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Growth and carcass traits of two rabbit genotypes: comparison of Slovene SIKA male line with commercial hybrids

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ABSTRACT

Growth rate and carcass traits of two rabbit genotypes (SIKA male line – Slovenian male line for meat production and commercial hybrid imported from Italy, 50 rabbits per genotype and 50 rabbits of each sex) were as recorded from weaning (41±1 day) to slaughter. Rabbits were fed standard feed mixture Kun/stand ad libitum. Thirty-six rabbits were slaughtered at 77th day and 40 rabbits at 90th day. For carcass evaluation 16 animals per genotype, age and sex were selected. SIKA rabbits reached significantly higher weight at 90 days (2933 vs. 2711 g) and significantly better feed conversion ratio than Italian hybrids (4.085 vs. 4.711 g). SIKA rabbits exhibited significantly lower kidney fat percentage (2.24%) than Italian hybrids (2.90%). There were no differences in percentage of different carcass cuts, pH 24 and meat colour between two genotypes. Increased animal age at slaughter from 77 to 90 days did not change kidney fat percentage.
(Keywords: rabbits, genotypes, growth, carcass quality)

INTRODUCTION

In Slovenia, our own selection line SIKA was formed to meet Slovenian needs for breeding rabbits. In Rabbit centre of Biotechnical Faculty, male SIKA line for meat production exists from 1995. In male line, the factors that influence growth rate, feed conversion ratio, slaughter, carcass and meat characteristics have to be controlled. The genetic origin of the rabbit influence their growth curve, proportions of separate digestive organs and carcass quality (*Pla et al.*, 1996; *Dalle Zotte* and *Ouhayoun,* 1998; *Piles et al.*, 2000). The aim of present study was to find optimal animal age or live weight at slaughter of Slovenian rabbit male line SIKA, so it was compared with commercial Italian hybrids at two different ages.

MATERIALS AND METHODS

Growth rate of 100 rabbits of two genotypes (SIKA male line – Slovenian male line for meat production and commercial hybrid imported from Italy, 50 rabbits per genotype and 50 rabbits of each sex) was recorded from weaning (41±1 day) to slaughter. Rabbits were fed standard feed mixture Kun/stand *ad libitum*, feed intake and weight of rabbits were recorded weekly. Thirty-six (36) rabbits were slaughtered at 77th day and forty (40) rabbits at 90th day. Animals were fasted 2 hours before slaughter. Slaughter weight, warm carcass weight (excluding head and lower parts of legs, including liver and kidneys), weight of liver, kidneys and separate digestive organs (with their contents) were measured at

slaughter. The proportions (%) of liver, kidneys and separate digestive organs with respect to the slaughter weight were calculated. For carcass evaluation 16 animals per genotype, age and sex were selected. Cold carcass weight without kidneys and liver was recorded 24 h after slaughter. After that kidney fat was removed, carcass was cut into fore and hind quarter between the 6th and 7th thoracic vertebra. Back was cut between last thorax and first lumbar vertebra. Hind leg was divided from loin between 6th and 7th lumbar vertebra. Hind leg was further dissected into meat and bone. Percentage of cuts was calculated from cuts weight and cold carcass weight. Meat colour and pH were measured 24 hours after slaughter on the cross section between last thorax and first lumbar vertebra.

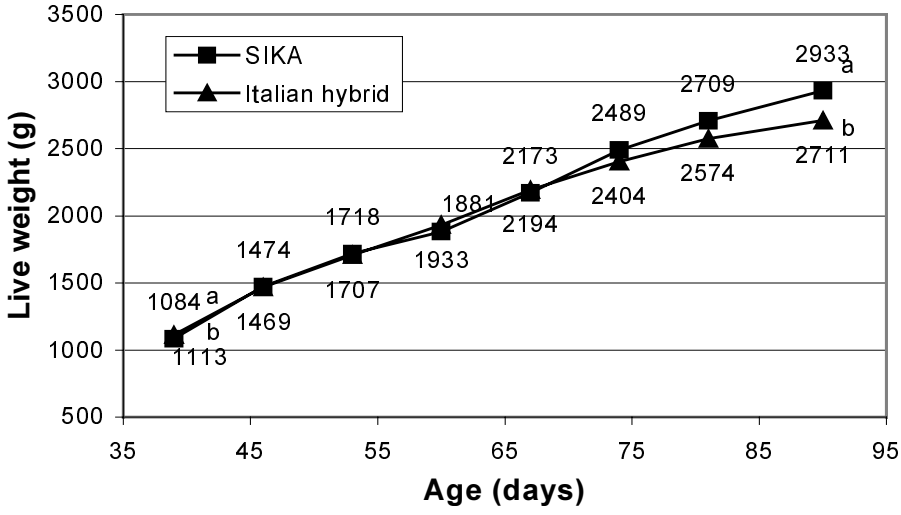
Statistical analysis was performed by SAS statistical package (*SAS*, 1999) with GLM procedure. Effects of genotype, age and sex as fixed effects and interactions between those effects were included in the model (except non significant interaction genotype*age*sex). For the analysis of rabbit's live weights data, the effect of age was excluded and covariate analysis (linear regression on weaning weight) was included in the model.

