

## USE OF MODIFIED ATMOSPHERE TO EXTEND THE SHELF LIFE OF CHICKEN BREAST FILLETS

Sarantópoulos C.I.G.L.<sup>1</sup>, Contreras C.C.<sup>1</sup>, Galvão M.T.E.L.<sup>2</sup>, Schramm R.<sup>1</sup>

<sup>1</sup>Institute of Food Technology – ITAL P.O. Box 139, Campinas, SP, Brazil

<sup>2</sup>Sadia S.A. – Rua Coroados 182. CEP 05092-020, S.P., Brazil

### BACKGROUND

The poultry shelf life is 8 days when sold refrigerated (temperatures around 4 °C). This period is very short considering that Brazil is a big country and most of the poultry production is concentrated in a specific region (mainly south region). In some parts of the country the product reaches retail close to the end of its shelf life.

It is known that after 4 days of storage it is possible to detect some changes in its quality, both sensory and microbiological. In modified atmosphere a significant number of research has focused different combinations of gas mixtures and temperatures to extend the product's storage period.

### OBJECTIVE

Evaluate the effect of gaseous atmosphere (70% O<sub>2</sub>/ 30%CO<sub>2</sub>) on the quality and shelf life of breast cut chicken.

### MATERIAL AND METHODS

**Packaging and Storage:** Chicken breast fillets (2 pieces/ 500 g) were packaged in a barrier bag with O<sub>2</sub>TR=26 cm<sup>3</sup> (STP)/m<sup>2</sup>/day and CO<sub>2</sub>TR=80 cm<sup>3</sup> (STP)/m<sup>2</sup>/day at 25 °C and 1 atm. All the bags were evacuated and injected with 70% O<sub>2</sub>/ 30% CO<sub>2</sub> using a Supervac GK-185 model. The package headspace volume was defined to get a relation of 1 l gas/kg of meat and 0.3 l CO<sub>2</sub>/kg of meat.

The average product temperature at the time of packaging was 5.2 °C and, immediately after packaging, the bags were stored in the dark at 1±1 °C along with control samples packed in low density polyethylene bags (PEBD) without any modification of the atmosphere. Every two days, 2 bags of both treatments (control and MAP) were submitted to sensory, microbiological and headspace gas analysis.

**Headspace gas composition:** The O<sub>2</sub>, CO<sub>2</sub> and N<sub>2</sub> concentrations were determined using a gas chromatography equipped with a thermal conductivity detector and Molecular Sieve 5A and Porapak Q columns. The final results were expressed as percentage volume O<sub>2</sub>, CO<sub>2</sub> and N<sub>2</sub>.

**Microbiological evaluation:** Initial microbiological characterization of the breast fillets consisted of the following tests: total aerobic mesophilic count, total aerobic psychrotrophic count, total enterobacteria count and total and faecal coliforms count. From this point on, the evolution of bacterial populations during storage were monitored by means of periodical total aerobic and enterobacteria counts. All the methods employed are recommended and described by Vanderzant & Splittstoesser 1992 with exception of Enterobacterias, described by Kennedy Jr. *et al.* 1982.

**Sensory analysis:** a panel of 6 trained judges evaluated the breast fillets color before opening the packages using a 9 cm non-structured line anchored at the extremes and in the middle (0=green; 4.5=normal; 9=pink). Immediately after opening the packages the trained panelist evaluated the putrid and sour odors and others (old and rancid) using a 5 point scale (1=absent; 2=slightly, 3=moderated; 4=intense and 5=extreme).

### RESULTS AND DISCUSSION

#### Headspace gas analyses

During storage the O<sub>2</sub> concentration was maintained between 72 and 76% and CO<sub>2</sub> varied from 28 to 22% indicating an appropriated gas barrier of the packaging material.

#### Microbiology

The breast fillets presented high initial counts for spoilage aerobic psychrotrophic (log 5.7 CFU/g) and total coliforms (1.5x 10<sup>4</sup> MPN/ g). In MAP (70% O<sub>2</sub>/ 30% CO<sub>2</sub>) and control samples the initial count did not change during the first three days of storage.

The aerobic psychrotrophic bacteria count from fillets packet in air exceeded 7 log CFU/g and reached their shelf life limit after ten days of storage. On the other hand, these numbers were not attained on any of the fillets stored in MAP (70% O<sub>2</sub>/30% CO<sub>2</sub>). Aerobic psychrotrophic bacteria numbering in excess of 7 log CFU/g were recovered from some fillets in each of the sets that had been stored under modified atmosphere after 17 days of storage. These results were alike at 22 days (7.3 log CFU/g).

This finding demonstrated the bacteriostatic effect of CO<sub>2</sub>. The MAP significantly reduced the growth rate of psychrotrophic bacteria and Enterobacteria when compared with control samples (Figure 1). Consequently it had major effect in extending the shelf life of poultry products. The breast fillets in 70% O<sub>2</sub>/30% CO<sub>2</sub> and in air presented initial enterobacterial counts of 3.7log CFU/g and their growth rate was significantly higher in the presence of air (Figure 1).

