Slovak J. Anim. Sci., 41, 2008 (4): 190 - 194
© 2008 SARC

MICROBIOLOGICAL QUALITY OF THE *ANAS PLATYRHYNCHOS* AND THE *FULICA ATRA* MEAT

P. HAŠČÍK*, I. NOVÁKOVÁ, M. KAČÁNIOVÁ, M. FIKSELOVÁ, S. PAVLIČOVÁ

Slovak University of Agriculture, Nitra, Slovak Republic

ABSTRACT

The aim of our experiment was the monitoring of the microbiological quality of the *Anas platyrhynchos* and the *Fulica atra* meat following the slaughter and seven days of maturing process. We measured a total count of microorganisms in the Glucose Tryptone Yeast agar at 30 °C and 48 hours, a number of coliform bacteria in Violet Red Bile agar at 37 °C and 24 hours and a number of mesophilic anaerobic sporulating microorganisms in the Nutrient agar at 25 °C and 72 hours. The evaluation of microorganisms was done by *Codex Alimentarius* SR. We noticed that the count of coliform bacteria was negative after slaughter in both experimental groups. The count of mesophilic anaerobic sporulating bacteria in the meat of the wild ducks ranged from 1.78 to 2.12 log CFU.g^{-1} and in the meat of the fulicas was found from 4.98 to 5.95 log CFU.g^{-1}. From the statistical point of view there was a high significant difference ($P \leq 0.001$). The total count of microorganisms in the meat of the wild ducks was zero, whereas in the meat of fulicas it ranged from 5.18 to 6.25 log CFU.g^{-1}. Statistical differences between meat samples from the wild ducks and the fulicas were significant ($P \leq 0.001$). The count of coliforms in the mature meat of wild ducks varied from 1.12 to 1.73 log CFU.g^{-1}. Differences between the meat samples from the wild ducks and the fulicas were not significant ($P \geq 0.05$). The count of mesophilic anaerobic sporulating microorganisms in the wild duck mature meat samples varied from 1.95 to 2.24 log CFU.g^{-1} and in the mature meat of the fulicas ranged from 5.00 to 6.00 log CFU.g^{-1}. Significant differences between meat samples of the wild ducks and the fulicas were determined ($P \leq 0.001$). The total count of microorganisms in the mature meat samples of the wild ducks ranged from 1.18 to 2.24 log CFU.g^{-1}, i.e. at average of 1.99 log CFU.g^{-1}. Higher values were detected in the mature meat samples of the fulicas. The values varied from 5.24 to 6.30 log CFU.g^{-1}, i.e. at average of 5.69 log CFU.g^{-1}. The comparison of meat samples of both experimental animals showed high significant differences ($P \leq 0.001$).

Keywords: microorganisms, *Fulica atra*, *Anas platyrhynchos*, meat, maturing

INTRODUCTION

Hoofed game is nowadays a determinative measurement in production and consumption of game. A high proportion is represented also by a feather game (Slamečka et al., 2003). Game is an economically significant product. It plays an eminent role as a complement of the menu. Feather game, at the production of 257 tons, creates 10% from market production of game (Hell et al., 2005; Haščík et al. 2005).

Although meat production is a one of main indicators, according to Haščík et al. (2004, 2005), it is necessary to pursue the nutrition quality of the meat, adherence to the sanitary code and the microbiological requirements. They are coupled with eventual contamination and consecutive devaluation of the meat. The maturing processes are running in muscles up to the point of time after death of game, until the supplies of glycogen and energetically valuable phosphates are available. Specific taste of the game meat is conditioned

Correspondence: E-mail: Miroslava.Kacaniova@uniag.sk

*Scientific paper formerly presented at the 8th International Conference on Risk Factors of Food Chain, Kraków, Poland, September 17, 2008

ISSN 1335-3686

by the production of enzymes and protein metabolites. The game meat, „the red meat", must be matured few days (5 or 7) in cold conditions, in order to get required tenderness and rich taste (Winkelmayer et al., 2005). It is necessary to avoid microbial contamination.

