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MEAT PERFORMANCE, CHEMICAL COMPOSITION AND SENSORY EVALUATION OF *MYOCASTOR COYPUS* MEAT

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ABSTRACT

The aim of the present study was to evaluate the main slaughter characteristics, chemical composition and sensory properties of meat obtained from 9-month-old male nutria (*Myocastor coypus*). The animals were killed at the farm, deboned, gutted and frozen. Meat samples were taken from the back, thigh and shoulder. Carcass yield, as well as water content, total protein and crude fat were determined in the laboratory. The energy content was calculated based on the conversion coefficients for protein and fat. The sensory evaluation was performed with a 5-point system for each monitored feature. Average of carcass yield without head was 54.73%. The average of water content varied from 72.80 (shoulder) to 73.68 g.100 g^{-1} (back), total protein oscillated from 20.78 (shoulder) to 21.65 g.100 g^{-1} (back), crude fat ranged from 3.65 (back) to 6.10 g.100 g^{-1} (shoulder). The average energy value was observed to range from 500.17 (back) to 577.91 kJ.100 g^{-1} (shoulder). The sensory evaluation of the observed meat from the carcass parts was high (4.14 - 4.21 points).

Keywords: *Myocastor cyoypus*, carcass yield, meat, proximate composition

INTRODUCTION

Venison, as a very good source of full-fledged meat, represents a dietetic food of great value in terms of protein content, mineral substances and a low representation of fat content. Venison, unlike the meat of farm animals, is predominantly red in colour since it contains a higher amount of myoglobin and haemoglobin and comes from animals with greater muscular performance. In our conditions, it is traditionally consumed as an additional type of meat and, besides its dietary advantages, it is popular especially among gourmets, or in the production of special meat products and, of course, a large portion is consumed by hunter families (**Haščík *et al*., 2023**).

From the point of view of achieving the meat efficiency of game, in recent years the results of various research tasks and breeding intentions have begun to be implemented and promoted **Hell, Slamečka & Gašparík (2000)**, **Haščík *et al.* (2004)**, while the solution complex also includes monitoring the achieved slaughter value of animals, assess the composition of the most valuable parts of the carcass, as well as the sensory quality of individual game species, including *Myocastor coypus*.

Nutria (*Myocastor coypus*) are reared in specialized farms using intensive production to obtain fur, meat and fat for domestic and international markets **(Cabrera *et al*., 2007)**. Nutria meat is consumed primarily in South America, particularly in Argentina and Uruguay. In addition to South America, nutria meat is consumed in the southern states of the USA, in European countries such as Germany, Poland, Spain, Slovakia and the Czech Republic, as well as in Asia **(Cabrera *et al*., 2007; Glogowski & Panas, 2009; Hanusová & Miluchová, 2017)**. In Europe, nutrias are reared mainly for fur production, with their meat only being a marginal product in terms of their economic value **(Cholewa *et al*., 2012; Migdal *et al*., 2013)**.

Despite the fact that nutrias have been kept for almost 80 years in Slovakia, their meat has not yet been appreciated. Possible reasons for this phenomenon involve lack of information about the meat, including how to achieve sustainable yields as well as understanding the technical and culinary qualities of the meat **(Hanusová & Miluchová, 2017)**.

However, at the end of the 20th century the market situation changed, and meat has become the main product. For meat performance, growth is an important parameter that affects the final live weight and composition of the carcass. Growth is affected by many factors, out of which breed and sex are the most important **Němeček, Tůmová & Chodová (2019).**

Slaughter characteristics represent valuable information in the meat production. In nutrias, the information about carcass value is variable because the uniform carcass definition is missing. Some authors have reported carcass with head **(Hermann & Muller, 1991)** and others without head **(Cabrera *et al*., 2007)**.

In addition to the production of high-quality river nutria meat suitable for direct consumption **(Panait, Ionescu & Nutrias, 1990; Bud, Vladau & Reca, 2013)**, and charcuterie, the production of skins is also important. However, little information is available in the scientific literature **(Faverin, Corva & Hozbor, 2002; Faverin *et al*., 2005; Saadoun, Cabrera & Castellucio, 2006)**.

