Modified atmosphere packaging of meat

Summary
Modified atmosphere packaging has been expanded and improved with the arrival of new technologies and increasing demands of buyers. Modified atmosphere packaging is a mixture of different kinds of gases (Oxygen O2, Carbon Dioxide CO2 and Nitrogen N2) in different ratios.
Total viable count of aerobic mesophilic bacteria in fresh beef and pork meat packed in a modified atmosphere and unpacked meat as control samples through the period of six days and stored at 4°C, was determined in this paper. Total count of bacteria was lower in meat packed in a modified atmosphere and was from 7 x 102/g on the first day of beef meat storage, to 2.5 x 106/g on the sixth day of storage. In control samples of beef, the total count was 8.8 x 104/g even on the first day of storage; it was 4.2 x 106/g on the fourth day, to be 1.6 x 107/g at the end of storage. The total count in pork samples packed in a modified atmosphere was from 1.8 x 103/g to the most of 4.2 x 106/g on the sixth day of storage. Unpacked pork contained 3.4 x 106/g even on the fourth day of refrigerator storage, i.e. 8.8 x 107/g on the last day.
Key words: fresh meat, modified atmosphere packaging, total count of bacteria

Fleischverpackung in modifizierter Atmosphäre

Zusammenfassung
Das Packen in einer modifizierten Atmosphäre wird mit neuen Technologien und immer größeren Forderungen der Käufer breiter und entwickelter. Das Packen in einer modifizierten Atmosphäre ist eine Mischung verschiedener Gase (Sauerstoff O2, Kohlendioxyd CO2 und Stickstoff N2) in verschiedenen Größenverhältnissen. In dieser Arbeit ist die gesamte Zahl der aeroben mesophilen Bakterien in frischem Rind- und Schweinefleisch verpackt in einer modifizierten Atmosphäre, sowie nicht verpacktem Fleisch als Kontrollmuster, während sechs Tage aufbewahrt auf Temperatur von 4°C, bestimmt. Die gesamte Bakterienzahl war im Fleisch, verpackt in einer modifizierten Atmosphäre, niedriger und bewegte sich von 7 x 102/g am ersten Tag der Rinderfleischaufbewahrung bis 2.5 x 106/g am sechsten Tag der Aufbewahrung. In den Rindfleisch-Kontrollmustern betrug die Gesamtzahl schon am ersten Tag der Aufbewahrung 8.8 x 104 und schon am vierten Tag war sie 4.2 x 106, während sie am Ende der Aufbewahrung 1.6 x 107/g betrug. In den Schweinefleischmustern verpackt in einer modifizierten Atmosphäre bewegte sich die Gesamtzahl von 1.8 x 103/g bis höchstens 4.2 x 106/g am sechsten Tag der Aufbewahrung. Das nicht verpackte Schweinefleisch erhöhte schon am vierten Tag der Aufbewahrung im Kühlschrank 3.4 x 106/g, bzw. am letzten Tag 8.8 x 107/g.

Key words: crude protein level, carcass quality, meat quality, Black Slavonian Pig.
In research conducted by Nieto et al. (2003), reduction of crude protein level in pig rations led to increased fat in shoulder and ham and to reduction of proportional share of shoulder in carcasses. However, Barea et al. (2008), did not determine influence of protein level in pig rations on the contents of intra-muscular and subcutaneous fat tissue in ham and shoulder.

Pig meat quality in relation to crude protein level in forage mixtures is shown in the Table 5.

Pig meat from Group A (higher crude protein value and a very significantly lower pH value. Values of Joo values) also indicate the standard meat quality. L* value indicates meat lightness, a* value indicates meat redness, and colour (“L”, “a”, and “b” values) also indicate the standard meat quality. Relative share of meat in individual basic joints of pig carcasses in relation to crude protein level in forage mixtures is shown in the Table 2.

Investigating the effects of four levels of crude proteins in feed of Iberian pigs, Barea et al. (2008) have determined a small, but significant influence of protein level on pig carcass composition. Increased fat depositing was observed on pigs fed lower protein level feed. Feeding rations with three protein levels (high, medium, low) to pigs in organic production, Millot et al. (2007) determined the lower meat percentage in pig carcasses when these were fed rations with lower protein level, while the influence on meat quality was not.

In addition to the share of muscle tissue, distribution of muscle tissue in carcasses is also very important, because not all parts have the same utilization and commercial value. Relative share of meat in individual basic joints of pig carcasses in relation to crude protein level in forage mixtures is shown in the Table 2.

