EFFECT OF SORBIC ACID ON SHELF-LIFE OF REFRIGERATED POULTRY CUTS UNDER FLUCTUATING TEMPERATURE REGIME

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INTRODUCTION : Frequent interruptions in power supply has become a serious problem for low temperature preservation of meat in the north-eastern parts of India. Fluctuations in temperature cause early spoilage of preserved poultry meat products and concomitant economic loss to poultry meat processors. The relatively short shelf-life of refrigerated fresh poultry is an added problem. This necessiates renewed search for consumer acceptable barriers for extending shelf-life of poultry carcasses preserved under low temperature by reducing initial bacterial load which has a direct bearing on the deteriorative changes of meat (Haines, 1933; Ingram, 1972). In this direction, application of organic acids that are 'generally recognised as safe' (GRAS) may be recommended as one of the positive ways to reduce initial microbial load of poultry carcasses with the final aim of extending the shelf-life of the product (Morrison and Fleet, 1985; Miller et al.,1992). Several researchers have reported varying degrees of success in preservation of poultry products by using sorbic acid at different concentrations (Robach et al.,1980; To and Robach, 1980; Elliot et al.,1985).

The purpose of this study was to determine the effects of different concentrations of sorbic acid on poultry cuts to quantify the appropriate concentration for use in refrigerated poultry meat under fluctuating temperature regime.

MATERIALS AND METHODS :

Treatments : A total of 80 broiler chickens weighing approximately 1.5kg each were randomly divided into 4 equal groups. The birds were slaughtered as per standard method followed in the department and were fabricated into retail cuts. Breast meat was hand deboned subsequently.

In group I, the deboned breast was subjected to treatment with 0.5% (w/v) sorbic acid (Loba Chemie, India). Samples were immersed in the solution of sorbic acid for 2 min. Similarly, the deboned breast samples were immersed in 0.75 and 1.00% (w/v) sorbic acid solutions (groups II and III), respectively. For controls (group IV), deboned breast was dipped in distilled water for the same duration of time. After the treatments, cuts were wrapped in polyethylene bags and were stored at a temperature of (-)2^{o}C.Thereafter,power supply to the refrigerator was interrupted at frequent intervals to cause fluctuations in temperature to maintain it in between (-)2 to 5^{o}C.

Determination of pH : The surface pH of the samples was determined potentiometrically by using a pH meter with combination probe electrode (type 335, Systronics India).

Microbiological examination : Swab technique was followed for collection of samples for determination of total viable counts. Swabs were taken from a total area of 12cm^2 from the skin of the cut. Serial dilutions were made in 0.1% peptone water and were inoculated in SPC agar by following the pour plate method. Inoculated plates were incubated at 37^{o}C for 48h and colony counts were expressed as $\log_{10}$cfu/cm^2.

Sensory evaluation : Sensory evaluation of the samples in relation to colour and flavour was performed by a 7-membered panel using hedonic scales. The colour of the uncooked meat samples was assessed visually by these panelists using the modified 6-point (6=most desirable colour, 1= undesirable) hedonic scale of Woolthuis and Smulders (1985).

For assessing the flavour quality, skin was removed from the cut and the meat was cut into cubes of approximately 1cm^3 and then fried in equal amounts of cooking medium for 3min. The cubes were analysed for flavour quality by the panelists after cooling to ambient temperature by using a 9-point hedonic scale (9 to 7 = very good, 3 to 1 = poor).

All the above parameters were studied at 6h and 2,4,7,and 10d of treatments except for sensory evaluation of the meat which was analysed at 6h and then on 7 and 10d of treatment.

Statistical analysis : The data of the experiments were analysed statistically as per method outlined by Snedecor and Cochran (1967).

RESULTS AND DISCUSSION :

The surface pH values of breat poultry meat was significantly lower than that of the controls after 6h of treatment and the samples treated with 1% sorbic acid solution had the least pH values (Table 1). The differences in pH values among the different treated and control samples , however, narrowed down on subsequent keeping and on the 10d of treatment these differences were statistically nonsignificant eventhough control samples showed comparatively higher pH values than the treated ones. Similar pattern of changes in pH values of poultry carcasses treated with lactic and ascorbic acid was also reported by Mello and Terra (1992).