Modern consumers look for valuable, soft and tender meat, rich in nutrients and vitamins, with a positive influence on human health **(McMichael & Bambrick, 2005)**. It appears likely that nutria meat may represent the most preferred type from the consumer point of view.

The aim of this work was to evaluate the meat performance, chemical composition and sensorial characteristics of meat from nutria fattened under defined conditions.

MATERIAL AND METHODS

In the verified experiment, 20 male river nutria (*Myocastor coypus*) was used as the biological material. The animals were 9 months old and came from farm breeding. The animals were euthanized and slaughtered in a permitted manner and transported in cooling boxes to the Institute of Food Sciences, SUA Nitra. We then subjected the nutria carcasses to perfect slaughtering.

For the chemical composition of the muscle tissue (basic analysis), we took samples of muscle tissue from arguably the most valuable parts of the river nutria carcass, i.e. the shoulder, back and thigh **(Trembecká *et al*., 2016)**. An average sample weighing 100 g, which was used for chemical analysis, was obtained from the individual monitored parts of the carcass, which had been previously deboned and after homogenization, we took 25 g samples from the individual muscles, which subsequently obtained an average meat sample. The chemical composition of the muscle was processed using the Fourier transform infrared spectroscopy (FTIR), Nicolet 6700 device at the Slovak Centre for Agricultural Research in Nitra, where we evaluated the content of water, total proteins, and crude fat in g.100 g^{-1} pieces of meat. We obtained the energy value in kJ.100 g^{-1} by calculation using conversion coefficients from the content of analysed proteins and fat **(Strmiska *et al*., 1988)**.

Sensory evaluation was carried out after preparation of meat samples from the thigh, shoulder and back of the river nutria by baking at 200 °C for 90 minutes with the addition of 40 ml of water and follow-up for another 15 minutes. The muscle samples were anonymously evaluated on a 0-5-point scale by a 7-member committee for aroma, taste, juiciness and tenderness of the meat.

Statistical analysis

The data obtained were subjected to analysis of variance (ANOVA) using SAS software (version 9.3, Enterprise Guide 4.2, USA). Tables show the results as minimum, maximum and the mean with standard deviation (SD) **(SAS, 2008)**.

RESULTS AND DISCUSSION

The results of the analysis of *Myocastor coypus* carcasses are presented in Table 1 and 2. **Mertin, Hanusová & Fľak (2003)** report a live weight of 4370 g for nutria at the age of 8 months, which is less than in our study (5370 g). On the contrary, **Tůmová & Hrstka (2013)** found approximately the same live weight of male river nutria, namely 5316.67 g and higher live weight (5974 to 5950 g) was found by **Němeček, Tůmová & Chodová (2019)**, respectively **Cabreva *et al.* (2007)**.

Table 1 Meat performance of male *Myocastor coypus* (g)

Parameter	Min.	Mean + *SD*	Max.
Live weight	5050.00	5370.00±342.05	5950.00
Skin	542.00	599.60±43.28	652.00
Head	422.00	458.00±35.41	514.00
Carcass with head	3222.00	3395.60±195.36	3714.00
Carcass without head	2800.00	2937.60±165.60	3200.00
Thigh	627.00	658.89±37.89	711.13
Back	413.26	554.16±129.98	717.23
Shoulder	136.94	156.68±22.32	184.10
Ribs	825.69	910.85±75.34	982.52
Carcass yield with head (%)	61.37	63.27±1.92	66.18
Carcass yield without head (%)	53.33	54.73±1.84	57.50
Edible offal	190.50	214.90±15.71	228.50
Heart	10.00	15.20±3.03	18.00
Kidneys	26.00	30.40±3.85	36.00
Lungs	20.00	31.60±12.36	52.00
Liver	118.00	131.20±12.38	148.00
Stomach	22.00	28.00±5.10	36.00
Inedible offal	1708.00	1974.40±190.91	2236.00
The weight of the digestive system	424.00	524.80±95.50	672.00

Notes: *SD* (standard deviation); Min. (minimum); Max (maximum).