The meat is an ideal nutrient medium for microorganisms. It has a high content of water, nitrogenous and mineral compounds, growth factors and pH, which is ideal for microorganisms. The meat as a food of animal origin is exposed to negative surrounding factors. These factors are responsible for surviving and propagation of microorganisms (Görner a Valík, 2004, Kačániová et al., 2005a). Contamination of the meat is caused by following factors: the illnesses of animals (microorganisms penetrate into the muscles from gastrointestinal tract), the delay of the evisceration, inexpert examination of the carcass and breach of sanitation (Winkelmayer et al., 2000). Steinhauserová et al. (2000) mentioned that the spectrum of microorganisms on the surface of the meat is very extensive. The most common Gram negative bacteria are: *Acinetobacter, Aeromonas, Alcaligenes, Enterobacter, Citrobacter, Moraxella, Pseudomonas, Escherichia, Serratia, Psychrobacter, Shewanella* and *Yersinia.* From the Gram positive bacteria *Bacillus, Brochotrix, Carnobacterium, Micrococcus, Microbacterium* and *Lactobacillus* are present.

MATERIAL AND METHODS

As a biological material *Fulica atra* (fulica) and *Anas platyrhynchos* (wild duck) of the both sexes were used. In the autumn the catching of feather game was done by the nets. From 30 fulicas and 30 wild ducks 15 females and 15 males were chosen randomly. They were transported immediately to the Department of Animal Product Evaluation and Processing of SPU Nitra, where they were slaughtered. For the quantitative microbial analysis of the meat (total count of microorganisms, number of coliform bacteria and count of mesophilic anaerobic sporulating bacteria) the thigh and breast muscles were taken 45 minutes after slaughter, i.e. before chilling of the meat and after 7 days of maturing process. It was cut (with sterile scalpel) 15 samples of particular muscle to sterile Petri dishes. The sections were 5 cm^2 in depth of 5 mm. The samples were stored at 4 °C. Several pieces from each animal were homogenized on meat-mincer (size of slots was 3 mm). The homogenized tissue in amount of 10 g was placed into the sterile flask with 90 ml of saline. The flasks were shaked on the beater for 30 minutes (*Codex Alimentarius* SR, 2006). Particular steps of isolation are presented in the table 1.

Basic statistical characteristics (arithmetical average, standard deviation, min., max. and variation index) were evaluated by the SAS statistical program. Differences between groups in the experiment were tested by the t-test and the Scheffe test.

RESULTS AND DISCUSSION

At the evisceration and the carcase splitting it is not possible to avoid microbial contamination. A mixture of bacteria, fungi and yeast, which are in contact with game, has various effects on quality of the meat as foodstuff. They can activate both positive and negative processes in the meat (Winkelmayer et al., 2005).

Microorganisms presenting in the meat are responsible for the alimentary diseases. Microorganisms affect by their metabolic activity quality of the meat, especially sensorial characteristics. Microorganisms participate in metabolism of proteins and lipids producing an unpleasant smell and changing the taste of the meat. Other negative features are the formation of visible colonies and mould films on the surface of the meat or changes in the meat pigmentation. The consumption of poor meat can cause enteric diseases (Grieger, 1991).

In our experiment we monitored the same groups of microorganisms in the meat of fulicas and wild ducks after the slaughter (Table 2) and following 7 days of the maturing process (Table 3).

The count of coliform bacteria was negative after slaughter in both experimental groups. Kačániová et al. (2004, 2005b) confirmed proper quality of the fulica's and the wild duck meat on the coliforms bacteria, that was in accordance with the *Codex Alimentarius SR* (2006). The standard for the count of coliform bacteria is 5 log $CFU.g^{-1}$.

Table 1: Isolated strains of microorganisms of the *Fulica atra* and the *Anas platyrhynchos* meat and their fundamental identification signs (Holt et al., 1994)

Cultivated microorganisms	Nutritive substrate	Temperature of cultivation	Time of cultivation	Colour of colony
Coliforms bacteria	VRB agar (8)	37 °C	24 - 48 h	Reddish purple
MASM	Nutrient agar	25 °C	38 - 72 h	Light amber
Total microorganisms count	GTY agar (9)	30 °C	48 - 72 h	Yellow

VRB-Violet red bile agar, MASM- mesophilic anaerobic sporulating microorganisms, GTY-Glucose tryptone yeast agar

Table 2: Representation of individual microorganism groups of *Anas platyrchynos* and *Fulica atra* meat in log CFU.g^{-1}