#### Sensory analysis

All breast fillets had a slightly variation in color, characterized as cream to pinkish. During storage the fillets kept in MAP (70% O<sub>2</sub>/ 30% CO<sub>2</sub>) showed a tendency to be slightly pinker than the control test. The fillets in air also showed more variations in color and, in some storage time, a tendency to have a slightly greenish color (Figure 2).

Of all odors studied the sour one as considered the most critical. Its presence was associated with the fermentation process so at the time its intensity reached value 3 (moderated) the product was considered not acceptable. Having this in mind the control samples were refused in the 17<sup>th</sup> day of storage and the modified atmosphere samples on the 22<sup>nd</sup>. The putrid odor was not detected in any treatment. The other odors were associated with "old" but were considered just slightly in both treatments (Table 1).

Conclusions

The use of modified atmosphere containing high levels of oxygen (70% O<sub>2</sub>/ 30% CO<sub>2</sub>) retain the breast meat color during storage at 1±1°C and contributed to extend in 5 days the detection of sour odors. Although sensory changes appeared just on the 17<sup>th</sup> day in the control and 22<sup>nd</sup> day in the MAP the limiting factor for the shelf life was microbiology. The control samples were refused in the 10<sup>th</sup> day and the MAP one on the 17<sup>th</sup> day. So the use of modified atmosphere packages with 70% O<sub>2</sub>/30% CO<sub>2</sub> , at a relation of 1l gas /kg of meat, can extend the breast meat shelf-life in 7 days when stored at a temperature around 1±1 °C.

Pertinent Literature

Kennedy Jr., Oblinger J.L., West R.L. Microbiological comparison of hot-boned and conventionally processed beef plate cuts during extended storage. J.Food Protection, v.45, n.7, p. 607-614.  
Vanderzant C., Splittstoesser D.F. Compendium of methods for the microbiological examination of foods. Washington, American Public Health Association, 1992. 1219p.

Figure 1. Evolution of psychrotrophic and enterobacteria microorganisms in chicken breast fillets in MAP 70% O<sub>2</sub>/ 30% CO<sub>2</sub> and their corresponding control samples packed in air, during storage at 1± 1° C.

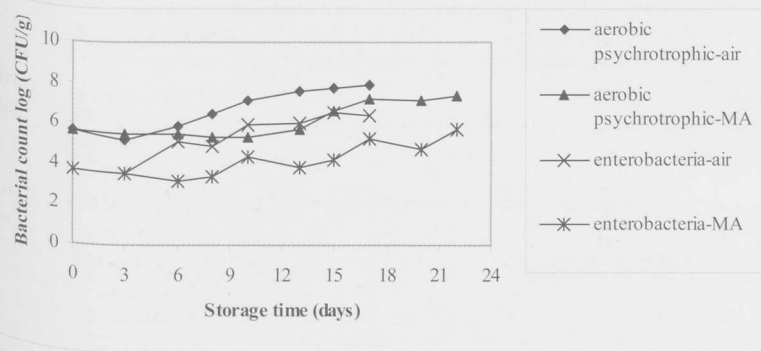


Figure 2. Visual appearance (color) of chicken breast fillets in MAP 70% O<sub>2</sub>/30%CO<sub>2</sub> and control samples packed in air, during storage at 1±1 °C.

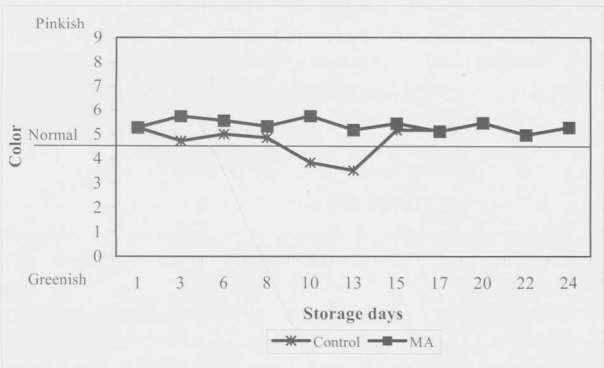


Table 1. Odor evaluation of chicken breast fillets in MAP 70% O<sub>2</sub>/30% CO<sub>2</sub> and control samples packed in air, during storage at 1± 1° C.

Storage Days	Odors					
	Putrid		Sour		Others	
	Control	MA	Control	MA	Control	MA
1	1.1	1.1	1.1	1.1	1.1	1.1
3	1.0	1.0	1.0	1.0	1.1	1.1
6	1.1	1.1	1.1	1.1	1.2	1.2
8	1.1	1.3	1.2	1.3	1.6	1.4
10	1.0	1.2	1.1	1.2	1.2	1.3
13	1.1	1.1	1.0	1.2	2.4	2.3
15	1.1	1.5	1.5	1.4	2.0	1.8
17	Na	1.5	3.5	1.5	1.5	1.2
20	Na	1.3	Na	2.8	Na	2.6
22	Na	1.2	Na	3.1	Na	1.8
24	Na	1.0	Na	3.4	Na	1.6