Microbiological and Chemical Quality of Minced Meat Packaged in Modified Atmosphere at +1-2°C.

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Summary: The aim of the work was to determine the shelf-life and the microbiological quality of minced meat packaged in modified atmosphere (MAP, 20% O2, 5% CO2, 75% N2). Changes in the microflora and in the chemical characteristics were monitored for a total period of 10 days. Different samples of minced pork meat and of minced mixed pork and beef meat (50% w/w) were packaged and stored at +1-2°C. The results demonstrated that the minced meat samples studied had a 6 days shelf-life; the microbiological quality, the pH value and the total volatile nitrogen (TVN) were acceptable. After the sixth day, both minced meats started to brown, becoming unacceptable by the consumers.

Keywords: spoilage, browning, safety, shelf-life, storage.

Introduction: Minced meat is a good substrate for the growth of different micro-organisms. Despite the packaging in Modified Atmosphere (MAP) and the storage at 4°C, the psychrotrophic bacteria can grow and produce browning and off-flavours. The effects of microbial contamination are the reduction of shelf-life and the potential compromise of the safety of the product. Salmonella spp., Campylobacter spp., Escherichia coli, Yersinia enterocolitica are often isolated from minced meat. They originate from personnel, equipment and slaughtering utensils and surface of the meat (Northjé et al., 1989). For these reasons, many studies have focused on defining the hygienic quality of minced meat (Northjé et al., 1989; Mutti et al., 2001; Marino et al., 1995). The aim of this work was to determine the microbiological quality and the shelf-life of minced meat investigating the behaviour of the microflora and the chemical changes occurring during storage under modified atmosphere and refrigeration at 1-2°C.

Materials and methods: Two different lots of minced meat were investigated; minced pork (P) meat and minced mixed pork (50% w/w) and beef (50% w/w) (PB) meat were packaged and stored at +1-2°C for ten days. The samples were packed in trays OPET, with 66 ml O2, 25 ml CO2 and 9 ml N2 /litre atmosphere. The covering films for MAP were PEEDOH-PE. Samples were examined at 0, 3, 5, 10 days to determine the increase of the microorganisms. Total aerobic counts were determined in Plate Count Agar (Oxoid, Italy) after incubation at 20°C for 2 days; Lactic Acid Bacteria (LAB) were determined in de Man Rogosa Sharpe (MRS, Oxoid, Italy) after incubation at 30°C for 5 days under microaerophilic conditions; E. coli and coliforms were detected in Coli ID (bioMerieux, France) after incubation of two days at 37°C. The presence of Listeria monocytogenes was evaluated by the ISO/DIS method (1990) and the presence of Salmonella spp. by the ISO/DIS method (1991). The chemical changes were evaluated determining the pH, using a digital pH-meter (Beckman, mod. 3560, Glenrothes, UK), the total volatile nitrogen (TVN) according to Pearson (1973), the number of peroxides (PV) according to Shanta et al., (1994) and the malondialdehyde (MDA) concentration according to Chiesa et al., (1999, 2000). The L*a*b* Hunter parameters were also evaluated by using a tristimulus colorimeter (Chromameter-2 Reflectance Minolta, Osaka, Japan).

Results: In both types of sample, the total aerobic flora increased until the end of the experiment. The growth was favoured by the presence of oxygen inside the package and the maximum values approached 10⁸ CFU/g. LAB increased in both minced meats until the 7th day and reached values...
of 1.4x10^8 CFU/g in the P and 6.0x10^8 CFU/g in the PB meat. The greatest increase was observed between 5 and 7 days of storage. At 10 days LAB decreased in both meats. Coliforms did not reach values higher than 4.3x10^3 CFU/g. No L. monocytogenes or Salmonella spp. were detected in the samples tested. The pH values after 7 days reached 5.76 in P and 5.55 in BP meat. The changes were due to the combined effect of the increase of the bacterial concentrations and of the production of volatile nitrogen compounds. The values of TVN in both the P and PB samples varied from 21.7 to 24 mgN/100g. The level of TVN was higher than the ones obtained by Pearson (1973), that determined that fresh beef meat could contain maximum values of 17 mgN/100 g. The peroxides values reached maximum levels at 7 days for PB, and at 3 days for P samples. After this time they decreased. The value of peroxides observed (less or equal to 5.7 meq O2/kg fat) can be considered acceptable according to the data of Church & Wood (1992). Viceversa Chizzolini et al. (1998) suggested 2-4 meq O2/kg fat as acceptable level of peroxides values. MDA was measured after 7 days of storage for both P and PB samples. The values were similar to the ones obtained by O’Grady et al. (2000) in minced beef meat packaged in different MAP. Similar results were also obtained by Smiddy et al. (2002) and Formanek et al (1998). The minced meat P and PB demonstrated a good colour retention only in the first 5 and 7 days of storage, while browning appeared within 7-8 days of storage. The PB meat maintained a brilliant red colour longer than the P meat.

**Conclusions:** Data demonstrated that both minced pork meat and minced beef/pork meat were safe. The spoilage started within 3 days of storage but could be measured at 7 days. This period should be considered the shelf-life of both products, because sensory and chemical analysis demonstrated a change in colour, an increase of TVN, number of peroxides and MDA concentration after that time. The spoilage was more predominant in mixed beef/pork meat.

**References**