Groups of microorganisms	Basic of statistical characteristics	Animal species	
		Anas platyrhynchos	*Fulica atra*
Coliform bacteria	$\bar{x}$	**0.00**	**0.00**
	min.	0.00	0.00
	max.	0.00	0.00
	s_x	0.00	0.00
	v %	0.00	0.00
Mesophilic anaerobic sporulating bacteria	$\bar{x}$	**1.99**	**5.39**
	min.	1.78	4.98
	max.	2.14	5.95
	s_x	0.12	0.32
	v %	5.97	5.84
Total count of microorganisms	$\bar{x}$	**0.00**	**5.62**
	min.	0.00	5.18
	max.	0.00	6.25
	s_x	0.00	0.42
	v %	0.00	7.53

$\bar{x}$ -average, s_x -standard deviation, v % - coefficient of variation

Table 3: Representation of individual microorganism groups of *Anas platyrchynos* and *Fulica atra* meat in log CFU.g^{-1} after 7 days of maturing

Groups of microorganisms	Basic statistical characteristics	Animal species	
		Anas platyrhynchos	*Fulica atra*
Coliforms bacteria	$\bar{x}$	**1.27**	**2.03**
	min.	1.12	0.00
	max.	1.73	3.43
	s_x	0.17	1.45
	v %	13.63	71.38
Mesophilic anaerobic sporulating bacteria	$\bar{x}$	**2.08**	**5.43**
	min.	1.95	5.00
	max.	2.24	6.00
	s_x	0.11	0.31
	v %	5.43	5.62
Total count of microorganisms	$\bar{x}$	**1.99**	**5.74**
	min.	1.18	5.24
	max.	2.24	6.30
	s_x	0.30	0.39
	v %	15.19	6.86

$\bar{x}$ -average, s_x -standard deviation, v % - coefficient of variation

The count of mesophilic anaerobic sporulating bacteria in the meat of wild ducks ranged from 1.78 to 2.12 log CFU.g^{-1} and in the meat of fulicas it was from 4.98 to 5.95 log CFU.g^{-1}. From the statistical point of view there was a high significant difference ($P \leq 0.001$). The attained results correspond to observations of Kačániová et al. (2005b). They observed the increased count of mesophilic anaerobic sporulating bacteria in the meat of wild ducks, as well. According to the *Codex Alimentarius* SR (2006) we can state that the microbial quality of the wild duck meat corresponded to the norm but the microbial quality of the fulica meat was not proper. The norm for mesophilic anaerobic sporulating bacteria is 2 log CFU.g^{-1}, according to the *Codex Alimentarius* SR (2006).

The total count of microorganisms in the meat of wild ducks was zero. In the meat of fulicas it ranged from 5.18 to 6.25 log CFU.g^{-1}. Basing on average results, we can state that the total count of microorganisms is conformable to the *Codex Alimentarius* SR (2006). The norm for the total count of microorganisms is 5.69 log CFU.g^{-1}. But we must highlight that 30% of samples of the fulica meat had excessive values.

The increasing count of microorganisms was noticed in samples of the wild duck meat (0.00-6.37 log CFU.g^{-1}) by Kačániová et al. (2004); but in other experiments (Kačániová et al., 2005b) the total counts of microorganisms were the same as in our experiment, i.e. zero. The differences between the meat samples from wild ducks and fulicas were significant ($P \leq 0.001$).

In the past, the game meat was usually stored at 0 to 4 °C. The principle of the 7 day-maturing process is to provide consumers with a matured meat. Profound autolysis occurs immediately after the 7 day maturing process (Kačániová et al., 2007). Thereat we have observed microbial contamination of the wild duck and the fulica meat at the end of the maturation.

All samples of the wild duck and the fulica meat were contaminated by the coliform bacteria; what indicates, that in the term of faecal contamination the muscles of game were not clean. The count of coliforms in the mature meat of wild ducks was in the range of 1.12 - 1.73 log CFU.g^{-1}. In the mature meat of fulicas it was ranged from 0.00 to 3.43 log CFU.g^{-1}. Other attributes were measured by Kačániová et al. (2004, 2007). The count of coliforms was zero in the meat of wild ducks, as well as in the meat of fulicas. These results confirm a proper microbial quality of feather game according to the *Codex Alimentarius* SR (2006). The *Codex Alimentarius* (2006) defines 5 log CFU.g^{-1} as a maximum value of the count of coliforms. Our results correspond to the norm value, listed in the *Codex Alimentarius* SR (2006). The differences between the meat samples from the wild ducks and the fulicas were not statistically significant ($P \geq 0.05$).

