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Effect of Treatments on the Iced storage Shelflife of Cuttlefish (*Sepia aculeata*) Fillets

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Effect of dip treatments in 2% salt + 0.2% citric acid solution and in 0.01% butylated hydroxy anisole (BHA) solution, each for 10 minutes, on the biochemical and organoleptic quality of ice stored cuttlefish (*Sepia aculeata*-Orbigny) fillets is reported. The salt + citric acid treatment was found to improve the appearance and overall quality of the fillets. Non protein nitrogen (NPN) and alpha amino nitrogen contents were higher in the salt+citric acid treated sample.The salt+citric acid treated sample was organoleptically in good condition for four days and fair upto six days of storage in ice. No discolouration was noticed in any of the samples during the period of storage.

Key words : Iced storage, cuttlefish fillets, biochemical quality, sensory characteristics, dip treatment

Several studies have been reported on the iced storage characteristics and shelf life of squid and cuttlefish (Joseph *et al.*, 1985; Joseph and Perigreen, 1988; Selvaraj *et al.*, 1991; Anon, 1994; Hisa *et al.*, 1999). The present investigation was undertaken to study the effect of sodium chloride + citric acid dip treatment and the antioxidant, BHA dip treatment on discolouration and chemical characteristics of cuttlefish (*Sepia aculeata*-Orbigny) fillets.

Materials and Methods

Cuttlefish *Sepia aculeata* (140-150 g size) procured from fishing harbour was used in the present study. Whole cuttlefish without any bruises or ink sac rupture were selected. The dressed mantles were divided into three lots. One lot was given a 10 min dip treatment in a solution containing 2% (w/v) sodium chloride and 0.2% (w/v) citric acid.The second lot was given a 10 min dip treatment in 0.01% (w/v) BHA solution Tween 80, an emulsifier, was used for preparing the antioxidant solution. The third lot was kept as control without any chemical treatment. All the three lots were iced in 1:1 ratio in plastic boxes. A temperature of $2 \pm 1^{o}C$ was maintained throughout the period of study. Samples were drawn on zero, second, fourth and sixth day of iced storage and analysed for biochemical and sensory characteristics.

Quality characteristics like alpha amino nitrogen (Pope and Stevens, 1939), non-protein nitrogen (NPN) (AOAC, 1975), total volatile base nitrogen (TVBN) and trimethylamine content (TMA) (Conway, 1947), free fatty acid (AOAC, 1998), peroxide value (Connell, 1975) and thiobarbituric acid reactive substances (TBARS) (Buege and Aust, 1978) were determined. The sensory evaluation of the raw and cooked samples were also carried out. The cooked samples were prepared by boiling the mantles in 2% brine for 10 minutes (Joseph *et al.*, 1985). The organoleptic evaluation of these samples was carried out by a six-member panel. The overall quality of meat was rated on a five point hedonic scale (Selvaraj *et al.*, 1991) ANOVA (Snedcor and Cochran, 1967) was done with respect to iced storage period and treatments using Factorial CRD (completely randomised design) for biochemical characteristics. The Quade test (Rangaswamy, 1995) was done for statistical analysis of the organoleptic quality.

Results and Discussion

Changes in NPN and its fractions and fat during iced storage of cuttlefish fillets are shown in Tables 1 and 2 respectively. Statistical analysis of the data showed significant variation in chemical characteristics between control and the treated. Alpha amino nitrogen and non-protein nitrogen decreased drastically during iced storage in all the samples. This decrease was less pronounced in the salt + citric acid treated samples. This shows the effectiveness of treatment in reducing leaching loss. Subba Rao and Heerdt (1955) observed that the addition of salt to fish muscle improves the moisture retention. Vaessen-Schoemaker (1966) also reported that the chelating action of citric acid improves water retention of products treated with this substance.

Table 1. Changes in NPN and its fractions in cuttlefish fillets during iced storage.

Parameter	Sample	Days of storage			
		0	2		6
NPN (%)	Control	0.618	0.556	0.391	0.373
	Salt+ citric acid	0.61	0.561	0.475	0.444
	BHA	0.599	0.547	0.479	0.392
α-amino nitrogen (mg/100g)	Control	249.385	173.778	97.587	27.131
	Salt+ citric acid	252.6	197.388	137.383	38.723
	BHA	255.239	189.255	113.812	32.586
TVBN (mg/100g)	Control	3.388	5.430	10.144	16.619
	Salt+ citric acid	3.395	5.214	9.619	14.867
	BHA	3.814	5.566	9.368	15.271
TMAN (mg/100g)	Control	1.355	3.393	5.246	9.495
	Salt+ citric acid	1.357	2.779	4.122	8.644
	BHA	1.386	3.478	4.662	8.825

Values are average of two determinations

During iced storage, TVBN and TMA content increased in the control and treated samples and this increase was less pronounced in the case of salt+citric acid treated sample. This suggests the combined effect of salt and citric acid in reducing the degradation of the nitrogenous compounds in the meat.