Sorbic acid exerted sanitising effect on the poultry cut by reducing total viable counts (TVC) significantly over the controls even after 6h of treatment (Table 2). The microbial quality of control samples after 6h of treatment was comparable to that of the samples treated with 0.5% sorbic acid solution after 7d of storage. Better decontamination effect

Table 1. Effect of sorbic acid treatment on surface pH of deboned poultry breast

Treatment groups	6h	2d	4d	7d	10d
I	5.84^{a}± 0.02	5.96^{a}± 0.01	6.15^{a}± 0.02	6.35^{a}± 0.01	6.55^{a}± 0.02
II	5.38$^{a}_{b}$± 0.02	5.45^{b}± 0.03	6.00$^{a}_{c}$± 0.01	6.29^{a}± 0.02	6.47^{a}± 0.01
III	5.12^{b}± 0.01	5.27^{b}± 0.02	5.70^{a}± 0.01	6.15^{a}± 0.01	6.30^{a}± 0.01
IV	6.65^{c}± 0.01	6.40^{a}± 0.02	6.46^{a}± 0.03	6.59^{a}± 0.02	6.77^{a}± 0.03

Means with atleast one common superscript column-wise donot differ significantly(P> 0.05).

was noticed when the concentration of sorbic acid was increased to 1% level. The microbial quality of meat samples stored upto 10d after treatment with this concentration of sorbic acid was better than the control samples of 6h of storage. Similar decontamination effect of sorbic acid and subsequent extension of shelf-life in preserved poultry carcasses was also observed by other researchers (Robach et al.,1980; Serdaroglu et al., 1992).

The sensory properties of poultry meat samples treated with sorbic acid in terms of colour and flavour were well accepted by the panelists (Table 3).

Table 2. Effect of sorbic acid treatment on surface total viable counts of deboned poultry breast (log_{10}cfu/cm^2).

Treatment groups	6h		2d		4d		7d		10d	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
I	4.83 (5.41^{a}±0.08)	5.73	4.57 (5.08^{a}±0.08)	5.53	5.51 (5.79^{a}±0.10)	5.93	5.61 (5.90^{a}±0.60)	5.99	5.96 (6.63^{a}±0.10)	6.71
II	4.01 (4.78^{b}±0.06)	4.87	4.02 (4.57^{b}±0.05)	4.77	4.97 (5.34$^{a}_{b}$±0.07)	5.65	5.40 (5.76^{a}±0.04)	5.89	5.94 (6.49^{a}±0.08)	6.75
III	4.46 (4.71^{b}±0.04)	4.81	3.88 (4.30^{b}±0.08)	4.61	4.85 (4.97^{b}±0.08)	5.13	5.02 (5.24^{b}±0.06)	5.54	5.50 (5.72^{b}±0.04)	5.85
IV	5.64 (5.93^{c}±0.07)	5.99	6.79 (6.96^{c}±0.05)	7.07	7.04 (7.32^{c}±0.07)	7.63	7.36 (7.68^{c}±0.04)	7.80	7.98 (8.18^{c}±0.06)	8.33

Means with atleast one common super-script column-wise donot differ significantly(P> 0.05)

Mean ± SE values are within paranthesis

Eventhough treated samples scored less for colour characteristic at the initial stage of the analysis, subsequently, these were better accepted by the panelists over the controls This initial low scorings may be due to proteinaceous denaturation of the colouring pigment (van der Marel et al.,1988). Similarly at the begining stage of analysis, flavour scores of the treated meat samples were rated poorer over the control samples due to the somewhat sour taste of the product. This undesirable flavour ratings of the treated samples diminished gradually and on the 10d of storage the meat samples treated with 1% sorbic acid solution were rated the best in terms of flavour quality. These find-ings are in agreement with the findings of Mello and Terra (1992).

Table 3. Effect of sorbic acid treatment on sensory properties of deboned poultry breast meat

Treatment groups	Sensory Parameters	6h	7d	10d
I	Colour	4.86^{a} ±0.12	3.14^{a} ±0.08	2.14^{a} ±0.06
	Flavour	6.14^{m} ±0.20	6.28^{m} ±0.18	5.43^{m} ±0.14
II	Colour	5.00^{ab}±0.16	3.57^{a} ±0.14	2.71^{b} ±0.04
	Flavour	5.86^{mn}±0.16	6.43^{m} ±0.18	5.57^{mn}±0.10
III	Colour	5.00^{ab}±0.08	4.28^{b} ±0.14	3.86^{c} ±0.04
	Flavour	5.71^{mn}±0.16	6.43^{m} ±0.16	6.00^{n} ±0.18
IV	Colour	5.43^{b} ±0.14	2.00^{c} ±0.10	1.57^{d} ±0.02
	Flavour	8.00^{p} ±0.20	6.28^{m} ±0.19	4.43^{p} ±0.08

Means with atleast one common superscript column-wise do not differ significantly (P> 0.05).

CONCLUSIONS : Use of sorbic acid enhanced the keeping quality of poultry meat by exerting inhibitory effect on surface microflora of poultry cuts. Sensory characteristics of the product were not affected adversely upto a concentration of 1% sorbic acid. The treated samples were found to be superior in terms of all the parameters studied over the control samples indicating that under fluctuating temperature regime, sorbic acid might be used conveniently for extending the shelf-life of refrigerated fresh poultry. However, the long term effect of such applications need to be investigated thoroughly.

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