

## SHELF-LIFE OF ORGANIC ACID TREATED VACUUM PACKED CHICKEN BREAST MEAT

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There is a trend among Brazilian consumers for consumption of fresh instead of frozen chicken meat. Brazil is a continental country and is not always possible to ship refrigerated meats from the production areas to far away destinations: the remaining shelf-life is too short to allow the time needed for commercialization.

Several studies have shown that treating chicken meat with organic acids or its salts increase its shelf-life (LAMUKA *et al.*, 1992; SMULDERS *et al.*, 1986). A review on this subject was carried out by XAVIER & BERAQUET (1994). SAWAYA *et al.* (1995) reported a 6-7 days increase in the shelf-life of chicken carcasses treated with acid lactic when storage was at 4°C. This shelf-life increase was reduced to 5-6 days when the storage temperature was higher, 7°C. DRESSEL & LEISTNER (1984) found that chicken carcasses treated with a mixture of 2% acetic, 1% lactic, 0.25% citric and 0.1% ascorbic acid had its shelf-life doubled. ROBACH (1979) reported a shelf-life increase from 10 to 19 days for chicken carcasses treated with a 5% potassium sorbate solution for 30s, when stored at 3°C. Using the same treatment SAWAYA *et al.* (1993) extended the shelf-life of chickens carcasses from 6-7 days to 13-14 days.

The effect of vacuum packaging on shelf-life of chicken meat is less effective than for beef. Several researchers report increase of 4 to 5 days in the storage period by the use of vacuum packaging instead of polyethylene (ARAFÁ & CHEN, 1975; PATTERSON *et al.*, 1984). Part of the inefficiency of vacuum packaging of chicken meats is due to its higher pH value. In this work acid treatment was used to lower the muscle used pH in combination with vacuum packaging that creates anaerobiose around the product.

**Objectives.**

To establish the combined effect of acid treatment and vacuum packaging on the shelf-life of chicken breast meat.

**Material and Methods.**

**Raw material:** Chicken breast meat without skin (*Musculus pectoralis*) where obtained 4 h *post mortem* from a local chicken slaughtering house and shipped immediately to the Meat Technology Center Plant in expanded polystyrene boxes filled with crushed ice. **Treatments:** Random samples of breast fillets were dipped for 1 min in the following solutions: a) 1% acetic acid; b) 0.5% acetic acid; c) 1% lactic acid; 2% potassium sorbate; water (control). The fillets were left to drip for 1 min and then vacuum packed in a film (PA/EVOH/PE), with permeability of 7cc O<sub>2</sub>/m<sup>2</sup>/atm/24h. The samples were stored under refrigeration (0 - 2°C) protected from light in plastic boxes. **Analyses:** **pH on chicken meat surface:** was measured in triplicates using a pHmeter INGOLD-WTW-pH91, with a 0,01 pH units resolution, by means of a glass electrode designed for surface pH determination. **Microbiological evaluation:** as recommended by ISO, 1988. One sample of 10cm<sup>2</sup> (5 x 2 cm<sup>2</sup>) was removed from two chicken fillets and macerated in peptonated saline solution for 1 min in a laboratory blender (STOMACHER 400-SEWARD). Appropriate dilutions were used to the following determinations: a) *psychrotrophic bacteria total count* – in OXOID PCA; incubation at 20°C for 72 h; b) *lactic acid bacteria* – in OXOID MRSSA (Mon Rogosa and Shape Agar), with addition of potassium sorbate and pH adjusted to 5,7; incubation at 20°C for 72 h (BAIRD *et al.*, 1987). **Sensory analysis:** consisted in the evaluation of odours change by a trained panel of 10 members, using a computerized system COMPUSENSE Inc. version 4.2, (CSA, 1992). Samples were presented to panelist in individual cabins in white plates covered by stretchable film. **Statistical analysis:** all samples were analysed in triplicate and the results were obtained from two trials. The variables studied were submitted to analysis of variance (ANOVA) and individual averages compared by the Tukey test ( $p < 0,05$ ) using the software STATGRAPHICS, 1989.

**Results and discussion.**

**pH change:** Normal chicken breast meat pH is in the range 5.8 – 5.9. As seen in Table 1 non treated samples stored under vacuum did not show any change that could be due to degradation processes. Acid treated samples showed a large initial pH drop after the acid treatment. Around four days of storage pH increased to normal values and remained constant up to the 21<sup>th</sup> of storage. No pH increase could be attributed unequivocally to other cause than sample to sample variation.

**Microbiological evaluation:** based on the criteria that a count of 7 log CFU/cm<sup>2</sup> indicates a spoiled sample, it is possible to estimate the shelf-life of the non treated vacuum packed samples in between 10 – 14 days (Table 2). The acid treatments increased the shelf-life between 6 and 10, days whereas the sorbate treatment increased shelf-life for at least 10 days. These results are compatible with those reported by SAWAYA *et al.* (1993) of 11 days shelf-life increase in vacuum packed chicken carcasses stored at 4°C treated with 50g/l of potassium sorbate, when compared to each one of the treatments. The growth of the lactic acid bacteria was also impaired by the sorbate and organic acids treatments. By the 14<sup>th</sup> day the non treated samples packed under vacuum reached counts above 7.0 log CFU/cm<sup>2</sup> whereas the treated samples did not reach this value even after 21 days of storage.

