

THE HYGIENIC STATUS OF GAME

RING CH. and PFEIFFER S.

Institute of Food Science, Meat Hygiene and Technology, Hannover, Germany

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SUMMARY

The cooking of game according to the "Nouvelle Cuisine" (BOCUSE, 1978) requires that the centre of the meat remains blood-red and the surrounding parts rosé. An optimal hygienic status of the game is necessary for this kind of cooking. It has to be stated that in comparison to slaughtering of domestic animals only few well-founded studies on the hygienic status of game have been published. To obtain more precise results, doctoral theses on this subject have been prepared and supervised - with exception of the work of LENZE (1977) - by the author*. All these investigations of roe deer, wild boar and hares were performed using official methods. The detected contamination of game by microorganisms e.g. *S. aureus*, *C. perfringens* and *E. coli* or even the detection of a rabies-infected animal led to the conclusion that game should only be consumed when well done. Due to the partial high contamination of liver and kidney with lead and cadmium the consumption of these organs, especially such of older animals should be prevented.

Introduction

According to Art. 1 (2) of the council directive 92/45/EEC shot haired game has not to be examined by a veterinarian under certain circumstances, e.g. that game is often only inspected by the hunter who is seldom motivated and also not sufficiently educated concerning meat hygiene.

Before the introduction of the "Nouvelle Cuisine" game was consumed only when well done. The traditional meat preparation guarantees a temperature of at least 80°C in the centre of the meat portions. By this treatment, most of the putrefying and pathogenic bacteria are killed. The shorter cooking of game according to the "Nouvelle Cuisine" results, however, in a blood-red meat centre with rosé surrounding parts. This can lead to considerable threats to the human health, especially when game is consumed by persons for dietetic reasons. Therefore, game of different species was investigated.

Methods

The investigations were performed according to official and legal methods.

Results

On the basis of the investigations of LENZE (1977) of 100 roe deers which had been shot or killed by accidents and also perished animals, we were confirmed to continue the investigation of the hygienic status of game of different species.

LENZE (1977) diagnosed e.g. enteritis in 9 shot animals, hepatitis in 3 animals and in 2 animals wounds and pneumoniae. 1 animal had abomasitis and 2 fasciolosis. In this study the degree of exsanguination was generally judged as insufficient. A flight distance of about 80 m slightly improved the exsanguination. The bacteriological examination of the muscles of the shot roe deers resulted in 60% low grade and 14% high grade contamination. Respective rates of 56% and 46% were determined in roe deers, which were at least suspected to be sick. Animals killed by an accident showed 46% of low and 42% of high grade bacteriological contamination. All samples of perished animals were high grade contaminated. From all contaminated samples *E. coli* and coccoid bacteria were isolated. Further isolations were *Proteus* from 5 animals and grampositive obligately anaerobe rods from 4 animals. *Salmonella* were not detected. Retarded opening of the carcass (2 h post mortem) and also chasing roe deers only wounded resulted in considerably more samples of high grade

bacterial contamination. Only 6 out of 23 animals to be classified as condemned for human consumption were detected by insufficiently instructed hunters.

In the region of Ravensburg HÄUSLE (1987) inspected 75 shot roe deers, 11 roe deers killed by accident and also 15 perished animals. Only 1 perished animal, found 1 day after a suspected accident, exhibited an abnormal odour. No animal showed pathologic-anatomical alterations. The degree of exsanguination was sufficient even in case of animals killed by accident and reduced water-binding-capacity of the game was not observed. In the samples of liver, spleen and kidney and in 2 samples of muscles of each animal, vegetative germs were found: in the samples of shot game 2%, of animals killed by accident 6% and of perished animals 15%. In 3% of the samples of muscles and organs of shot game grampositive obligately anaerobic rods but no clostridia were diagnosed, *E. coli* in 1% of the organ samples. In the group of animals killed by accident 14% of the muscles were contaminated by grampositive obligately anaerobic rods (including 5% *C. perfringens*). In 6% and 9% of organs *E. coli* and grampositive obligately anaerobic rods, respectively, were detectable, but no clostridia. In 7% of the samples of the muscles of perished game Enterobacteriaceae were detected, in 3% *E. coli* and in 33% grampositive obligately anaerobic rods (including 13% *C. perfringens*). In the organ samples Enterobacteriaceae were detected at a rate of 9%, *E. coli* and *S. aureus* at 2% each and grampositive obligately anaerobic rods at 27% (including 4% *C. perfringens*). *It should be noted that of 50 blood samples serologically tested for Q-fever 40% showed a positive and 4% a suspicious result.* The tests for brucellosis and leptospirosis were always negative. The diagnosis for 1 perished animal was rabies. Residues of lead in muscles, liver and kidney were not detected. A maximum tolerated residue limit for cadmium of 1 ppm is permitted by the German health ministry for bovine kidneys. This value was exceeded in 33% of the animals of more than 1 year and by 60% of the animals of more than 3 years of age. The concentrations of muscles and liver samples were lower than 1 ppm. The histological examination of the *M. rectus abdominis* for sarcosporidiosis showed positive results in 19% of the game-kids and in 89% of the older animals.