RESULTS AND DISCUSSION

Despite worse start at 39 days of age (*Figure 1*) SIKA rabbits reached significantly higher weight at the end of the experiment (90 days of age) than Italian hybrids. Live weight of SIKA rabbits at 90 days was comparable with Pannon White rabbits (*Szendrő et al.*, 1998) and INRA 9077 strain (selected on prolificacy) (*Dalle Zotte* and *Ouhayoun*, 1998) and it was higher than Hyla hybrid rabbits (*Nizza* and *Moniello*, 2000), which had almost the same weight (2750 g at 90 days) as Italian hybrids from our experiment. Both our genotypes were heavier than New Zealand rabbits from Burundi (*Anous*, 1999) and Mexico (*Ortiz Hernandez* and *Rubio Lozano*, 2001) and lighter than two hybrid meat lines (synthetic meat line and Hy+), selected for high growth rate (*Dalle Zotte* and *Ouhayoun*, 1998; *Piles et al.*, 2000).

Figure 1

Live weight of two rabbit's genotypes



Average daily weight gain in entire trial was significantly higher in SIKA line with significantly better feed conversion ratio than in Italian hybrids (*Table 1*). Daily weight gains of both genotypes were lower than in two hybrid meat lines, selected for high growth rate, but higher than in INRA 9077 strain (*Dalle Zotte* and *Ouhayoun*, 1998; *Piles et al.*, 2000)

Feed intake and feed conversion of both our genotypes were higher than in Hyla hybrids (*Nizza* and *Moniello*, 2000), where rabbits from 51st to 70th day of age consumed about 110 g of feed per day and feed conversion was from 2.72 to 3.09.

Table 1

Production parameters of two rabbit genotypes at two different ages: LS-means (±SEE) with significance (P) of effects

	Genotype			Age		
	SIKA	**Italian hybrid**	**P**	**77 days**	**90 days**	**P**
Average daily weight gain (g/day)	37.50 ±0.940	33.59 ±0.950	**0.0046**	37.26 ±133.636	33.84 ±125.598	**0.0126**
Average daily feed intake (g/day)	150.61 ±2.779	154.37 ±2.807	0.3435	153.07 ±2.878	151.90 ±2.705	0.7680
Consumed feed in entire trial (g)	6714 ±129.0	6846 ±130.3	0.4721	5814 ±133.6	7747 ±125.6	**<.0001**
Average feed conversion ratio	4.085 ±0.123	4.711 ±0.124	**0.0006**	4.191 ±0.128	4.604 ±0.120	**0.0210**
Slaughter weight (g)	2727 ±47.5	2634 ±48.0	0.1771	2534 ±49.2	2828 ±46.2	**<.0001**
Warm carcass weight (g)	1436 ±28.3	1377 ±28.5	0.1474	1322 ±29.3	1492 ±27.5	**<.0001**
Dressing percentage (%)	52.58 ±0.319	52.20 ±0.323	0.4066	52.10 ±0.331	52.69 ±0.311	0.1954
Liver weight (g)	77.22 ±2.336	79.75 ±2.359	0.4491	77.99 ±2.419	78.98 ±2.274	0.7678
%	2.85 ±0.072	3.03 ±0.073	0.0771	3.09 ±0.075	2.79 ±0.070	**0.0044**
Kidney weight (g)	18.00 ±0.411	17.26 ±0.415	0.2115	18.14 ±0.426	17.13 ±0.400	0.0875
%	0.67 ±0.017	0.66 ±0.017	0.8147	0.72 ±0.017	0.61 ±0.016	**<.0001**

Slaughter weight was slightly (P=0.1771) higher and proportion of liver (% of slaughter weight) was lower (P=0.0771) in SIKA line than in Italian hybrids (*Table 1*).

Proportions of liver in our experiment were much lower than in New Zealand from Burundi, Hyla and synthetic meat line, selected for high growth rate (4.0 to 4.6% of slaughter weight) , while proportions of kidneys were comparable (*Anous*, 1999; *Nizza* and *Moniello*, 2000; *Piles et al.*, 2000). Because of different calculation methods it is hard to compare dressing percentage with other authors: in our experiment it was better than in New Zealand in Burundi (*Anous*, 1999) and comparable with *Kermauner* and *Štruklec* (1996).