According to Grau and Hamm (1952), and colour (“L”, “a” and “b” values) was determined using a Minolta CR-410 Chromatometer. The research results were processed according to LSD test system softwork statistica (Stat Soft Inc., 2008).

Results and discussion

Data in the Table 1 show that there are significant differences in for-}

mation of Black Slavonian pig carcasses in relation to crude protein level in forage mixtures.

Pig carcasses from Group A (higher crude protein level in forage mixtures) had a significantly (p<0.01) smaller relative share of fat parts – jowl and lard as well as abdominal-rib part and shoulder – and a very significantly (p<0.01) higher share of ham and neck, in relation to pig carcasses from Group B (lower crude protein level in forage mixtures). No significant differences were detected between the analyzed groups in terms of back part (p>0.05).

Pig carcasses from Group A had a somewhat higher share of muscle tissue in relation to those from Group B, but the difference was not statistically significant (p>0.05), while there was an absolute and relative very significantly (p<0.01) higher share of bones determined. Pig carcasses from Group B had an absolute and relative very significantly (p<0.01) higher share of fat tissue (Tables 2 and 4).

Investigating the effects of four levels of crude proteins in feed of Iberian pigs, Barea et al. (2008) have determined a small, but significant influence of protein level on pig carcass composition. Increased fat depositing was observed on pigs fed lower protein level feed. Feeding rations with three protein levels (high, medium, low) to pigs in organic production, Millot et al. (2007) determined the lower meat percentage in pig carcasses when these were fed rations with lower protein level, while the influence on meat quality was not.

In addition to the share of muscle tissue, distribution of muscle tissue in carcasses is also very important, because not all parts have the same utilization and commercial value. Relative share of meat in individual basic joints of pig carcasses in relation to crude protein level in forage mixtures is shown in the Table 2.

A significantly (p<0.05) higher share of ham and a very significantly (p<0.01) higher share of neck meat were determined in carcasses of pigs fed with forage mixture with higher crude protein level. In carcasses of pigs that were fed forage mixture with lower crude protein level, a very significantly (p<0.01) higher share of loin and shoulder meat was determined. No significant (p>0.05) differences between the analyzed groups were detected in terms of share of meat in belly-rib part of pig carcasses.

In terms of absolute and relative share of muscle tissue in ham, no significant (p>0.05) differences were detected between the pigs from Group A and Group B, although the pigs from Group B had a significantly higher share of ham meat in carcasses. Loin and shoulder had a very significantly (p<0.05) higher absolute and relative share of muscle tissue in car-}
groups and better than the one earlier determined for pig breeds of meat type and their crosses (Senčić et al., 2002; Senčić et al., 2003; and Senčić et al., 2005).

Muscle tissue consistency, expressed as the area of filter paper wetness below compressed meat, was also standard and no significant differences were detected between the analyzed groups.

Crude protein level in fat-free mixtures also significantly influenced the chemical composition of meat. Meat of pigs that were fed fat-free mixtures with higher crude protein level (Group A) had a significantly (p<0.05) higher content of crude protein, a very significantly (p<0.01) higher water content, and a very significantly (p<0.01) lower content of crude fat in relation to meat of pigs that were fed fat-free mixtures with lower crude protein level (Group B). No significant differences (p>0.05) were detected between the analyzed groups in terms of ash content.

### Conclusion

Increased crude protein level in fat-free mixtures had a very significant (p<0.01) influence on reduction of fat tissue share (34.55% : 39.09%) and on increase in muscle tissue share (47.10% : 46.11%) in pig carcasses, although not to a statistically significant extent (p>0.05). Pig carcasses from Group A (higher crude protein level) in relation to those from Group B (lower crude protein level) had significantly (p<0.01) higher lean meat share of ham (15.62% : 14.62%) and meat (MLD) of pigs from both groups was of very good quality, considering the analyzed indicators (pH, pH", water holding capacity, and colour). The meat from Group A pigs, in relation to the meat from the Group B pigs, had a significantly (p<0.05) higher crude protein content (21.47% : 20.93%), a very significantly (p<0.01) higher water content (70.62% : 65.70%), and the lower crude fat content (6.89% : 12.34%), while in terms of ash (1.02% : 1.02%) no significant differences (p>0.05) were detected between the analyzed groups of pigs.

### References


