CHLORINE AND ORGANIC ACIDS IN THE CONSERVATION OF REFRIGERATED CARCASSE.

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INTRODUCTION

The self life of the poultry carcasses is directly related to its initial contamination (INGRAM, 1922). The application of decontaminators on the carcass surfaces has been recommended as one of the ways to reduce the contamination (MORRISON, 1965).
Chlorine solutions are frequently used in poultry, beef cattle and pork meat slaughterhouses, being studied by various researchers (6, 8, 11). On the contrary, the ascorbic and lactic acids are not commonly used in commercial slaughterhouses, in spite of the fact that their bacterial and bacteriostatic properties are largely documented (3, 5, 10, 11, 12, 14, 15).
The purpose of this work is to compare the effects of chlorine solutions and ascorbic/lactic acids in the conservation of refrigerated poultry carcasses.

ABSTRACT

Freshly processed poultry carcasses were dipped into chlorine solution (5 and 40 ppm), and association of ascorbic acid 1% and lactic acid 1% and distilled water. The storage temperature was 5 C. Changes in aerobic plate counts, coliforms and psychotrophic bacterias were monitored. The association of acid treatments provided an effective inhibitory system against the poultry spoilage organisms.

MATERIAL AND METHODS

Treatments: In the laboratory, poultry carcasses recently slaughtered were submitted to the following treatments: treatment 1 - Control - water immersion for 2 minutes; treatment 2 - immersion in chlorine solution to 5 ppm for one minute; treatment 3 - immersion in chlorine solution to 40 ppm for 30 minutes; treatment 4 - immersion in ascorbic acid solution 1%, lactic acid 1% for 3 minutes. The immersion solutions were at ± 2°C. After the treatment, the carcasses were wrapped in plastic bags and stored at a temperature of 5°C for eleven days. The experiments were repeated twice.

Microbiological analysis: Swab of the carcasses skin was done in a total area of 12 cm^2, immediately after the treatment and after 2, 5, 8 and 11 days of storage. Total counting of the strict and optional aerobic microorganisms in pattern agar for counting (Merck) incubated at 32°C for 48 hours. Total counting of coliforms in agar violet red neutral bile (DIFCO) incubated at 37°C. Total counting of psychotrophics: in pattern agar for counting (Merck), incubated at 7°C for 8 days.

Determination of pH: The pH of the skin of the treated carcasses was determined in a DIGIMED potentiometer using glass electrode combined simultaneously with the microbiological analysis.

Residual analysis: Residual analysis were also performed in the same days of the microbiological analysis. The carcasses were washed with 300 ml of deionized water and afterwards, portions were taken for the determinations.The chlorine was titrated with sodium thiosulphate, using starch as indicator (1).The ascorbic acid was determined by titration with potassium iodate, using starch indicator (16). The lactic acid was determined colorimetrically using iron chloride for color development (13).

Sensorial analysis: Together with the microbiologic analysis, the carcasses were submitted to the evaluation of a panel composed by seven tasters who graded from zero to nine the attributes of color, smell, taste and texture. The grades 9.0 to the carcasses were considered very good, 3.0-4.0 unpleasant and 1.0-2.0 unacceptable. For analysis of taste and texture, pieces of poultry were enveloped in aluminium paper and grilled during 40 minutes at the temperature of 200°C.

Statistical analysis: For the microbiological data, the analysis of variance was calculated considering the entirely casualized design with subdivided items. Duncan's test was used to check the difference between the averages, considering the signification level 5% (7). The sensorial data were analysed through the quadrisquare test of Friedman and to check the difference between the averages the DMS test was used (4).

RESULTS AND DISCUSSION

The effects of the treatments in the counting of total coliforms, total aerobics and psychotrophics is shown in Table 1. In none of the treatments existed significative reduction in the level of coliforms. In spide of the numerical differences, the statistical analysis did not show signification, what can be justified by the high coefficient of variation (CV = 42.97%).
The use of chlorine 5 and 40 ppm was efficient just for the control of total aerobics until

the 5th day. From then on, the aerobic grew quickly, having no influence in the period during which the carcasses were good enough for consumption. The level of psychotrophics was not reduced during storage time. The acids association was effective to the reduction of counting of total psychotrophics and total aerobics until the 5th and 8th days respectively. In the 8th storage day, these was a reduction of total aerobics of 2.32 log/cm^2. Considering the limit level of these bacterias of 10^7 ufc/cm for the appearance of slime and smell characteristics of deterioration, the control carcasses and the ones treated with chlorine 5 e 40 ppm, reached this level in 5 - 6 storage days. On the other hand the carcasses treated in acids associations reached the same level in 8 and 11 days. ARAFA & CHEN (2) and VAN DER MAREL et alii (17) found an increase in the period during which the refrigerated poultry is good enough for consumption, using 1% of lactic acid respectively, however with lower storage temperatures, what causes a decrease in the growth of microorganisms. In works previously realized in our laboratories, using 1.25% of lactic acid during 1 minute in poultry carcasses, the latter reached a contamination of 10^7 ufc/g between the 5th and 8th storage day ($\pm 5^o$ C). The greatest increase found in the good enough for consumption life is due to an increase in the immersion time and the acids associations. Tables 2 and 3 show the effect of the treatments on the pH and on the residues left in the skin of the carcasses. The carcasses treated with chlorine did not present pH variation when compared with the control and no chlorine residues were found along the storage period, what confirms its reduced effect as decontaminator. The carcasses treated with acids presented a reduction in the pH approximately 1.5 units, immediately after the treatment, and in every analysed day, residues of asocrbic and lactic acids were found, what caused a greater increase in the good enough for consumption life of these carcasses. The residues of the acids decreased during storage. The averages of the grades obtained through the panel of tasters are presented in Tables 4 and 5. The color of the carcasses treated with association of acids presented, immediately after immersion a discret decolorization, probably due to proteinaceous denaturation, caused by the quick decrease of pH (VAN DER MAREL et alii, 17). This decolorization did not affect the control. Similar results were found by VAN DER MAREL et alii (17) when they experimented lactic acid 1% in poultry. The carcasses treated with ascorbic and lactic acids proved to be unacceptable in relation to smell between the 8th and 11th storage day. The residues of the acids did not interfere in relation to taste and texture of the grilled carcasses. Similar results were found by ARAFA & CHEN (2) when they submitted to taste carcasses treated with 1% of ascorbic acid. The carcasses submitted to treatment whith chlorine 5 and 40 ppm did not differ of the control in any of the evaluated atributes, these carcasses were considered improper for consumption between the 5th and 8th storage day. Similar behavior was verified in relation to the non treated carcasses.