**Sensory analysis:** Odour is the sensory attribute generally related to bacterial growth, although aging of the meat generates off-odours due to amines and sulfur containing compounds. Considering a score below 4.0 as an indication of spoilage (Table 3) and relating these scores to the total psychrotrophic counts observed in Table 2 it can be noticed a relation of this score with counts between 6.0 – 7.0 CFU/cm<sup>2</sup> between day 10 and day 14 for non treated vacuum packed samples and between day 16 and day 21 for the other treatments. Based on odour evaluation the non-treated vacuum packed sample would have a shelf-life between 10 – 14 days; 1% acetic acid treatment between 16 – 21 days and sorbate treated samples between 14 – 16 days.

### Conclusions.

The combination of treatments with organic acids and vacuum packaging of chicken breast meat results in a shelf life around 20 days, that is, 6 to 10 days longer than for vacuum alone. The use of either 1% acetic or lactic acid seemed to be the most efficient treatments.

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Table 1. pH change of vacuum packed chicken breast meat treated with organic acids and sorbate, stored at 0-2°C \*

Treatment	Storage time (days)									Tukey**
	0	4	5	7	9	10	14	16	21	
vacuum only	5.81	5.78	5.74	5.76	5.81	5.84	5.74	5.72	5.75	b,c
1% acetic acid	5.03	5.56	5.59	5.73	5.69	5.66	5.65	5.58	5.79	A
0.5% acetic acid	5.02	5.70	5.74	5.72	5.64	5.71	5.72	5.63	5.69	A
1% lactic acid	4.74	5.62	5.73	5.66	5.75	5.76	5.65	5.63	5.67	a,b
2% sorbate	5.90	5.85	5.74	5.81	5.89	5.77	5.75	5.79	5.82	C
Tukey** (95%)	a	b	b	b	b	B	b	b	b	

\* Individual numbers are means of triplicate measurements of two trials. \*\* Different letters indicate significant differences ( $p < 0.05$ ) between means

Table 2. Total counts of psychrotrophic and lactic bacteria treated with organic acids and sorbate, stored at 0-2°C \*

Treatment	Storage time (days)									Tukey**	
	0	4	5	7	9	10	14	16	21		
vacuum only	1	4.40	5.70	4.20	6.07	4.60	6.50	7.30	6.90	7.70	b
	2	2.75	4.93	3.40	2.75	4.50	5.30	7.45	6.00	6.70	b
1% acetic acid	1	3.70	4.85	3.30	5.00	3.20	5.45	5.80	6.20	6.80	a,b
	2	1.90	4.30	2.30	1.90	2.50	4.65	4.75	4.60	5.80	a,b
0.5% acetic acid	1	3.65	4.50	-	4.60	3.70	4.30	4.00	6.20	6.50	a
	2	2.55	3.70	3.20	2.55	3.50	3.50	3.50	5.30	6.10	a
1% lactic acid	1	3.45	4.20	-	4.00	3.70	3.90	4.20	6.30	7.00	a
	2	2.25	3.00	3.10	2.25	4.60	3.50	3.50	5.80	5.00	a
2% sorbate	1	4.00	4.80	3.90	4.20	4.00	3.90	-	6.60	5.40	a
	2	2.45	4.60	2.50	2.45	2.50	2.50	2.50	4.50	5.00	a
Tukey** (95%)	1	a,b	a,b,c	a	a,b,c	a,b	a,b,c	a,b,c	d	d	
	2	a	a,b,c	a	a	a	a	c	a,b	b	

1= Counts of psychrotrophic (CFU/cm<sup>2</sup>) 2= Counts of lactic bacteria (CFU/cm<sup>2</sup>)

\* Individual numbers are means of triplicate measurements of two trials. \*\* Different letters indicate significant differences ( $p < 0.05$ ) between means

Table 3. Odours scores of vacuum packed chicken breast meat treated with organic acids and sorbate stored at 0-2°C \* (0=putrid 5=desirable 10=acid)

Treatment	Time (days)									Tukey** (95%)
	0	4	5	7	9	10	14	16	21	
vacuum only	5.1	4.7	5.2	6.0	5.3	4.5	4.0	3.3	2.1	a
1% acetic acid	6.7	5.3	5.7	5.6	4.7	5.2	4.6	4.8	3.5	a
0.5% acetic acid	5.8	4.6	4.9	5.6	5.2	5.2	4.6	3.3	3.6	a
1% lactic acid	5.3	5.5	4.9	5.9	3.9	4.6	4.3	4.8	3.6	a
2% sorbate	5.5	5.1	4.6	5.4	4.8	4.5	4.0	3.7	3.3	a
Tukey** (95%)	d	b,c,d	c,d	d	b,c,d	b,c,d	b,c	a,b	a	

\* Individual numbers are means of triplicate measurements of two trials. \*\* Different letters indicate significant differences ( $p < 0.05$ ) between means