Beutling, Cholewa & Miarka (2008) found nutria skin weight of 700 g, while we observed lower values in males (599.60 g). In the meantime, higher values (883.83 to 1239.90 g) were recorded by **Faverin, Corva & Hozbor (2002)**, respectively **Niedzwiadek & Kowalski (1987)**. Several authors evaluated the carcass of rivers nutria with or without the head. The values of the carcass with the head were 3395.60 g and 2937.60 g without the head. The obtained values are comparable with the data collected by **Tulley *et al.* (2000)**, respectively **Tůmová *et al*. (2017)**, but lower (3070 to 3340 g), as found by **Cabrera *et al.* (2007)**, respectively **Glogowski & Panas (2009)**.

The carcass yield of nutria was 54.73% without the head and 63.27% with the head. Lower values of carcass yield without the head were found by **Tulley *et al.* (2000)** - 49.60%, **Tůmová *et al.* (2017)** - 49.80%, **Tůmová *et al.* (2015)** - 50.40 - 50.50%, or **Glogowski & Panas (2009)** - 52.40%. Comparable values (54.20 - 56.20%) were found by **Cabrera *et al.* (2007)**, respectively **Januškevičius *et al.* (2015)** - 55.00 - 56.40%.

The weight of the viscera was 214.90 g, which was less than reported by **Mertin, Hanusová & Fľak (2003)** - 252.21 g. On the contrary, when evaluating the inedible parts, we found values at the level of 1974.40 g, which is higher when compared to **Mertin, Hanusová & Fľak (2003)** - 1704.07 g.

The weight of the heart was 15.20 g, the liver 131.20 g, the kidneys 30.40 g and the digestive system 524.80 g, which are lower values except for the weight of the digestive system as found by **Tůmová *et al*. (2015)**, respectively **Němeček, Tůmová & Chodová (2019)**.

Table 2 Fat content in carcass of *Myocastor coypus* (g)

Parameter	Min.	Mean + *SD*	Max.
Subcutaneous fat	373.40	459.22±59.41	518.70
Gastric fat	0.60	2.36±1.44	3.90
Abdominal fat	83.20	112.54±36.63	166.70
Kidney fat	0.40	4.08±3.29	8.80
Heart fat	0.10	0.48±0.47	1.20

Notes: *SD* (standard deviation); Min. (minimum); Max (maximum).

Table 3 Chemical composition of the most valuable parts of *Myocastor coypus* carcass (g.100 g^{-1})

Parameter	Min.	Mean + *SD*	Max.
Thigh			
Water	72.70	73.20±0.40	73.70
Total Protein	20.50	21.03±0.36	21.50
Crude Fat	4.10	4.75±0.45	5.50
Energy value (kJ.100 g^{-1})	511.26	531.29±15.16	55.64
Back			
Water	73.20	73.68±0.52	74.60
Total Protein	21.10	21.65±0.33	22.00
Crude Fat	2.50	3.65±0.60	4.10
Energy value (kJ.100 g^{-1})	461.03	500.17±20.30	515.87
Shoulder			
Water	71.30	72.80±0.46	72.50
Total Protein	20.00	20.78±0.45	21.10
Crude Fat	5.30	6.10±0.65	6.90
Energy value (kJ.100 g^{-1})	553.13	577.91±20.46	608.39

Notes: *SD* (standard deviation); Min. (minimum); Max. (maximum).

The fat mass in the carcass of male river nutria was at the level of 459.22 g (subcutaneous fat), stomach fat (2.36 g), abdominal fat (112.54 g), kidney fat (4.08 g) and heart fat (0.48 g), which are lower values than those found by **Tůmová & Skřivanová (2012)**, respectively **Tůmová & Hrstka (2013)**.

