z, Szendró Z 2009: Response of fattening rabbits reared under different housing conditions. 2. Carcass and meat quality. Livestock Sci **122**: 39–47

Dokoupilová A, Janda K, Mach K, Vostrý L, Majzlík I 2009a: Užitkovost a složení masa finálních hybridů brojlerového králíka HYLA v závislosti na jejich porážkové hmotnosti a věku. In: Sborník 10. celostátního semináře „Nové směry v intenzivních a zájmových chovech králíků“, Praha, 38–41

Dokoupilová A, Mach K, Majzlík K, Zavadilová L 2006: Využití tradičních plemen pro šlechtění a hybridizaci brojlerového králíka. In: Zborník prednášok „Aktuálne smery v chove brojlerových králikov“, Nitra, SR, 31–38

Dokoupilová A, Marounek M, Mach K, Vostrý L, Janda K 2009b: Kvalita masa a užitkovost brojlerových králíků krmených směsí s doplňkem organického a anorganického selenu. In: Sborník 10. celostátního semináře „Nové směry v intenzivních a zájmových chovech králíků“, Praha, 42–46

Lambertini L, Bergoglio G, Masoero G, Gramenzi A 1996: Comparison between provisal and Hyla rabbit strains. I. Slaughtering performance and muscle composition. In: 6th Word Rabbit Congress, Toulouse, Vol. 3, 195–199

Mach K, Majzlík I, Dokoupilová A, Vostrý L 2007: Spotřeba krmiva a jatečná hodnota brojlerových králíků v závislosti na intenzitě růstu během výkrmu. In: Sborník 9. celostátního semináře „Nové směry v chovu brojlerových králíků“, Praha, 80–84

Mach K, Ondráček J, Dokoupilová A, Vostrý L, Janda K, Majzlík I 2009: Užitkovost finálních hybridů brojlerového králíka HYLA v závislosti na genotypu a krmné dávce. In: Sborník 10. celostátního semináře „Nové směry v intenzivních a zájmových chovech králíků“, Praha, 58–68

Metzger SZ, Odermatt M, Szendró ZS, Mohaupt M, Romvári R, Makai A, Biró-Nemeth E, Sipos L, Radnai I, Horn P 2006: A study of the carcass traits of different rabbit genotypes. World Rabbit Science **14**: 107–114

Rössler B, Seeland G, Körnicke I 2003: Kreuzungeffekte für ausgewühlte Schlachtleistungsmerkmale verschledener Kaninchenrassen und deren Kreuzungen. 13. Arbeitstagung uber Haltung und Krankhaiten der Kaninchen, Pelztiere und Heimtiere. Celle, 236–240

Seeland G, Rössler B, Röder B 1996: Analyse des Wachstums verschiedener Kaninchenrasse mit ausgwahlten Wachstumfunktionen. Archiv für Tierzucht **39**: 533 – 544

Skřivanová et al. 1995: Vliv výživy a genotypu na výsledky výkrmu brojlerových. Náš chov **10**: 39–40

Skřivanová V, Marounek M, Tůmová E, Skřivan M, Laštovková J 2000: Performance, carcass yield and quality of meat in broiler rabbits: a comparison of six genotypes. Czech Journal of Animal Science **45**: 91–95

Tůmová E, Skřivanová V, Skřivan M, Marounek M, Laštovková J, Kubošková M, Knížek J 1996: The effect of genotype on the growth, digestibility of nutrients and meat quality of broiler rabbits. Scientia Agriculturae Bohemica **27**: 39–48

Volek Z, Marounek M, Skřivanová V 2007: Effect of a starter diet supplementation with mannanoligosaccharide or inulin on health status, caecal metabolism, digestibility of nutrients and growth of early weaned rabbits. Animal **1**: 523–530

Vostrý L, Mach K, Jakubec V, Dokoupilová A, Majzlík I 2008: The influence of weaning weight on growth of the Hyplus broiler rabbit. In: 9th World Rabbit Congress, Verona, Itálie, 255–259