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FACTORS INFLUENCED ON SAFETY AND QUALITY OF GAME MEAT

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SUMMARY

The different factors (environmental, microbial contamination, handling procedures with game, post - mortal changes of game meat) influenced on safety and quality of farmed and hunted wild game meat are described. The emphasis is given on residues of contaminants: risk chemical elements (Cd, Pb, Hg), mycotoxins (aflatoxin, ochratoxin, trichothecene), veterinary drug residues (sulfanilamid, amprolium, clopidol) and biogenic amines in game meat in fact of their adversely affect on human health.

Key words: safety, quality, game meat

INTRODUCTION

Game is influenced with a great variability of environmental activities. Some of them cause quality changes and the others influence on health safety of game meat.

GAME AND ENVIRONMENTAL POLLUTION

Selected species of wild animals can be used also as bioindicators of ecosystem pollution (Vavrová et al., 2003, Almášiová et al., 2008). The increased occurrence of risk chemical elements in tissues of free-living animals can be sign of environmental pollution (Szymczyk, and Zalewski 2003, Holovská et al., 2008).

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RISK CHEMICAL ELEMENTS

Cadmium is an important environmental contaminant with important toxic and teratogenic effects for human and animals (Srebočan et al., 2006). It cumulates mainly in liver and kidney, but Cd occurs also in muscle (Kimáková, 2000). Cadmium is a factor of pathological processes such as hepatic and renal tubular dysfunction (Toman, 2005). The knowledge of chemical interactions between toxic elements e.g. Cd, Pb, Hg and essential elements Cu and Zn is very important. The toxicity of one metal can be dramatically modulated by the simultaneous ingestion of another (Skalická and Naď, 2007).

Lazarus et al., (2004) observed the levels of some toxic and essential metals in the kidney of red deer caught in Easter Croatia. The median mass fraction of toxic Cd, Hg, and Pb in the kidney was 0.099; 0.362; 0.578 mg.kg⁻¹, respectively. The median levels of essential elements Zn, Cu, Fe in the kidney were 35.1; 5.2; 108,0 mg.kg⁻¹, respectively. Study showed age-related differences in the accumulation Cd, Pb, Zn and Fe in the kidney. Toxic metal levels in the kidney exceeded the levels considered acceptable for human consumption, especially in older animals. Pompe-Gotal and Crnic (2002) found, that 43% of roe deer liver samples and 90% of kidney samples in Croatia, exceeded the permitted values defined by Croatian Regulations (NN 46/94 and NN 11/01) for Cd in meat (0.1 mg/kg) and viscera (0.5 m/kg) and were unfit for human consumption. Cd-intake from the consumption of moose meat, liver and kidneys were assessed in moose hunters in Finland. The consumption of liver and kidneys significantly increased Cd intake, whereas meat contributed only slightly (0.16µg/day/person) to the daily total Cd intake. 10% of hunters had an intake of Cd>8.76 µg/day from moose. The study revealed that users of moose organs have a relatively narrow safety margin from the levels of Cd probably causing adverse health effects (Vahteristo et al., 2003). In this reason, the study of risk chemical elements in game is essential for assessment environmental pollution on animal health and food safety (Kramárová et al., 2005).

MYCOTOXINS

From hygienic point of view is required to monitor game health condition as well as structure and quantity sources of risk (chemical and microbiological) connected with game meat. Among factors, which can negatively affect game health are also mycotoxins. Aflatoxin B₁ is the most effective carcinogen of animal liver. The main alterations are necrosis of liver and degeneration of hepatocytes (Laciaková et al., 2006). The main toxic effects of ochratoxins A for animals are nephrotoxicity, mutagenity and car-

cinogenity. It varies depending on age, sex, and nutritional condition and on species of animals. The most prevalent trichothecene in crops used for food and feed production is Deoxynivalenol (DON). Toxic effects of DON on animals concern mainly immune system and the gastrointestinal tract. The toxicity of DON is thought to be due to inhibition of protein synthesis and cytotoxicity in a variety of cells (Faixová et al., 2006). Farmed game can be contaminated by mycotoxins through low quality of feed.

