SOME ASPECTS OF CURING OF SHARKS AND RAYS

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[A simple method for eliminating urea almost completely from elasmobranch muscle consists in desalting the initially salted muscle in 5% brine. The initial salting removes about 58% of the urea, which occurs to the extent of 5.8 to 7.5% D.W.B. in the fresh muscle, and the desalting further reduces the urea content to negligible quantities (0.2%)]

INTRODUCTION

Catches of elasmobranch fish viz. sharks, rays, skates etc. amounted to 40,761 tonnes accounting for 6.3% of the total marine fish landings in India for 1962. Even though a part of this catch was consumed fresh, a good portion was salt cured and partly consumed in internal markets and partly exported to neighbouring countries.

The flesh of the elasmobranch fish in general possess a peculiar odour and flavour which are not relished by many fish consumers. The odour and flavour of fish are largely attributed to the various nitrogenous constituents which contribute to the non-protein nitrogen fraction of the fish muscle. In the case of clasmobranch fish, the non-protein nitrogen contributes 30% of the total nitrogen of the muscle (Velankar and Govindan, 1958). Urea, trimethyalamine oxide and free α-amino acids are the major components constituting 40%, 17.5% and 5% respectively of the total non-protein nitrogen, the rest being accounted for by other minor consitituents. What exactly contributes to the peculiar odour and flavour of elasmobranch fish is not known at present. However, high content of urea present in the flesh decomposes easily imparting a strong ammoniacal odour to the flesh. Even though proper salting removes more than half of the total quantity of urea orginally present in the flesh, the remaining urea in the muscle is more than sufficient to produce fairly objectionable levels of ammoniacal odour in the cured product by decomposition even in the first fortnight of storage.

Even though some attempts have been made previously to remove urea from the elasmobranch fish by incorporating chemicals like sodium bicarbanate and sodium dihydrogen phosphate in the curing salt, not much success has been attained. In the present work, a simple technique of desaltation of the originally salted flesh has been found to give promising results as far as the removal of urea is concerned.

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Materials and methods

Fresh sharks and rays from the landing places at Calicut were used.. Moisture and salt were determined by the method described by Suryanarayana Rao et. al (1958) and total volatile nitrogen and urea nitrogen in the aqueous extract were determined by Conway's Microdiffusion Method. The fish after gutting and washing were cut into slices about two inches thick and salted in the ratio 1:3 (salt to fish).

Results and discussion

The results are given in Tables I II, III, IV, V and VI

Table I gives the maximum penetration of salt and the removal of urea.

Table II gives reduction of urea on pickling in saturated brine after initial salting (1:3) and light washing.

Table III gives the reduction in urea on deslating of the origiually salted shark slices and on resalting of the desalted samples in the ratio 1:7.

Table IV gives the relation between the size of the slices and reduction in urea. In this case, the shark flesh was cut into longitudinal fillets as is done commercially and then cured.

Table V gives the behaviour of ray fish on salting, deslating and resalting.

Table VI gives distribution of urea in flesh and brine at different stages of salting, desalting and resalting of shark flesh.

Results obtained in preliminary experiments showed that incorporation of chemicals like sodium bicarbonate and sodium dihydrogen phosphate with curing salt at 5% level does not have any beneficial effect as far as removal of urea is concerned. The penetration of salt is also not affected to any extent by the presence of these chemicals. However, taste panel studies showed a better consumer appeal for the bicarbonate treated sample.

From table I it was observed that the maximum penetration of salt and removal of urea takes place within the first 24 hours of salting after which the changes are rather negligible. Hence prolonging the time of salting beyond 24 hrs. did not have any appreciable effect on the removal of urea.

Figures in table II show that there is only a slight reduction in the urea content even after pickling for 15 days. This may be because the brine being saturated, there is no considerable exchange of matter between the brine and the flesh. It may also be noted that spoilage takes place in the pickle as shown by the increase in T. V. N. values.