During the investigation of 65 wild boars from the south of Munich SCHERLING (1989) found 2 animals with ascites. These alterations were stated by the hunter only in 1 case but he did not condemn the animal. The alterations of lymph nodes of 16 animals in form of abscesses or chronical alterations induced by parasites, respectively, were never recognized by the hunters. None of 2 animals with hyperaemic colons was condemned by the hunters in spite of a very intensive and repellent odour. Strong urinary smell emanated from 1 male. The intensity of the male odour could be considerably reduced by removal of the external sex organs during the carcass opening. The pH-values measured 45 min post mortem of 18 from 20 animals ranged from 6.0 to 6.7. The pH of 1 animal with a very long agony due to a hit into the neck-region was 5.8. The pH-values of 60 animals measured 24 h post mortem ranged from 5.3 to 5.9, those of 3 other animals between 6.2 and 6.4. Sickness, pathologic-anatomical alterations and retarded opening of the carcass had obviously no considerable effect on the acidification of the meat. The degree of exsanguination of 75% of the animals was judged from good to sufficient. The indicating coefficient Q for water-binding-capacity varied between 0.35 and 0.68. The bacteriological examination of the muscles of 52 wild boars showed in 25% a low and in 4% a high grade contamination. Of 35 muscle samples of animals hit into the heart 60% showed no, 35% a low grade and 6% a high grade bacterial contamination. No bacteria were detected in the case of 17 animals hit into the region of head or neck except 1 with a low grade bacterial contamination. Of the muscle samples of 13 animals with a distinct haematoma 69% were low grade and 15% high grade bacteriologically positive. The contamination of primarily almost sterile game is obviously effected by the bullets, which are contaminated by parts of skin and hair. The germs are then distributed by the blood-circulation, especially when haematoma are formed. The detected bacterial flora was mainly composed by cocci and aerobic spore-formers colonizing the epidermis. For a lead examination only the 17 animals with hits into the region of head and neck were used to exclude the secondary contamination by the bullet. The maximum tolerated residue limit permitted by ZEBS 1986 for muscles of cattle and pigs of 0.25 ppm was exceeded only in the sample of a boar (<1 year). The maximum tolerated residue limit permitted by ZEBS 1986 for the liver of cattle and pigs of 0.8 ppm was exceeded in 29% of the samples. The mean value was 0.55 ppm and the maximum 4.92 ppm. The limiting value of 0.8 ppm valid for kidneys was higher in 29% of the samples. The mean value was 0.71 ppm and the maximum 3.9 ppm. An influence of the age on the concentration of lead could not be determined. The concentration of cadmium was tested in 20 animals. The mean value of the muscles was 0.085 ppm. The maximum residue limit for muscles of cattle and pigs of 0.1 ppm for cadmium permitted by ZEBS 1986 was higher in 40% of the samples, the maximum of 0.64 ppm was found in a 10 year old female. The maximum residue limit for the liver of 0.5 ppm was reached or was exceeded in 22% of the samples. The maximum was 1.17 ppm. The mean value of 19 tested kidneys was 5.5 ppm and one kidney showed even a maximum of 42.81 ppm cadmium. The permitted

limit of 1.0 ppm was exceeded in 95% of the samples. Cadmium increases in kidneys with the age of the animals. The examination for trichinellosis was negative in all cases.

