A comparison of the quality of nutria meat and rabbit meat

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Abstract

The aim of this study was to compare the meat yield and meat quality of Standard nutria with that of the purebred Czech White rabbit breed. Twenty nutrias were fattened to 8 months of age, and 36 rabbits to 90 days of age, under defined conditions. They were fed complete feed mixtures specific for each of the two species. The results of our study show that the rabbits had a demonstrably higher dressing-out percentage ($P \leq 0.001$; 60.18 compared with 55.74%). On the other hand, nutria had a significantly lower proportion of perirenal fat ($P \leq 0.044$) than rabbits. A significantly lower content of crude protein was recorded in the nutria thigh muscle ($P \leq 0.004$). The total cholesterol was significantly lower in nutria than in rabbit meat ($P \leq 0.001$; 60 mg compared with 92 mg·100 g^{-1} of meat). The nutria meat also had a lower L* value ($P \leq 0.003$) than the rabbits. That value expresses the lightness of the meat, and reflects that fact that nutria meat is darker than rabbit meat. The nutria also had a significantly lower proportion of monounsaturated fatty acids ($P \leq 0.001$), although the proportion of polyunsaturated fatty acids ($P \leq 0.031$; 31.14% as compared with 26.99%) and the n6/n3 fatty acids ratio were demonstrably higher in nutria meat ($P \leq 0.001$; 16.50% as compared with 7.47 %).

Carcass composition, nutria, physical characteristics, rabbit

Introduction

An interest in a healthy nutrition has been on the increase in recent years. Today, consumers show a preference for a meat with a low content of fat and cholesterol and a high protein content, good dietary properties and high nutritional value. The meat of both nutria and rabbits satisfy all these requirements.

The growth of the animals, which is influenced primarily by nutrition, origin, climatic conditions and method of rearing, is important to meat yield. Young nutria at the age of eight months, at the time of fur maturity when the desired live weight and meat quality are attained, are used for the production of meat in nutria farming. At this age, the average live weight of nutria, as stated by Skřivan et al. (1976), ranges from 3 500 to 5 500 g. In rabbits, the desired live weight and meat quality depend on the genotype of the rabbits; broiler rabbits attain slaughter maturity at an age of around 75 days and a weight of around 2.5 kg, purebred breeds at an age of three months. Volek et al. (2012) determined a live weight of 2 650 to 2 700 g in the Czech White at the age of 90 days. The dressing-out percentage is one of the most important indicators of meat yield, and is dependent on the fattening performance of the animals, their age and gender. The dressing-out percentage with the head in nutria generally ranges from 60 to 64% (Mertin et al. 2003). Zadina et al. (2004) give a dressing-out percentage of 57 to 61% for rabbits. The weight of nutria carcasses ranges from 1 200 to 5 000 g (Beutling et al. 2008); the weight of rabbit carcasses from 1 500 to 1 600 g (Tůmová et al. 2003). Skřivan et al. (1976) state a proportion of edible offal of 5 to 7% in the nutria, of which the liver weighs 80 to 300 g, the heart 10 to 30 g and the kidneys 20 to 40 g. In rabbits, in contrast, the liver weighs around 80 to 100 g, the heart 7 to 10 g and the kidneys 15 to 20 g, with a proportion of edible offal of 5 to 6% (Skřivanová et al. 2000).

Physical characteristics such as pH and meat colour are important in relation to the meat

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quality. The pH of the meat shows the intensity of the oxidation of the muscle during the course of post-mortal changes and the glycolytic potential of the meat and the associated oxidative metabolism of the muscle (Blasco and Ouhayoun 1996). Alt et al. (2006) give an average pH value for nutria meat of 5.8 with the value variability in a range from 5.62 to 6.07. Fushy et al. (2006) determined a pH of 5.7 in rabbit thigh. The colour of the meat is a characteristic property of meat depending on the content of myoglobin and haemoglobin. Meat colour is characterised by the parameters L* – lightness, a* – position of colour between green and red, and b* – position of colour between blue and yellow (Ouhayoun and Dalle Zotte 1996). The parameters L*, a*, b* vary in dependence on the type of muscle in which colour is measured. Rabbit *biceps femoris* (BF) muscle is more oxydative than the *longissimus lumborum* (MLD) muscle, and has higher a* values. The value of the L* parameter in the nutria thigh muscle is around 42.97. Pla et al. (1998) state an L* value of 53.86 in rabbit MLD and a range of 4.17 to 4.83 in BF.