The count of mesophilic anaerobic sporulating microorganisms in the wild duck mature meat samples was in the range of 1.95 – 2.24 log CFU.g^{-1} and in the mature meat of fulicas it was ranged from 5.00 to 6.00 log CFU.g^{-1}. Average values were incompatible with the *Codex Alimentarius* SR (2006). The norm for mesophilic anaerobic sporulating bacteria is 2 log CFU.g^{-1}. The differences between the meat samples from wild ducks and fulicas were significant ($P \leq 0.001$).

The total count of microorganisms in the mature meat samples of wild ducks was in the range of 1.18 - 2.24 log CFU.g^{-1}, i.e. at the average 1.99 log CFU.g^{-1}. These values are compatible with the norm of the *Codex Alimentarius* SR (2006). Higher values were detected in the mature meat samples of fulicas. The values were in the range of 5.24 – 6.30 log CFU.g^{-1}, at the average of 5. 69 log CFU.g^{-1}. Comparison of the meat samples of both experimental animals showed high significant differences ($P \leq 0.001$).

The statistically significant differences ($P \leq 0.001$) were found among the count of coliforms and the total count of microorganisms in the meat of wild ducks immediately after the slaughter and following the 7 day maturing process. No statistically significant differences ($P \geq 0.05$) were found in counts of mesophilic anaerobic sporulating bacteria after the slaughter and after the 7 day maturing process.

The similar tendency of the statistical significant differences ($P \leq 0.001$) was observed between values of the counts of coliforms in samples of the fulica meat after the slaughter and maturation. In the counts of mesophilic anaerobic sporulating bacteria and in the total counts of microorganisms after the slaughter and the maturing process no statistically significant differences ($P \geq 0.05$) were found.

CONCLUSION

The zero values of the counts of coliform bacteria in the meat of wild ducks and fulicas after the slaughter, as well as values 1.27 log CFU.g^{-1} (the wild duck mature meat) or 2.30 log CFU.g^{-1} (the fulica mature meat) give a good premise to consummation of this meat. The count of mesophilic anaerobic sporulating bacteria in the meat of wild ducks was at allowed values, according to the *Codex Alimentarius* SR. After 7 days of the maturing process the value of mesophilic anaerobic sporulating bacteria count increased at about 0.08 log CFU.g^{-1} above the norm. High values of the mesophilic anaerobic sporulating bacteria counts were observed in the fresh and the mature meat of fulicas; in particular, the count of mesophilic anaerobic sporulating bacteria was about 2.69 higher than it is allowed. After maturation, the value of the count of mesophilic anaerobic sporulating bacteria was about 2.69 higher than is allowed by the *Codex Alimentarius* SR. The total count of microorganisms in the meat samples of wild ducks after the slaughter was zero and the values increased after maturation up to 1.99 log CFU.g^{-1}, which is in accordance with the *Codex Alimentarius* SR. In the meat samples of fulicas after the slaughter this value was 5.62 log CFU.g^{-1}, i.e. close to maximum of the allowed norm. The total count of microorganisms in the mature meat samples of fulicas was about 2.13% higher than in the fresh meat. This value falls outside the *Codex Alimentarius* norm.

Basing on our experiments we can state, that the maturing process of the game meat does not exert a negative influence on the meat quality, but in many cases the microbial quality is even better, than in the fresh meat.

REFERENCES

GÖRNER, F. – VALÍK, Ľ. 2004. Aplikovaná mikrobiológia požívatín. In: Bratislava - Malé Centrum, 2004, I.vydanie, 528 p., ISBN 80-967064-9-7.

GRIEGER, C. 1991. Mikrobiológia požívatín živočíšneho pôvodu. Príroda : Bratislava, 1991, II. vydanie, 272 s., ISBN 80-07-00388-6.

HAŠČÍK, P. – GAŠPARÍK, J. – ČUBOŇ, J. – KULÍŠEK, V. – KRIVÁNEK, L. 2004. Nutritional composition of Muscle of the Most Valuable Part of Pheasant Carcasses from phesantries. In: *Folia venatoria*, vol. 34, 2004, p. 161-166, ISBN 80-88853-79-6.