Table 2

Slaughter parameters of two rabbit genotypes at two different ages: LS-means (±SEE) with significance (P) of effects

	Genotype			Age		
	SIKA	**Italian hybrid**	**P**	**77 days**	**90 days**	**P**
Stomach weight (g)	97.13 ±3.463	97.78 ±3.497	0.8942	88.79 ±3.587	106.13 ±3.371	**0.0008**
(%)	3.56 ±0.126	3.72 ±0.128	0.3616	3.51 ±0.131	3.76 ±0.123	0.1692
Small intestine weight (g)	100.57 ±2.346	92.78 ±2.369	**0.0224**	99.05 ±2.429	94.30 ±2.283	0.1584
(%)	3.72 ±0.074	3.54 ±0.074	0.0819	3.92 ±0.076	3.34 ±0.072	**<.0001**
Large intestine weight (g)	76.56 ±1.764	68.66 ±1.781	**0.0024**	74.07 ±1.827	71.15 ±1.717	0.2479
(%)	2.83 ±0.064	2.63 ±0.064	**0.0305**	2.93 ±0.066	2.53 ±0.062	**<.0001**
Caecum weight (g)	164.41 ±4.002	148.80 ±4.041	**0.0077**	156.81 ±4.144	156.40 ±3.895	0.9432
(%)	6.06 ±0.149	5.71 ±0.151	0.1027	6.21 ±0.155	5.57 ±0.145	**0.0035**
GI tract weight (g)	438.67 ±8.541	408.03 ±8.626	**0.0139**	418.72 ±8.846	427.98 ±8.314	0.4484
(%)	16.17 ±0.287	15.60 ±0.290	0.1656	16.57 ±0.297	15.21 ±0.279	**0.0013**

The small intestine, large intestine, caecum and entire gastrointestinal (GI) tract (with contents) were significantly heavier in SIKA rabbits; similar results were found when proportions of these organs were considered (*Table 2*). These results together with better weight gain and feed conversion ratio indicate that digestive tract was better developed in SIKA rabbits. This resulted in improved digestibility and nutrients utilisation in SIKA line compared with commercial hybrids.

Weights of GI tract and separate digestive organs in both genotypes were higher than reported by *Kermauner* and *Štruklec* (1996). Proportion of GI tract is comparable with Hyla rabbits (*Nizza* and *Moniello*, 2000), but lower than in synthetic line (*Piles et al.*, 2000).

SIKA rabbits exhibited slightly higher cold carcass weight (P=0.112) than Italian hybrid line (*Table 3*). They had statistically significant (P<0.05) lower kidney fat quantity and percentage from Italian hybrid rabbits. SIKA rabbits had higher (P<0.05) weight of loin and hind leg. This was only the consequence of higher carcass weight, because there were no differences in percentage of different carcass parts (fore quarter, back, loin and hind leg) between two lines. Otherwise *Gomez et al.* (1998) reported differences in kidney fat, fore and hind leg percentage between different rabbit lines. *Pla et al.* (1996) also found differences in percentage of carcass cuts and kidney fat between two breeds differing in adult weight. Breeds with higher adult body weight had less fat at the same weight.

Therefore *Dalle Zotte* and *Ouhayoun* (1998) reported the highest kidney fat percentage in line that reached the highest maturity at slaughter. In most experiments the adult weight is not known and so it is difficult to distinguish between effect of genotype and adult weight. Meat content in the hind leg was higher in SIKA rabbits, but there were no differences in meat and bone percentage in hind leg between two genotypes.

The effect of age is quite logical: older animals had lower average daily gain, worse feed conversion ratio, higher slaughter and carcass weight, what agrees with results of *Nizza* and *Moniello* (2000). Older rabbits had lower proportions of liver, kidneys, total GI tract and separate digestive organs (except stomach proportion) than younger rabbits.

Cold carcass weight increased with increased animal age (*Table 3*). At 77 days of age rabbits of SIKA line had 1219 g of cold carcass weight and Italian hybrid line had 1218 g. At 90 days of age SIKA rabbits reached 1468 g of cold carcass weight and Italian hybrid rabbits had 1360 g. The difference between two lines at 90 days of age was statistically significant ($P<0.05$) and consequently also the interaction between genotype and animal age tended to be statistically important ($P=0.117$). With increased animal age from 77 to 90 days, the quantity of kidney fat increased for more than 6 g, while the percentage of kidney fat did not change significantly. With increased animal age the percentage of fore quarter did not change, while the percentage of back and hind leg decreased (0.5% and 1%) and the percentage of loin increased (2%). The interaction between genotype and age was statistically significant for percentage of fore quarter ($P<0.05$). In SIKA rabbits the percentage of fore quarter increased for 0.7% from 77 to 90 days of age while in Italian hybrid rabbits decreased for 0.8%. With increased animal age, meat percentage in hind leg increased and bone percentage decreased ($P<0.05$).