VETERINARY DRUG RESIDUES

The inseparable part of public health ensuring is also the control of veterinary drug residues in food-producing animals and their products (Máté, 2004). Residues of veterinary drugs in food producing animals and their products are monitored in European Union according to the Council Directive 96/23/EC (14) to ensure that the maximum residue limits (MRLs) specified by the Council Regulation (EEC) No. 2377/90 are not exceeded in all examined matrices. Rabbit meat and farmed game meat, but also meat from hunted and wild animals intended for human consumption is also subjected to the compulsory control of veterinary drug residues. To the effect of present valid hygienic legislation („hygienic package“), hunters must comply with any additional requirements imposed in Member State where hunting takes place, in particular to permit monitoring of certain residues and substances. The control of veterinary drug residues is important from viewpoint of veterinary care on the health of farm-breeding animals, but also from the viewpoint of possible feeding of wild animals with supplemented feeds (Kožárová, et al., 2005).

The farm breeding system of game birds helps to increase e.g. wild pheasant and partridge population. However, in the special breeding systems of game birds, the high concentration of birds together with infectious, mycotic and parasitic diseases (coccidiosis) can cause high losses (Goldová et al., 2004). Various synthetic chemicals (sulfanilamid, amprolium, clopidol) are used in rearing of pheasants and partridges. Anticoccidial medication of food during rearing is necessary in the control strategies in the farm breeding of game birds (Goldová et al., 2002). The risk also occurs in the case when farmed game meat could be reclassified and sold as wild game meat. In this case, the probability of the presence of veterinary drug residues is much higher (Sanco, 2002).

BIOGENIC AMINES

Biogenic amines are produced in various kinds of meat. They are compounds, which belong to the group of endogenous foreign substances. Various factors (way of game hunting, health condition, handling and storage of meat game) can

unfavourably affect the process of biochemical post - mortal changes in game meat. Unacceptable decomposition of meat can be often manifested in increased levels of biogenic amines. Increase of biogenic amines is detected earlier than sensory changes of meat. Biogenic amines cause health problems (allergy, respiration and digestive problems), in case of their increased occurrence, which can be danger for consumer (Ruiz-Capillas and Jiménez-Colmenero, 2004). Monitoring of biogenic amines in meat is important, because can pose a potential public health risk (Dičáková and Bystrický, 2008).

POST - MORTAL CHANGES OF GAME -MEAT

Detailed knowledge of meat ripening process is necessary for the safety and quality of meat game production and meat consumed in optimal ripening condition. The lactic acid is formed as product of biochemical changes at post - mortal changes of meat. It is indicator of typical or atypical process of meat ripening. The dynamic of lactic acid in all time period of ripening process in meat reflect quantitative transformation of glycogen to lactic acid (Koréneková and Turek, 2008). This increase is important at the beginning phase of process. It manifests also with decrease pH meat during 24 hours after killing of animals in dependence on temperature of surroundings. The low value of pH suppresses growth of saprophytic and mainly putrescent organism. It precipitates on the prolongation of shelf life of meat stability. The important improve of organoleptic properties are at phase real ripening of meat. Consequently is release firmness of meat, improving coupling water coupling and moderate increase pH. The actin-myosin complex is release by effect of protease and gives out to proteolysis of myofibril proteases. The phase of deep autolysis is already unacceptable process. Peptides are decomposed on oligopeptides and amino acids. Lipids are also decomposed. It is affect with microbial proteolyses. Sensorial attributes of meat become unacceptable. Meat has shortened shelf life, storage and markedly is spoiled (Ingr, 2003). It is important to explore biochemical changes of game meat during ripening processes with aim to preserve nutrition and organoleptic properties.

There is very few information about ripening process of meat in various kinds of game. Malý and Gál (2001): observed changes of pH in hove game during 24 hours. They obtained decrease of pH in roe deer on the value 5.84, red deer 5.75 and reindeer 5.80. These changes were evaluated as a optimal ripening process.

LIPIDS

Lipids, as compound of aromatic substances are important in hare creating sensorial characteristics of meat game. The composition and consistence of game meat

depends on lipids. Lipids are basis of essential polyunsaturated fatty acids (PUFA). Important are mainly PUFA from line ω -3. The diet enriched with ω -3 PUFA reduces risk of formation of arteriosclerosis, hypertension and arthritis (Echarte at al., 2001). However exactly PUFA the most often underlie oxidative changes. The oxidation of lipids is autocatalytic process. It performs in biological membranes of cells. The oxidation speed is influenced by fat composition (mainly PUFA), temperature, metal contamination, light, value of pH and enzymes (Turek et al., 1999). The substances having an important effect on occurrence of civilisation diseases are formed during oxidation of lipids (Marcinčák et al., 2006). Oxidative decomposition of fat-soluble substances causes formation of oxidative products and free radicals. It manifests with significant decrease quality of game meat. Knowledge of oxidative changes procedure in individual phases of oxidative process in relation to handling conditions and game meat storage is dominant factor of successful trade in present market mechanism e.g. requirements service for longer distances and distribution during longer time.