HACKNER (1990) examined 65 wild boars in the north of upper Bavaria and detected hepatitis parasitaria multiplex in 21% of the livers. In 9 animals he found alterations of lymph nodes. During the sensoric examination 11 male animals (1 to 4 years old) exhibited the typical sexual odour, 3 animals (3 to 4 years old) an urinary odour and 3 young boars with old bullet wounds a musty odour. According to the test of Pauli for keeping the quality 9% of the animals were condemned. The pH-values were always determined immediately after opening the carcass. A determination after already 45 min post mortem was possible only in the case of 2 young boars (<1 year) because of hunting-specific reasons. The values amounted 5.5 and 6.2, respectively. In the case of all other animals which were opened about 2 h after killing the pH-values ranged between 6.1 (75 min post mortem) and 5.5 (225 min post mortem). The degree of exsanguination was good in 15% of the animals, sufficient in 26%, reduced in 29% and insufficient in 29%. Hits into the muscles or retarded opening of the carcass resulted in a reduced degree of exsanguination. The water-binding-capacity coefficient Q ranged between 0.34 and 0.67, in the case of 47 animals between 0.4 and 0.64. The bacteriological examination of muscles showed germs in the samples of 8% of the animals. The detected germs were Coliforms, Micrococci and grampositive obligately anaerobic rods, but no clostridia. In the case of an examination of 1 sample of muscle, liver, spleen, kidney and lymph node of every animal, 24% of the animals were bacteriologically positive in 1 of the samples, 49 % in 2, 24% in 3, 5% in 4 of the samples and 3% in all 5 samples. When opening the carcass within 1 to 2 h post mortem, 45% of the animals were bacteriologically positive, a later opening after 2 to 3 h post mortem resulted in a rate of 79%. Pathologic-anatomical alterations do not necessarily lead to an considerable increase of bacteriological positive samples since 53% of the samples of animals without such alterations were bacteriologically positive and 60% of samples of animals with alterations. The degree of tissue damage by the bullets did not influence the rate of bacteriological positive samples. The internal organs were examined only of 20 animals, without a bullet damaged stomach or intestine. Bacteria were detected in the following decreasing range: Coliforms, Micrococci, Enterobacteriaceae, Proteus and Salmonella typhimurium or S. aureus. After opening the carcass 132 min and 168 min post mortem, respectively, Salmonella were found in 2 animals. The concentration of cadmium was examined in 25 animals. An average content of muscles of 5 ppb was determined with a maximum of 11 ppb. The contents of the kidneys ranged between 6.9 ppm and 19.12 ppm with an average of 12.84 ppm. The concentration of cadmium in the examined kidneys exceeded the maximum residue limit of 0.5 ppm, permitted by ZEBS 1990 for kidneys of cattle and pigs. Trichinellosis could not be detected.

According to GEUCHEN (1994) 4 out of 53 shot hares of the region south of the lower Rhine river valley exhibited a slight deviation of odour caused by the bullet damaged intestine. The pH-values, determined 45 min post mortem, ranged between 5.47 and 6.40, 70% of the pH-values between 5.85 and 6.25. 24 h post mortem the pH-values varied between 5.53 and 5.95. The pH-values of the 4 hares, caught by the hunters' dogs ranged from 5.64 to 6.32. The degree of exsanguination was good to sufficient in 81%, reduced in 19%. The bacteriological examination showed germs in the samples of muscles (2%), of liver (13%), of spleen (4%) and of kidneys (2%). In 6 livers were diagnosed 3times E. coli or Enterobacteriaceae, in the spleen 2times unspecific vegetative germs and also in 1 kidney. 3 animals were bacteriologically positive in the liver and the spleen. In 2 of these 3 animals E. coli was detected in both organs, in the third animal E. coli in the liver and unspecific vegetative germs in the spleen. The muscles, liver, spleen and kidney of 1 hare showed E. coli. The serological tests for brucellosis were always negative, for leptospirosis positive in 59%, suspicious in 28% of the animals. Cadmium from 0.003 ppm to 0.299 ppm with a mean value of 0.008 ppm were determined in the muscles, 25% of the samples exceeded the maximum residue limit of 0.1 ppm, permitted of the ZEBS 1990 for muscles of cattle and pig. These high values could be induced by gas exhaust from a motorway close to the hunting-ground. In 20 examined livers, the contents of cadmium ranged from 0.089 ppm to 1.491 ppm with an mean value of 0.432 ppm. The maximum residue limit of 0.3 ppm was exceeded in 75% of the samples, permitted by the ZEBS 1990 for livers of cattle. In the kidney the contents varied from 0.016 ppm to 15.0 ppm with a mean value of 2.493 ppm. Out of 20 samples, 18 exceeded the maximum residue limit of 0.5 ppm, permitted by the ZEBS 1990 for kidneys of cattle.

Conclusion

- * The examined game showed rather often partially considerable pathologic-anatomical alterations.
- * The exsanguination was relatively often insufficient.
- * Hunted animals showed, in comparison to slaughtered animals, often a higher bacteriological contamination.
- * Animals, suspected to be sick and sick animals, respectively, as well as perished animals were bacteriologically positive to a larger extent than animals estimated as healthy by the hunters.
- * A critical point is the frequent detection of germs, such as *S. aureus*, *C. perfringens* as well as *E. coli*, *Salmonella* and other Enterobacteriaceae and also the detection of leptospirosis and rabies, which can cause food borne diseases.
- * In hares, an infection with leptospira is very frequent.
- * Roe deers in the region of Ravensburg were infected to 40% with *Coxiella burnetii*.
- * Bullet damaged tissue should be removed generously, because haematomas show a higher degree of germ contamination than undamaged tissue.
- * Negative results of the examination for Trichinellosis of 130 wild boars were obtained, but KUJAWSKI (1990) indicated by statistical analysis that about 10.000 (14% of all shot) wild boars have not been examined for trichinellosis in Germany in 1989.
- * The consumption of insufficiently heated game has to be rejected strictly, including the demand of the "nouvelle cuisine".
- * Liver and kidney should not be consumed, especially those of older animals, because the maximum residue limits for lead or cadmium can be exceeded extremely in these organs.
- * Hygiene of game begins in each case with the checking of the animal before shooting and ends with its consumption.

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