Nutria meat is delicate in taste, darker than rabbit meat and, in view of its more favourable composition of fatty acids, more nutritious than lamb or beef, for example. In terms of its chemical composition, it contains an average of 67 – 70% water, 20 – 21% protein and 4 – 10% fat (Mertin et al. 2005). Saadoun et al. (2006) state a total amount of cholesterol in nutria meat of just 70 – 72 mg to 100 g of meat. The most nutritious part of the nutria are the thighs, which contain 21.4 to 22.9% protein, 1.83 to 2.07% fat and 69.9 to 71 mg cholesterol to 100 g of meat (Sperber et al. 1982). The thigh muscle of the nutria has a low content of saturated (SFA) and monounsaturated (MUFA) fatty acids at 37 – 42% (Ramirez et al. 2005). In contrast, the proportion of polyunsaturated fatty acids (PUFA) is high at 30 to 40 %. Of total fatty acids in nutria meat, German and Dillard (2004) state 32.5 – 33% of oleic acid (C18:1) and 23 – 28 % of linoleic acid (C 18: 2n6).

Rabbit meat is classified as a white, easily digestible, dietary meat with fine fibres. Tůmová et al. (2008) state the water content in rabbit meat of 63.6 – 76.8%. The percentage of protein in rabbit meat ranges from 18.1 to 23.7% (Skřivanová et al. 2000) and the fat content from 0.6 to 14.4%, with an average value of 6.8% (Dalle Zotte 2004). Tůmová et al. (2008) reveal a total amount of cholesterol of 45 – 90 mg to 100 g of meat. In comparison with nutria meat, rabbit meat has less polyunsaturated fatty acids. Hernández et al. (2006) state an amount of around 36.9% saturated fatty acids, 28.5% monounsaturated fatty acids, and 34.6% polyunsaturated fatty acids.

The aim of this work was to compare the slaughter value, physical characteristics and chemical composition of meat from rabbits and nutria fattened under defined conditions.

Materials and Methods

This study focused on the comparison of the meat yield and meat quality of standard nutria with purebred Czech White rabbits. The Czech White rabbit is one of seven breeds of rabbit included in the national programme for the protection of animal genetic sources. It is a meat breed of rabbit. The Czech White was selected for the experiment for its high growth intensity and good carcass composition. Its principal advantage is its high dressing-out percentage. The Standard nutria, whose principal advantageous features are its size, structure, coat colour, and extremely good reproduction and growth properties, is also included in the animal genetic sources programme.

Twenty Standard nutrias of both genders were included in the study. From weaning at the age of two months, the nutrias were housed by gender in boxes with a partially slant floor. The nutrias were fed by pelleted food mixture for the duration of fattening up to the age of eight months. The environmental conditions corresponded to the requirements of nutria as given in Ministry of Agriculture Regulation no 208/2004 on minimum standards of protection of animals.

Thirty-six Czech White rabbits were used in the experiment with rabbits. After weaning (at 42 days of age) the rabbits were housed two to a cage under defined conditions. The rabbits' housing corresponded to European standards. A 0.09 m^2 of floor space was allowed for each rabbit. The rabbits were fed by a complete granulated feed mix for rabbits from weaning to the end of fattening (at 90 days of age).

Twelve nutria and 24 rabbits were selected for the purposes of monitoring meat quality. The two genders were equally represented.

The carcass analysis was performed on the rabbits at the end of the experiment in accordance with the

methodology of the European harmonisation criteria (Blasco and Ouhayoun 1996). After stunning, bleeding, skinning and evisceration, the rabbit carcasses were divided into individual parts. A head was separated from the carcass at the first cervical vertebra, after which the fore and hind parts were separated at the seventh lumbar vertebra. In the hind section, the thighs were separated by a cut between the sacrum and the thighbone. After separation, the individual parts of the carcass were weighed on a digital scale. The individual parts of the nutria were separated in a similar manner as in the carcass analysis of the rabbits.

Basic physical characteristics (pH and meat colour) were determined in thigh and loin muscle. Samples of muscle tissue (the meat of both thighs) were taken for the purposes of analysis, and the basic chemical composition of the meat and the composition of fatty acids determined.

The pH values were determined with the use of a 330i (WTW) pH meter with a glass piercing-tipped electrode. Meat colour expressed as L* (lightness), a* (redness) and b* (yellowness) was measured with a Minolta Spectra MagicTM NX spectrophotometer (Konica Minolta Sensing, Inc., Osaka, Japan). Meat colour and pH were measured one hour after slaughtering.

Content of dry matter was determined by drying samples at 105 ± 2 °C for 4 hours in a hot-air dryer. Free fat was obtained by extraction with petroleum ether using a Soxlet 1043 apparatus (FOSS Tecator AB, Hoganas, Sweden). Determination of free fat was performed in accordance with the standard ISO 1444 (1997). The ash content was calculated by the gravimetric method after four-hour combustion in a furnace at 550 °C. Determination of crude protein was performed in a Kjeltec Auto 1030 Analyzer (Tecator, AB Sweden). The values were subsequently converted into the content of protein in the meat using the coefficient 6.25. The cholesterol content was determined from the intramuscular fat of the thigh muscle by the photometric method (Perkin Elmer, model 5000).