The chemical composition of the most valuable parts of the *Myocastor coypus* carcass is shown in Table 3. The water content was from 73.20 (thigh) to 73.68 g.100 g^{-1} (back), protein 20.78 (shoulder) to 21.65 g.100 g^{-1} (back), fat content from 3.65 (back) to 6.10 g.100 g^{-1} (shoulder) and energy value from 500.17 (back) to 577.91 kJ.100 g^{-1} (shoulder).

Pavlenko *et al.* (2019) state that the average water content in river nutria meat varied from 67 to 73 g.100 g^{-1}, protein - 20.80 g.100 g^{-1} and fat – 4.1. - 10 g.100 g^{-1}. Lower water content in the meat of river nutria (69.60 to 70.60 g.100 g^{-1}) was found by **Cabrera *et al.* (2006)** and **Saadoun, Cabrera & Castellucio (2006)**. Lower protein content (18.45 to 20.05 g.100 g^{-1}) was found by **Migdal *et al*. (2013)** and **Mardari & Leonte (2016)**. The fat content, on which the energy value of the

food depends the most, was lower in the studies by **Cabrerra *et al.* (2006)**, **Saadoun *et al.* (2006)**, **Tůmová & Hrstka (2013)**, **Januškevičius *et al.* (2015)**, **Němeček, Tůmová & Chodová (2019)** from 1.83 to 3.09 g.100 g^{-1}. On the contrary, higher amount of fat (7.83 g.100 g^{-1}) was reported by **Migdal *et al.* (2013)**, respectively comparable (5.77 g.100 g^{-1}) was observed by **Mardari & Leonte (2016)**.

The energy value of the carcass parts of the river nutria in our experiment was slightly higher compared to 465 kJ.100 g^{-1} found by **Němeček, Tůmová & Chodová (2019)** and lower in comparison 652.70 to 836.80 kJ.100 g^{-1} **(Pavlenko *et al.*, 2019)**.

The sensory evaluation of the most valuable parts of the river nutria carcass using a 5-point system (Table 4) varied for smell from 4.13 point (thigh) to 4.35 point (back), oscillated in case of taste from 4.08 point (back) to 4.33 point (shoulder), ranged with respect to juiciness from 4.10 point (back) to 4.23 point (thigh) and ranged in case of tenderness from 4.03 point (back) to 4.23 point (thigh). From the overall sensory evaluation, we can conclude that all evaluated meat samples achieved high sensory values on average, namely 4.14 point (back) to 4.21 point (shoulder). Also **Tůmová *et al.* (2016)**, who scored with a 9-point system, achieved relatively favourable values in the evaluation of all sensory properties of nutria meat.

Table 4 Sensory evaluation of the most valuable parts of *Myocastor coypus* carcass (0-5 points)

Parameter	Min.	Mean + *SD*	Max.
Thigh			
Smell	3.50	4.13±0.36	5.00
Taste	3.50	4.15±0.46	5.00
Juiciness	3.00	4.23±0.58	5.00
Tenderness	3.00	4.23±0.57	5.00
Mean	3.38	4.16±0.34	5.00
Back			
Smell	3.50	4.35±0.46	5.00
Taste	3.00	4.08±0.49	5.00
Juiciness	3.00	4.10±0.53	5.00
Tenderness	3.00	4.03±0.57	5.00
Mean	3.13	4.14±0.42	5.00
Shoulder			
Smell	3.50	4.15±0.49	5.00
Taste	3.00	4.33±0.52	5.00
Juiciness	3.50	4.18±0.44	5.00
Tenderness	3.50	4.20±0.41	5.00
Mean	3.38	4.21±0.36	5.00

Notes: *SD* (standard deviation); Min. (minimum); Max (maximum).

CONCLUSION

Based on the results achieved, we can conclude that the meat efficiency of male river nutria from farm breeding, as well as the nutritional and sensory properties of their meat, show interesting aspects when compared to commonly consumed types of meat that are traditionally consumed in the world. Although from the point of view of the meat efficiency a lower carcass yield is achieved in case of the river nutria, from the nutritional point of view (higher protein content, lower fat content) we may consider it as dietetic meat and acceptable as a supplement to the food chain for ordinary consumers from a sensory point of view.

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