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Short communication

MEAT QUALITY OF TRANSGENIC RABBIT

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ABSTRACT

The aim of this study was to investigate the influence of human protein C (hPC) gene integration on meat quality of inbred line of New Zealand White rabbit breed. Transgenic animals (founders) were created by microinjection of DNA into pronuclei of zygote. Rabbit meat quality and concentration of selected elements in muscular substance were evaluated in transgenic and non-transgenic animals.

We found no effect of hPC gene integration in the content of water in muscle (74.00 ± 0.26 vs. 71.50 ± 0.28 %), protein (21.55 ± 0.26 vs. 21.12 ± 0.29 %), fat (3.50 ± 0.50 vs. 3.35 ± 0.45 %), energy (495.55 ± 10.50 vs. 456.00 ± 12.00 kJ) and water holding capacity (33.85 ± 0.84 vs. 35.65 ± 0.92 %) between transgenic and non-transgenic rabbit. No effect of hPC gene integration was also in concentration of the selected elements in muscular substance.

Our results showed no effect of integrated and expressed hPC gene in rabbit genome on the rabbit meat quality.

Key words: transgenic rabbits; hPC; meat quality

INTRODUCTION

Despite more than 150 reports on transgenic rabbit generation there are at disposal minimum data that indicate not only quality of obtained recombinant proteins but also possible effects of transgenesis on meat, milk or reproduction performance of genetically modified animals (Chrenek *et al*., 2008).

The need of systematic study of biological properties in transgenic animals is a consequence of their spread and commercial utilization in various spheres of human activity. Possible interactions of integrated genes of transgenic organisms with the existent genotype are one of the intensive discussed problems (Rafay *et al*., 2008). Emigration of integrated foreign gene from the experimental population into production herds can markedly affect performance with possible consequences in food chain. Therefore better knowledge of relations between performance indexes and expression of integrated gene gives precondition of objective evaluation of application benefits of transgenesis.

In practical conditions are used specialized rabbit lines for meat production that maximize heterosis and complementary effects in generation of commercial hybrids within hybridisation schemes. Lines are created on the basis of multi-breed crossing and various types of selection. Results of such processes are populations of animals with fixed genes for the complex of maternal properties (maternal lines) and populations bred for intensive growth, dressing percentage and fattening capacity (paternal lines) (Mach *et al*., 2004). Harmonized criteria that enable comparison of parameters among various groups of animals are used to evaluate the level of performance.

Using the gene construct (mWAP-hPC) in case of integration should cause expression of recombinant

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protein in the mammary gland only. Since transgenic rabbits should have integrated gene in each cell with nucleus the objective of this work was to evaluate the possible effect of gene integration on qualitative meat parameters and concentrations of selected constituents in rabbit meat.

MATERIAL AND METHODS

Animals

In experiment we used New Zealand White transgenic rabbit offspring that were obtained after breeding of transgenic founders (mWAP-hPC gene construct) with non-transgenic rabbit of the same breed (Chrenek *et al.*, 1999). Detection of the transgene integration in the offspring of F1 generation was done by PCR method. Total DNA was isolated from ear tissue (Chrenek *et al*., 1999) of newborn rabbits.

All studied animals were housed in wire-floor cages at the air temperature 22 ± 3 °C, humidity 75 ± 5 %, ad libitum access to water and feed. They were fed pellets (KKV, Anprokrmi Ltd. Slovakia) during the observation.

Tested animals were from identical litters and after testing on gene integration they were divided into two groups – with positive integration and without integration. The positively tested ones, without sex differentiation, were evaluated in one statistical group and compared with their non-transgenic siblings from identical litters.

Analysis of rabbit meat quality

Muscle of thigh (m. biceps femoris) was used for chemical analysis of meat sampled 1 hour after slaughter. Sample of muscle was wrapped into aluminium foil and stored at temperature 4 ºC for 24 hours. pH value was assessed by stab electrode and apparatus Radelkis OP-109 24 hours p.m. Content of water, proteins and intramuscular fat (cw – content of water, cp – content of proteins, cf – content of fat) in muscular substance was analysed by Infratec 1265 apparatus at 48 hours post mortem. Meat colour (mc) was evaluated in the apparatus Spekol 11 as percent of remission at wavelength 540 μm. Water holding capacity (whc) was determined by pressure method as described by Grav-Hamm in an apparatus modified by Rafay *et al.* 2008. Content of elements (Cu – copper, Zn – zinc, Fe – iron, K – potassium, Na – sodium, Mg – magnesium, P – phosphorus, Ca – calcium) in thigh muscle was studied after dry mineralisation in atomic absorption spectrophotometer UNICAM 939 Cambridge UK. Content of phosphorus was measured spectrophotometrically by apparatus SPECOL 11 (Rafay *et al.*, 2008).