Table 3

Carcass weight and composition of two rabbit genotypes at two different ages (LSM±SEE) with significance (P) of effects

	Genotype			Age			SEE
	SIKA	**Italian hybrid**	**P**	**77 days**	**90 days**	**P**	
Cold carcass weight, g	1343.6	1288.8	0.112	1218.3	1414.1	**<0.001**	±24.03
Kidney fat, g	30.5	39.2	**0.008**	31.7	38.0	**0.051**	±2.2
%	2.24	2.99	**<0.000**	2.58	2.66	0.676	±0.14
Fore quarter, g	361.1	339.7	**0.059**	324.4	376.4	**<0.001**	±7.7
%	26.52	26.61	0.744	26.63	26.49	0.649	±0.22
Back, g	168.6	163.7	0.419	157.1	175.2	**0.005**	±4.2
%	12.42	12.83	0.206	12.88	12.36	0.107	±0.22
Loin, g	293.5	263.3	**0.033**	244.4	312.4	**<0.001**	±9.5
%	21.44	20.48	0.076	19.95	21.96	**0.001**	±0.37
Hind leg, g	492.5	455.9	**0.028**	444.7	503.4	**0.001**	±11.1
%	36.25	35.66	0.094	36.48	35.43	**0.004**	±0.24
Meat content in g	193.2	177.9	**0.048**	170.9	200.1	**<0.001**	±5.2
hind leg, %	84.75	84.58	0.763	83.98	85.34	**0.026**	±0.41
Bone weight in g	34.4	32.1	0.056	32.4	34.1	0.161	±0.80
hind leg, %	15.25	15.43	0.763	16.02	14.66	0.226	±0.41

Animal genotype did not exhibit any effect on meat colour and pH 24 hours after slaughter. *Dalle Zotte* and *Ouhayoun* (1998) reported significant differences in L* and a* values between different genotypes, though the differences were very small. *Pla et al.* (1996) found only the differences in b* value on the surface muscle between different genotypes.

With increased animal age meat tended to be darker (lower L values, P=0.142) and less red (lower a values, P<0.05). Changes in meat lightness were different in two rabbit lines (P value for interaction between genotype and age was 0.049). In SIKA rabbits L value did not change with animal age while in Italian hybrid rabbits L value decreased from 59.08 at 77 days to 56.54 at 90 days.

Table 4

Meat colour and pH of two rabbit genotypes at two different ages (LSM ± SEE) with significance (P) of effects

	Genotype			Age			SEE
	SIKA	Italian hybrid	P	77 days	90 days	P	
CIE L value	58.46	57.81	0.371	58.6	57.60	0.142	0.51
a* value	3.9	3.58	0.246	3.42	4.12	**0.035**	0.23
b* value	3.85	3.64	0.493	3.62	3.86	0.441	0.15
pH 24	5.69	5.68	0.861	5.60	5.77	**<0.001**	0.02

Sex had no explicit effect on studied growth, slaughter and carcass traits, except on weight and proportion of large intestine and carcass fat percentage (data not presented). Male rabbits had significantly lower weight (69.8 *vs.* 75.4 g) and proportion of large intestine (2.63 *vs.* 2.83%) than females. *Kermauner* and *Štruklec* (1996) found lower caecum weight in male than in female rabbits, but no influence of sex on large intestine weight was found. Other authors also reported no influence of sex on growth parameters (*Szendrő et al.*, 1998; *Ortiz Hernandez* and *Rubio Lozano*, 2001), on dressing percentage (*Piles et al.*, 2000; *Ortiz Hernandez* and *Rubio Lozano*, 2001), or on GI tract weight and proportions of liver and kidneys (*Piles et al.*, 2000). Male animals also showed lower percentage of kidney fat than female animals (2.22 vs. 3.02%). *Piles et al.* (2000) also reported 0.24% higher total dissectible fat in female than in male animals at 9 weeks of age. But the effect of sex on proportion of different carcass cuts was not observed (*Piles et al.*, 2000).

CONCLUSIONS

In present study, rabbits of SIKA male line demonstrated higher growth rate, better feed conversion ratio and better carcass quality than commercial Italian hybrids. Differences between genotypes were more distinctive in older animals. Kidney fat percentage did not increase with animal age at slaughter, therefore also at 90 days of age growth potential was still not exploited.

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