Free fatty acids increased during storage upto the fourth day and then decreased in the control and salt+citric acid treated samples. The BHA treated sample showed a continuous increase in the FFA content. Both PV and TBARS showed a steady increase in all the samples. But this increase was least in BHA treated sample.

Table 2. Changes in fat in cuttlefish fillets during iced storage.

Parameter	Sample	Days of storage			
		0	2	4	6
FFA (% oleic acid)	Control	19.833	21.388	42.097	35.807
	Salt + citric acid	19.692	28.00	31.32	28.875
	BHA	4.486	7.233	25.173	36.974
PV (milliequivalent/ kg fat)	Control	7.499	11.805	12.517	12.132
	Salt + citric acid	5.931	7.856	9.615	9.999
	BHA	4.8	5.166	6.191	8.012
TBARS (mg malonal dehyde/ kg meat)	Control	0.9005	0.968	2.378	2.458
	Salt + citric acid	0.858	0.854	1.628	2.255
	BHA	0.649	0.748	1.512	2.089

Values are average of two determinations

Compared to the control, the increase in TBARS was less in salt+citric acid treated sample. This may be because of the retardation of lipid autoxidation through the metal chelating action of citric acid. The presence of transition metal ions such as iron and copper in trace amounts in most foods act as catalysts of lipid oxidation (Castell and Spears, 1968; Mahoney and Graf, 1986). Metal chelating agents such as citric acid and EDTA, chelate metal ions or suppress reactivity by occupying all co-ordination sites on the metal ion (Mahoney and Graf, 1986) and therefore, may be effective agents in retarding metal - catalysed lipid oxidation (Lemon *et al.*, 1950). Metal - catalysed lipid oxidation may be more pronounced in cephalopod meat as cephalopods are reported to accumulate a number of heavy metals (Kreuzer, 1984; Falandysz, 1989).

The sensory evaluation of ice stored cuttlefish fillets was carried out for both raw and cooked samples. There was no significant difference between the scores obtained

for raw and cooked fillets. Fig. 1 shows the overall organoleptic quality of raw fillets. The results showed that the salt+citric acid treated sample was organoleptically in good condition for four days and fair upto six days of storage in ice. The control and the BHA treated sample were found to be fair upto the fourth day and by the sixth day they reached the limit of acceptability.

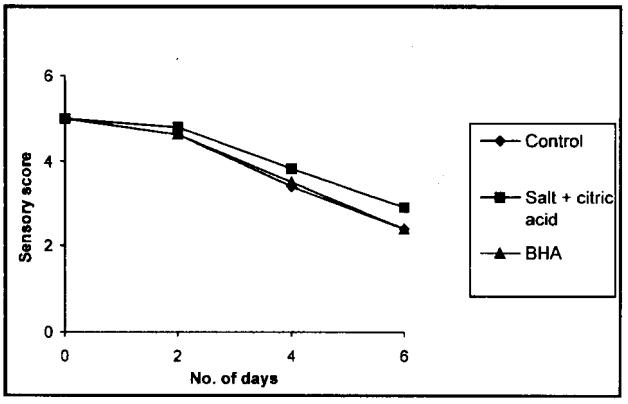

Fig. 1. Changes in organoleptic score of raw cuttlefish fillets during iced storage.

The organoleptic quality of the ice-stored cuttlefish was adjudged to be good for 2 days, fair upto 4 days and acceptable upto 6 days of storage in ice (Sastry and Srikar, 1985). Hence, for the effective utilisation of cuttlefish the material should be preserved by freezing within 2 days of storage in ice. Joseph *et al.* (1985) observed that squid cannot be kept in ice in prime condition for more than 2 days. In another study, the dressed cuttlefish subjected to direct icing and in ice-water slurry packed in polystyrene container was found to be in acceptable condition even on the tenth day of storage;but whole cuttlefish subjected to the same storage condition was found to be acceptable only upto the eighth day (Anon, 1994).

During the period of iced storage, no yellow discolouration was observed in any of the samples. However, the control and the BHA treated samples were found to lose their original sheen, white colour and firm texture with the increase in storage days. The salt + citric acid treated sample retained the original quality which may be attributed to the increased moisture retention due to texturisation of the muscle by salt + citric acid treatment. The better colour of the salt + citric acid treated sample may be due to the effect of citric acid (ADB/Infofish, 1985). Joseph *et al* (1985) reported that, by dressing the squid immediately after capture, the pink and yellow discolouration could be avoided.

The present study highlights that gutting, proper handling, thorough washing and immediate icing can prevent discolouration. It is also concluded that the problem of rapid leaching of protein and non protein nitrogen components from the fillets when kept in direct contact with ice for longer periods can be overcome effectively for a period upto six days by the use of the salt and citric acid treatment.

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