Fatty acids were determined by the gas chromatography method based on the saponification of glycerides and phospholipids with subsequent esterification of free fatty acids in an alkaline methanol environment.

The program SAS 9.1. was used for the statistical evaluation of the results. The results were processed by a variance analysis method – ANOVA with the use of GLM procedures. The significance of differences between groups was tested by a Tuckey test. The value $P \leq 0.05$ was considered significant for all measurements.

Results and Discussion

The results of the carcass analysis of a Standard nutria and Czech White rabbits are given in Table 1. A demonstrably higher live weight ($P \leq 0.001$) and skin weight ($P \leq 0.001$) were recorded in nutria. Mertin et al. (2003) state a live weight of 4 370 g for nutria at the age of 8 months, which is less than that found in our study. Beutling and Cholewa (2008) determined a weight of nutria skin of 700 g. Volek et al. (2012) found a weight of Czech White rabbits similar to that found in our study, with a live weight of 2 702 g and a skin weight of 424 g at the age of 90 days. A significantly higher carcass weight

Table 1. Carcass analysis of Standard nutria and Czech White rabbits

Indicator	Species		Significance
	Nutria	Rabbit	
Live weight (g)	5316.67	2804.00	< 0.001
Weight of skin (g)	883.83	467.00	< 0.001
Weight of carcass with head (g)	2972.00	1555.00	< 0.001
Dressing-out percentage with head (%)	55.74	60.18	< 0.001
Dressing-out percentage without head (%)	47.17	55.39	< 0.001
Fore part as proportion of carcass (%)	45.54	48.08	0.087
Hind part as proportion of carcass (%)	51.23	51.98	0.694
Thighs as proportion of carcass (%)	34.59	33.42	0.159
Thigh meat as proportion of carcass (%)	21.67	25.83	< 0.001
Perirenal fat as proportion of carcass (%)	0.97	1.48	0.044
Kidneys as proportion of carcass (%)	0.95	1.10	0.035
Heart as proportion of carcass (%)	0.56	0.58	0.848
Liver as proportion of carcass (%)	5.58	5.55	0.941

($P \leq 0.001$) was also found in the nutria. Mertin et al. (2003) reveal a nutria carcass weight of 2 792 g. The rabbit carcass weight we found corresponds with the results of Volek et al. (2012) who detect a rabbit carcass weight of 1 568 g. The differences determined in this study were influenced primarily by live weight, which were 5 316 g for nutria and 2 804 g for rabbits. In contrast, a demonstrably higher dressing-out percentage, with the head, was determined in rabbits ($P \leq 0.001$). Similarly, Volek et al. (2012) recorded a dressing-out percentage of 57% in Czech White rabbits. In Standard nutria, Beutling et al. (2008) recorded a dressing-out percentage of 54.5%. No significant differences between nutria and rabbits were shown by the proportion of the fore part or the proportion of the hind part. No statistically significant differences were recorded for the thighs of nutria and rabbits. In contrast, the proportion of thigh meat was significantly higher in rabbits ($P \leq 0.001$). Rabbits also had a significantly higher proportion of perirenal fat compared with nutria ($P \leq 0.044$). Demonstrable differences were recorded in the edible offal only for the kidneys, which were significantly heavier in rabbits ($P \leq 0.035$).

The pH values and meat colour recorded for Standard nutria and Czech White rabbits are given in Table 2. No significant differences were recorded between the meat of nutria and rabbits for the pH of the thighs and loin, and the value of post-mortal changes can be said to be similar in nutria and rabbits. Alt et al. (2006) determined a pH value of 5.6 in the thigh muscle of the nutria. Fushy et al. (2006) state a pH of 5.7 for rabbit thigh muscle. The colour of rabbit loin showed a significant higher L* value, which expresses the lightness of the meat ($P \leq 0.001$), while the a* value was significantly higher in nutria meat ($P \leq 0.001$). In contrast, no statistically significant difference was recorded for the b* value. A lower L* value was also recorded in nutria thigh ($P \leq 0.003$). No difference between nutria and rabbit meat was seen for the parameter a*; in contrast conclusively higher values for the b* parameter were recorded in nutria meat ($P \leq 0.001$). Our results show that the meat of the nutria is of a darker colour than rabbit meat. Similar results for the nutria are given by Alt et al. (2006), who determined a remission value indicating meat colour of 9.64%. These results show that the meat of young nutria is darker than rabbit meat.

