EFFECT OF CARBON MONOXIDE AND ARGON IN SLICED TURKEY MEAT UNDER MODIFIED ATMOSPHERE PACKAGING (PRELIMINARY ASSAYS).

Fraqueza, M.J.; Ferreira, M.F.; Ouakinin, J.S. and Barreto, A.S.
Faculty of Veterinary Medicine. CIISA.Technical University of Lisbon. R.Prof. Cid dos Santos. Polo Universitário. Alto da Ajuda. 1300-477 Lisbon. Portugal.

Background

The preference of consumers for poultry meat, stimulated the Industry to the develope of new products and technologies, which reinforced its position in the market and contributed to the increase world consumption.

Technologies for meat packaging with new gas atmospheres to increase shelf life and improve product presentation, facility of storage, distribution, sale and utilisation have been underlined (Ohlsson, 1994). The success of these technologies depends on the specificity of gas mixtures related to the product, the nature and initial quality of meat, the temperature control, the barrier properties of the packaging film and the efficacy of the equipment (Taylor, 1996).

The decay of poultry meat is mainly geared by bacteria (*Pseudomonas, Achromobacter, Flavobacterium, Acinetobacter/Moraxella, Alcaligenes, Aeromonas, Brochotrix, Lactobacillus*) and some yeast, which induce spoilage with putrid odours and changes in general appearance (Cox *et al.*, 1998). The shelf life of poultry meat increases with CO_2 concentration up to 25 % but in such modified atmosphere packaging (MAP), becomes discoloured (Farber, 1991).

Most studies about MAP deals with red meats (beef and pork); in these studies new mixtures of gases, including carbon monoxyde (CO) are adopted (Sorheim *et al.*, 1997). One of the problems of the adoption of CO in poultry meat, apart from the Legislative prohibition, is the development of a pink or red colour after cooking or roasting turkey meat attributed to the presence of CO and nitric oxide (Sorheim *et al.*, 1997). Argon is a gas authorised by the Directive 95/2/CE (1995) to contact with food. It is of primary importance to clarify the influence if these gases on the behaviour of spoilage flora, on the colour stability, on lipid oxidation and on protein degradation of turkey meat.

Objective

The aim of this work is to study the effect of $CO_2/N_2/Co$ and Ar/N_2 packaging atmospheres on the spoilage flora, colour, lipids and protein stability of sliced turkey meat packaged and stored under refrigeration at 0±1°C.

Methods

The sampling of breast muscles was performed under commercial conditions from turkey carcasses (BUT 9) selected for deboning according to plant criteria. The removed breast muscles were sliced in scallops of 1.5 cm thickness with a surface area of approximately 90-100cm^2. Scallops of the same breast cuts were transported into polyethylene bags to the laboratory. Less than one hour afterwards they were packaged under the different study conditions i.e. individually packed on polystyrene trays wrapped in an oxygen permeable polyvinyl film, performing an aerobic atmosphere package, and after flushing with gas mixtures of 50 CO_2/49.5% N_2/0.5% CO (MAP-1 atmosphere) and 50 % Ar/50% N_2 (MAP-2 atmosphere), put into "HBX-070" bags (a multilayer film EVOH-based) sealed in a vacuum packaging machine (EVT-7-CD, Tecnopri Barcelona). The so packaged meat trays were immediately stored at 0±1°C in the dark for 25 days.

On days 0, 5, 12, 19, and 25 the following analyses were carried out:

Microbiological analysis: total aerobic counts at 30°C for 3 days (Plate Count Agar, Merck, Germany), total psicrotrophic aerobic counts at 10°C for 10 days (Plate Count Agar, Merck, Germany), anaerobic count at 10°C for 10 days (Brewer Anaerobic Agar, Merck, Germany) *Pseudomonas spp.* counts (CFC agar base, Oxoid, UK) after incubation at 30°C for 2 days, lactic acid bacteria counts on Man Rogosa Sharpe Agar (Oxoid, UK) incubated at 30°C for 3 days and *Brochothrix termosphacta* count in streptomycin, actidione, thallous acetate agar (STAA, Oxoid, UK) incubated for 2 days at 30°C. Counts were expressed as log cfu/g. Physico-chemical analysis: objective measurement of colour was perfomed over the surface of scallop samples unpacked for a 30 min. air exposure raw and cooked (80°C, 15 min) with a Minolta Colorimeter CR-300 (Minolta, Osaka, Japan) using the L, a, b, coordinates (CIELAB colour system), each value being the arithmetic mean value of nine determinations over sample surfaces.

Evaluation of protein degradation by the Total Volatile Basic Nitrogen assay (TVBN) and lipid oxidation by Thiobarbituric Acid test (TBA) were performed.

Results and Discussion

Figures 1 and 2 report the counts of the bacterial flora developed in turkey scallops under the different conditions of package. At zero day, the initial contamination of sliced turkey meat reported total aerobic counts at 5,5 log cfu/g, the *Pseudomonas spp.* counts were higher than the other groups of spoilage bacteria analysed.

The gas mixture containing CO seems to be effective in reducing the growth of the whole spoilage bacteria. The inhibition of *Brochothrix termosphacta* in this atmosphere is more effective than that reported by Santé *et al.* (1994) with 100% of CO_2. Lactic acid bacteria have not been affected by any of the packaging atmospheres.

Figure 3 shows that samples packaged in MAP-1 atmosphere had a-values higher than those in the other conditions as expected due to carboxymyoglobin. However, after cooking (Figure 4) samples don't have any noticible differences in developing red colour compared with the others scallops under study conditions. Development of lipid oxidation assayed by the TBA test has been impaired by the presence of O_2 in the atmosphere. Protein degradation as indexed by TBVN increased with time mainly under aerobic packaging conditions but has been slowed by the Co in the MAP-1 gas mixture.