TABLE 1 - Counting of bacterias under the different treatments during storage 5^{o}C ± 1.

Treatments	1st day	2nd day	5th day	8th day	11th day
	---------- Total coliforms (log 10 ufc/cm^2) ----------				
1**	1,61 m*	1,70 m	3,01 m	4,38 m	5,25 m
2	1,47 m	1,37 m	1,33 m	2,91 m	5,37 m
3	1,87 m	0,71 m	0,79 m	2,73 m	2,96 m
4	1,45 m	1,19 m	1,16 m	1,98 m	4,06 m
	---------- Total aerobics (log 10 ufc/cm^2) ----------				
1**	3,69 mb*	4,13 m	5,66 m	7,06 m	7,70 mb
2	3,59 mb	3,79 m	4,55 b	6,96 m	8,01 m
3	4,18 m	4,11 m	4,46 b	7,07 m	7,36 mb
4	2,98 b	2,91 m	3,11 c	4,74 b	5,84 b
	---------- Total psychotrophics (log 10 ufc/cm^2) ----------				
1**	3,28 m*	4,13 m	5,97 m	7,83 m	8,38 m
2	2,55 m	3,52 m	4,75 mb	7,46 m	8,02 m
3	2,48 m	3,82 m	4,30 mb	7,68 m	8,12 m
4	1,90 m	2,96 m	3,70 b	5,84 m	5,84 m

* In the vertical line, averages with the same letter do not differ significantly.

** Treatment 1 is the control treatment.

TABLE 2 - Effect of the treatments in the pH of the skin of the carcasses along the storage period.

Treatments	pH during the storage period				
	1st day	2nd day	5th day	8th day	11th day
1	6,00	6,11	6,38	6,85	6,82
2	6,27	6,11	6,24	7,01	6,93
3	6,16	6,13	6,74	7,02	7,41
4	4,55	5,11	5,77	6,27	6,41

TABLE 3 - Residual values left by treatments in the carcasses along the storage period.

Storage	Treatment 2	Treatment 3	Treatment 4	
(days)	Chlorine	Chlorine	Ascorbic acid*	Lactic acid
0	---	---	9,97	24,42
2	---	---	5,84	13,96
5	---	---	3,43	10,37
8	---	---	1,74	9,42
11	---	---	1,28	5,06

- No chlorine residues were found.
* The values of ascorbic and lactic acids are in mg/100g of carcasse.

TABLE 4 - Effect of the treatments in the color and smell of the carcasses.

storage (days)	Color				Smell			
	T1	T2	T3	T4	T1	T2	T3	T4
0	8,00mb*	8,71m	7,14b	7,00b	7,57m	7,71m	7,14m	7,14m
2	7,71m	7,00m	7,00m	7,42m	8,74m	8,14m	6,42m	7,28m
5	7,71m	7,57m	8,14m	7,00m	6,85m	6,14m	7,14m	7,00m
8	1,00m	4,00b	2,57m	6,75c	1,85m	1,14m	1,57m	7,00b
11	1,85m	3,00m	1,71m	3,14m	1,28m	1,71mb	1,57mb	3,42b

* In the horizontal line average with the same letter do not differ significantly.
T1, T2, T3, T4 = treatments.

TABLE 5 - Effect of the treatments in the taste and texture of the carcasses.

Storage	Taste				Texture			
(days)	T1	T2	T3	T4	T1	T2	T3	T4
0	7,85mm	7,71	7,85	7,00	8,00mm	8,14	8,00	7,71
2	7,71mm	7,71	7,28	7,28	7,71mm	7,57	7,57	7,71
5	7,14mm	7,00	7,14	7,28	7,14mm	7,42	7,57	7,28

* ns = non significant, horizontal number.
T1, T2, T3, T4 = treatments.

CONCLUSIONS

The use of association of ascorbic and lactic acids both at 1% after the poultry slaughter caused a significant reduction in the population of microbes, increasing the shelf life of refrigerated carcasses. Besides, the association of acids does not affect the sensorial characteristics of the carcasses. In spite of the fact that chlorine is the decontaminator most frequently used in commercial slaughterhouses, in the present work concentrations up to ppm proved to be inefficient. It is necessary to write new essays, using a greater number of repetitions for better measuring the effect of the treatments under the total coliforms.

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