Table 2. The pH and a meat colour in Standard nutria and Czech White rabbits

Indicator	Species		Significance
	Nutria	Rabbit	
pH of thigh	6.27	6.57	0.063
pH of lain	6.52	6.64	0.370
Colour of loin cut L*	36.44	47.21	< 0.001
Colour of loin cut a*	8.79	-1.79	< 0.001
Colour of loin cut b*	9.16	7.69	0.155
Colour of thigh cut L*	43.46	54.61	0.003
Colour of thigh cut a*	4.78	-48.86	0.102
Colour of thigh cut b*	10.79	7.48	< 0.001

A comparison of the chemical composition of meat of Standard nutria and Czech White rabbits is given in Table 3. No evident differences in the content of dry matter in the meat of nutria and rabbits can be found in the results of the study. A conclusively lower content of crude protein was recorded in nutria ($P \leq 0.004$). The values for nutria are in accordance with the figures given by Saadoun et al. (2006), who determined a content of crude protein of 202.15 g in the thighs of Standard nutria. Tůmová (2012) determined a figure of 219 g for the thigh muscle of Czech White rabbits. No significant differences were found for the fat content ($P \leq 0.633$).

Saadoun et al. (2006) revealed a fat content of just 15 g for nutria. Nutria meat had a significantly lower cholesterol content ($P \leq 0.001$). These results corresponded with the results of Saadoun et al. (2006). These authors found a content of total cholesterol in nutria meat of 71 mg to 100 g of meat. Tůmová et al. (2008) determined a cholesterol content of 91 mg to 100 g of meat in rabbit thigh, which is similar to the content we determined.

Table 3. The chemical composition of the thigh meat of Standard nutria and Czech White rabbits

Indicator	Species		Significance
	Nutria	Rabbit	
Dry matter (g)	257.90	254.57	0.487
Crude protein (g)	208.97	223.87	0.004
Crude fat (g)	30.96	28.39	0.633
Cholesterol (mg/100 g)	60.00	92.20	< 0.001

Table 4 shows the proportions of groups of fatty acids in Standard nutria and Czech White rabbits. No significant differences were recorded between the meat of nutria and rabbits in the proportion of saturated fatty acids (SFA). Horbañczuk et al. (1998) state a proportion of SFA in the thigh muscle of the nutria of 37 to 42%. Hernández et al. (2006) recorded a content of SFA in rabbit thigh of 36.9%. The proportion of monounsaturated fatty acids (MUFA) was significantly higher in rabbit meat ($P \leq 0.001$). In contrast, the proportion of polyunsaturated fatty acids (PUFA) was higher in nutria ($P \leq 0.031$). Similar values were found by Paleari et al. (1998), who state a figure of as much as 34% PUFA for nutria thigh meat. Marounek et al. (2007) detected a proportion of PUFA in rabbit thigh of 32.3%, which is less than the values found in our study. The PUFA/SFA ratio showed no significant differences. Rather lower values for the PUFA/SFA ratio are given in the literature. German and Dillard (2004), for example, state a ratio of PUFA and SFA in nutria of 0.45, while Marounek et al. (2007) give a figure of 0.4 for PUFA/SFA in rabbits. The proportion of polyunsaturated n3 fatty acids (PUFA n3) was significantly lower ($P \leq 0.001$) and the proportion of polyunsaturated n6 fatty acids higher ($P \leq 0.003$) in nutria meat than in rabbit meat. The ratio of PUFA n6/n3 was significantly higher in nutria meat ($P \leq 0.001$).

Table 4. The composition of fatty acids in Standard nutria and Czech White rabbits

Indicator	Species		Significance
	Nutria	Rabbit	
SFA (%)	37.42	36.01	0.104
MUFA (%)	31.00	36.27	0.001
PUFA (%)	31.14	26.99	0.031
PUFA/SFA (%)	0.83	0.76	0.212
PUFA n3 (%)	1.78	3.22	< 0.001
PUFA n6 (%)	29.35	23.77	0.003
PUFA n6/n3 (%)	16.50	7.47	< 0.001

Conclusions

The results of the comparison of rabbits and nutria meat show that nutria meat is of high quality with good dietary properties. The most important parts for consumption are the thighs which are of high nutritional value. The meat contains a large amount of easily

digestible proteins, and nutria meat contains less cholesterol than a rabbit meat. The content of monounsaturated fatty acids is lower than in rabbit meat. Nutria meat contains a higher proportion of the polyunsaturated fatty acids essential to human health. For these reasons, nutria meat is of excellent quality and suitable for extending the range of meat on offer and for increased consumption.

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