Table I – Development of lipid oxidation (TBA) and protein degradation (TBVN) on sliced turkey meat packaged under study conditions.

	Aerobiose			MAP – 1					MAP - 2				
Storage days	0	5	12	0	5	12	19	25	0	5	12	19	25
TBA (mg MA/1000g)	15.5	16.0	22.1	15.5	19.5	18.6	28.4	31.9	15.5	6.0	10.5	16.6	11.9
TBVN (mg NH_3/100g)	27.5	26.6	47.0	27.5	26.6	28.1	26.2	30.2	27.5	22.4	28.8	36.0	36.7

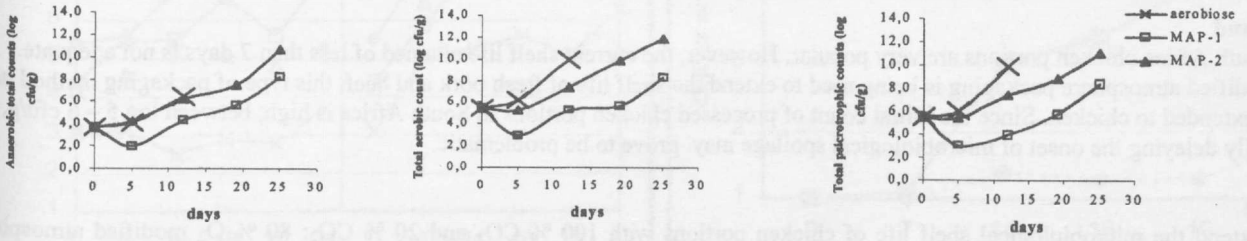

Figure 1: Evolution of the aerobic, anaerobic and psicrotrophic flora on sliced turkey meat packaged under aerobiose, 50 % CO_2/49.5% N_2/0.5% CO (MAP-1) and 50% Ar/50% N_2 (MAP-2).

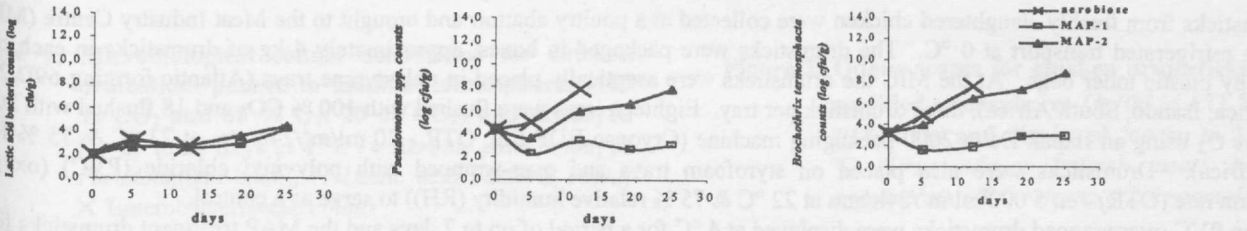

Figure 2: Development of lactic acid bacteria, *Pseudomonas spp.* and *Brochothrix termosphacta* on sliced turkey meat packaged under aerobiose, 50 % CO_2/49.5% N_2/0.5% CO (MAP-1) and 50% Ar/50% N_2 (MAP-2).

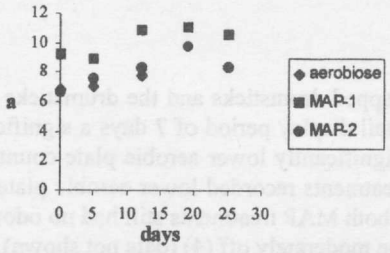

Figure 3: Evolution of a-value (red colour) on sliced turkey meat packaging under aerobiose, 50 % CO_2/49.5% N_2/0.5% CO (MAP-1) and 50% Ar/50% N_2 (MAP-2).

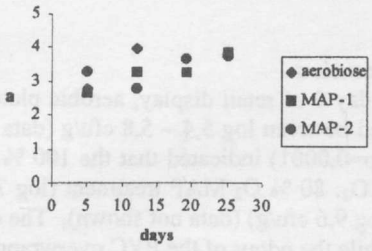

Figure 4: Development of pink colour on cooked sliced turkey meat after being submitted to the diferent packaging atmospheres (aerobiose, 50 % CO_2/49.5% N_2/0.5% CO (MAP-1) and 50% Ar/50% N_2 (MAP-2).

Pertinent literature

Cox, N.A.; Russell, S.M.& Bailey, J.S. 1998. The microbiology of stored poultry. In: The microbiology of meat and poultry. pp.266-286. Ed. A. Davies and R. Board. Blackie Academic & Professional. London.

Farber, J.M. 1991. Microbiological aspects of modified atmosphere packaging technology - a review. J. Food Protection. **54**: 58- 77.

Ohlsson, T. 1994. Minimal processing-preservation methods of the future: an overview. Trends in Food Sci. & Technol. **5**: 341-344.

Sorheim, A.; Aune, T. & Nesbakken, T. 1997. Technological, hygienic and toxicological aspects of carbon monoxide used in modified atmosphere packaging of meat. Trends in Food Sci. & Technol. **8**: 307-312.

Santé, V.; Renerre, M. & Lacourt, A. 1994. Effect of modified atmosphere packaging on colour stability and on microbiology of turkey breast meat. J. Food Quality. **17**: 177-195.

Taylor, A.S. 1996. Basic considerations in meat packaging. In: Meat quality and meat packaging. Part II. pp.259-271. Ed. ECCEAMST. Utrecht. Netherlands.