HAŠČÍK, P. – GAŠPARÍK, J. – ČUBOŇ, J. – KULÍŠEK, V. – KAČÁNIOVÁ, M. – MASSANYI, P. 2005. Comparison study of wild duck Anas Platyrhanchos meat efficiency from different hinting grounds. In: *Folia veanatoria*, vol. 35, 2005, p. 139-146, ISBN 808093-000-7.

HELL, P. - SLAMEČKA, J. - GAŠPARÍK, J. - VODŇANSKÝ, M. 2005. Valuation of the production of venison in Slovakia in the years 1969-2004. In: *Folia venatoria*, vol. 35, 2005, p. 115-124, ISBN 80-8093-000-7.

HOLT, G.J. - KRIEG, N.R. - SNEATH, P.H.A. et al. 1994. Bergey's Manual of Determinative Bacteriology. Baltimore, Williams and Wilkins, 1994, 787 p.

KAČÁNIOVÁ, M. - MINDEK, S. - HAŠČÍK, P. - KOŠŤÁLOVÁ, D. - PETROVÁ, J. 2004. Microbiological quality of will duck meat. In: Rizikové faktory potravového reťazca, Nitra, 2004, p. 98-100. ISBN 80-8069-415-X.

KAČÁNIOVÁ, M. - ČUBOŇ, J. – HAŠČÍK, P. - PAVLIČOVÁ, S. 2005a. Effect of *Enterococcus faecium* on some characteristic in ceca of chickens and its typisation by PCR. In: *Acta fytotechnica et zootechnica*., vol. 8 (1), 2005, p. 17-20.

KAČÁNIOVÁ, M. - HAŠČÍK, P. - ČUBOŇ, J. - PETROVÁ, J. - MINDEK, S. 2005b. Mikrobiologická kvality mäsa divých kačíc. In: 1. medzinárodné vedecké hydinárske dni (Zborník na CD), SPU : Nitra, 2005, s. 20-22, ISBN 80-8069-576-8.

KAČÁNIOVÁ, M. - HAŠČÍK, P. – GAŠPARÍK, J - ČUBOŇ, J. – PAVLAČOVÁ, S. - PETROVÁ, J. 2007. Microbial colonisation of Fulica atra gastrointestinal tract and its effect on microbiological duality of meat. In: *Folia venatoria*, vol. 36-37, 2007, p. 135-144, ISBN 978-80-8093-030-1.

POTRAVINOVÝ KÓDEX V ÚPLNOM ZNENÍ – I., II. A III. ČASŤ. 2006. aktualizované znenie. Epos : Bratislava, 2006. 736 s. ISBN 80–8057–676–9.

SLAMEČKA, J. – MERTIN, D. – HELL, P. – MOJTO, J. – JURČÍK, R. 2003. Slaughter yielda and duality of the meat of free Libiny pheasants and pheasants from farm breeding. In: *Folia venatoria*, vol. 33, 2003, p. 135–143, ISBN 80-88853-62-1.

STEINHAUSEROVÁ, I. 2000. Specifická mikroflóra baleného masa. In: *Czech J. Food Sci*., vol. 18, 2000, p. 159 – 163.

WINKELMAYER, R. 2000. Wildfleischhygiene; herausgegeben von der Zentralstelle Őster. Landesjagdverbände, 2000.

WINKELMAYER, R. - LEBESORGER, P. - ZENKA, H.F. 2005. Hygieny zveřiny. Středoeuropský institút ekologie zveře : Wien-Brno-Nitra, 2005, 168 s.
ISBN 80-7305-523-6

Author's addresses: Peter Haščík; Department of Animal Products Evaluation and Processing, Faculty of Biotechnology and Food Sciences, Slovak University of Agriculture, Nitra, Slovak Republic, Ivana Nováková, Miroslava Kačániová; Department of Microbiology, Faculty of Biotechnology and Food Industry, Slovak University of Agriculture, Nitra, Slovak Republic, Martina Fikselová; Department of Plant Processing and Storage, Faculty of Biotechnology and Food Industry, Slovak University of Agriculture, Nitra, Slovak Republic, Simona Pavličová; Department of Food Hygiene and Safety, Faculty of Biotechnology and Food Sciences, Slovak University of Agriculture, Nitra, Slovak Republic