Statistic analysis

Obtained values of all studied parameters were processed to basic variation-statistical characteristics (mean - $\overline{x}$, standard error – s_x) and significance of mean differences were stimated by t-test.

RESULTS AND DISCUSSION

Values of qualitative parameters of meat in leg are in tab. 1. No statistically significant effect of gene integration was noticed between transgenic and non-transgenic in the content of proteins in muscle (74.00 ± 0.26 vs. 71.50 ± 0.28 %), protein (21.55 ± 0.26 vs. 21.12 ± 0.29 %), fat (3.50 ± 0.50 vs. 3.35 ± 0.45 %), energy (495.55 ± 10.50 vs. 456.00 ± 12.00 kJ) and water holding capacity (33.85 ± 0.84 vs. 35.65 ± 0.92 %). We did not find significant differences in basic characteristics of element concentrations between meat of transgenic and non-transgenic rabbit (tab. 2).

Table 1: Basic statistical characteristics of chemical composition of rabbit meat

trait	transgenic (n=7)	control (n=7)
	$\overline{x}$ ± sx	$\overline{x}$ ± sx (n=7)
content of water (%)	74.00 ± 0.26	71.50 ± 0.28
content of protein (%)	21.55 ± 0.26	21.12 ± 0.29
content of fat (%)	3.50 ± 0.50	3.35 ± 0.45
content of energy (kJ)	495.55 ± 10.50	456.00 ± 12.00
pH	5.80 ± 0.10	5.50 ± 0.11
meat colour (%)	20.55 ± 1.58	21.40 ± 1.58
water holding capacity (%)	33.85 ± 0.84	35.65 ± 0.92

Table 2: Basic statistical characteristics of element concentrations in rabbit meat

element (unit)	transgenic (n=7)	control (n=7)
	$\overline{x}$ ± sx	$\overline{x}$ ± sx
Cu (mg/1 kg)	1.10 ± 0.20	0.89 ± 0.23
Zn (mg/1 kg)	17.25 ± 4.43	18.25 ± 4.85
Fe (mg/1 kg)	17.15 ± 6.05	20.90 ± 6.60
K (g/1 kg)	5.20 ± 0.32	5.24 ± 0.35
Na (g/1 kg)	0.81 ± 0.08	0.78 ± 0.09
Mg (g/1 kg)	0.45 ± 0.06	0.44 ± 0.07
P (g/1kg)	2.35 ± 0.37	2.94 ± 0.40
Ca (g/1kg)	0.32 ± 0.05	0.25 ± 0.06

In previous article (Rafay *et al*., 1999) we found content of water in rabbit meat (m. long. dorsi) in value of 74.37 ± 0.19 % corresponding with data obtained from muscle of leg in both groups in this study. Similarly Szendrö *et al.*, (1996) assessed water content 73.8 ± 0.44 % in samples of muscle from hind legs of rabbits weighing 2.500 – 2.590 kg. Statistically no significant difference between transgenic and non-transgenic animals in water content in muscles of legs was found in our work, but in our previously research (Rafay *et al*., 2008) statistically significant difference in water content in muscles of legs found between transgenic and non-transgenic animals (mWAP-hFVIII) represented 0.81 %. Muscular fat consists of phospholipides of muscular contractile fibres, fibroblasts and membranes of adipocytes, glycerides located on adipocytes around fibres and free fatty acids. Szendrö *et al*., (1996) give average value of fat in muscular substance of leg 3.28 ± 0.56 %. Our results (3.50 %) in transgenic animals are higher. According to Lambertini *et al.*, (1996) and Hernandez *et al.*, (1998) differences in meat quality parameters among genotypes of rabbits are constant.

It was found in some cases that in older rabbits increases glycolytical metabolism, concentration of myoglobin and pH value decreases (Hulot and Ouhayoun, 1999). However, previously study (Rafay *et al*., 2008) showed statistical differences in content of water, protein, fat and energy between transgenic (mWAP-hFVIII) and non-transgenic rabbits. Our present results showed no significant differences in all parameters of rabbit transgenic (mWAP-hPC) and non-transgenic meat quality.

CONCLUSION

We can conclude that no effect of integrated and expressed hPC gene on the rabbit meat quality was observed.

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