HANDLING PROCEDURES WITH GAME

The importance of reducing the stress resulting from handling procedures (capture, restraint, transport) before the slaughtering of animals is highlighted, due to its adverse effects on meat quality. The hygienic and animal welfare criteria should be adopted in the slaughtering of wild animals. The importance of carcass inspection immediately after slaughtering is stated, so that meat can be destined for human consumption (Casoli, et al., 2005). The emphasis is also to give on the shot game handling in order to improve and maximally preserve meat and secure better hygienic quality of meat. It presents a series of factors that require special attention, e.g. freshly shot game on the hunting, ground to transportation to authorised facilities for cutting and cooling (Konjevic, 2008).

MICROBIAL CONTAMINATION

Microbial contamination is factor which can remarkably affect safety and quality of game meat. It depends on period of time between killing and evisceration of game. Games are required to be chilled immediately after killing and health examination. It may be stored no more than 15 days at temperature of not more than 4° C (for small wild game and farmed game). An important indicator of hygienic level obtaining of game meat is total count of microorganisms (Jevinová et al., 2005). Increasing count of psychotropic microorganisms (*Pseudomonas*) is evident also in case keeping of storage temperature. They are characterised by strong proteolytic and lipolytic activ-

ity and can be reason of microbial decomposition of meat during chilling storage (Pipová et. al. 2003).

Atanassova et al., (2008) microbiologically analysed 289 samples of freshly shot game in Germany (wild boars, roe deer, red deer). The mesophilic aerobic count showed mean log 10-counts of 2.6 CFU/cm² for roe deer, 2.9 CFU/cm² for red deer and 3.2 CFU/cm² for wild boars. *Enterobacteriaceae* gave mean log 10-values of 2.1 CFU/cm² for all three species with differing ranges. The concentrations of coagulase positive staphylococci were >2.0 log 10 CFU/cm². *Listeria* was found in 14 samples and 3 samples gave a positive result for *Campylobacter*. *Salmonella* was not found in any of the samples analysed.

The significant meat contamination of game (e.g. deer) should be in the case, if a bullet hit the abdomen, intestines or a larger part of chest. It cause perforation of rumen and contamination of the carcass with rumen content (Winkelmayer, 2005). The microbiological conditions of meats from hunted animals can be compromised by poor placement of shots, the usual evisceration and sometimes further dressing of carcass in the field, and ageing of carcasses at ambient temperatures (Gill, 2007).

CONCLUSION

It is necessary to study globally effect of various factors (obtaining, handling, package, storage and distribution) on the meat quality of game. Consequently, it make possible modification of these factors and to improve of nutritional and sensory properties of meat. Therefore there are very required methods, which is necessary to realise to achieve optimal safety and quality of game meat and thus increase of protection of consumer health.

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ZUSAMMENFASSUNG

FAKTOREN, DIE GESUNDHEITLICHE RICHTIGKEIT UND QUALITÄT DES WILDFLEISCHES BEEINFLUSSEN

Verschiedene Faktoren sind beschrieben (Umwelt, mikrobielle Kontamination, Verfahren mit Tieren, Veränderungen auf dem Fleisch nach dem Tod der Tiere), die gesundheitliche Richtigkeit und Qualität des Fleisches von gezüchtetem und erjagtem Wild beeinflussten. Die Betonung liegt auf Verschmutzersresten: chemischen Risikoelementen (Cd, Pb, Hg), Mycotoxinen (Aflatoxin, Ochratoxin, Trichothecene), den Resten von veterinärischen Medikamenten (Sulfonamid, Amprolium, Clopidol) und biogenen Aminen im Wildfleisch, d.h. auf ihrer schädlichen Wirkung auf menschliche Gesundheit.

Schlüsselwörter: gesundheitliche Sicherheit, Qualität, Wildfleisch

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PRODUCING HOME - MADE SAUSAGES FOR ONE'S OWN NEEDS

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SUMMARY

The paper describes the procedures of producing home-made sausages in household. Recipes for producing sausages differ depending on the tradition of the area where they are produced.

Still, regardless of the kind of sausages, it is necessary to hold on to basic normative of production during their production, for the purpose of quality and propriety of a final product.

Key words: sausages, production, household

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