Deslating the originally salted shark slices is very effective in removing urea retained in the muscle after salting as shown by figures in Table III. During desalting, the excess salt in flesh comes out so as to establish equilibrium with the brine and in doing so, the residual urea also comes out. 5% brine is the optimum strength that can be used for desalting, because use of 10% brine does not bring down the urea level as low as 5% brine does; and moreover, from the point of view of economy also a weaker brine is preferable. But weaker brine than 5% brings about some spoilage in the flesh as shown by the T. V. N. value. The desalted sample can very well be used for making edible fish flour or for immediate consumption as it is practically free of urea. If it has to be dried and preserved, it must be resalted; as otherwise, the salt content will be too low to give any preservative action. Moreover, it has been observed that the desalted sample take up an undesirable dark colour and a

TABLE - I EFFECT OF SALTING TIME ON MOISTURE, SODIUM CHLORIDE, T. V. N. AND UREA IN SHARK FLESH

Samples description	Moisture %	NaCI % (D. W. B.)	T. V. N. mgN/ 100 g. muscle	Urea % (D. W. B.)
Fresh	72.13	0.3	15.0	5.80
After salting for 24 hours	57.13	15.59	Nil	2.45
After salting for 48 hours	54.37	17.14	Nil	2.40
After salting for 72 hours	55.60	16.90	Nil	2.36

TABLE—II EFFECT OF PICKLING SALTED SHARK FLESH ON ITS MOISTURE, SODIUM CHLORIDE, T. V. N. AND UREA CONTETNS

Sample description	Moisture %	NaCI% (D. W. B.)	T. V. N. mgN/ 100 g muscle	Urea % (D. W. B.)
Fresh	73.00	0.20	10.0	5.90
After salting for 24 hours	58.42	17.24	Nil	2.50
After pickling for 7 days	62.50	15.40	15.0	2.35
After pickling for 15 days	64.45	13.04	32.2	2.20

TABLE —III CHANGES IN MOISTURE, SODIUM CHLORIDE, T. V N. AND UREA IN SHARK FLESH ON SALTING, DESALTING AND RESALTING

Sample description	Moisture %	NaCI % (D.W.B.)	T. V. N. mgN/ 100 g muscle	Urea % (D.W.B.)
Fresh	75.0	0.14	Nil	6.20
After salting	58.3	17.20	Nil	2.60
After desalting in 10% brine	68.0	7.20	Nil	0.54
After desalting in 5% brine	70.4	6.10	Nil	0.23
After desalting ia 2% brine	71.5	4.50	35.0	0.19
After resalting the desalted (5% brine) sample	59.2	16.50	Nil	0.12

TABLE - IV EFFECT OF THE SIZE OF FILLETS ON SALT PENETRATION AND REMOVAL OF UREA DURING SALTING, DESALTING AND RESALTING OF SHARK FLESH

Sample description	Moisture %	NaCl % (D.W.B.)	T. V. N. mgN/ 100 g muscle	Urea % (D. W. B.)
Fresh	73.5	0.4	20.0	7.50
After salting	59.3	16.2	Nil	2.75
After desalting	70.2	6.3	Nil	0.22
After resalting	59.5	16.3	Nil	0.14

TABLE — V BEHAVIOUR OF RAY FISH FLESH ON SALTING, DESALTING AND RESALTING

Sample description	Moisture %	NaCl % (D. W. B.)	T. V. N. mgN/ 100 g muscle	Urea % (D.W.B.)
Fresh	78.50	0.25	10.00	3.70
After salting	59.89	15.70	Nil	2.10
After desalting	76.25	4.90	Nil	0.19
After resalting	58.50	17.20	Nil	0.10

TABLE - VI DISTRIBUTION OF UREA IN THE FLESH AND BRINE AT DIFFERENT STAGES OF SALTING, DESALTING AND RESALTING OF SHARK FLESH

Sample description	Urea % on Dry Weight Basis In Flesh	In brine	Total	Remarks
Fresh	7.20	. .	7.20	
On salting	2.70	4.30	7.00	Compare with 7.2 in fresh
On desalting	0.18	2.50	2.68	Compare with 2.7 before desalting.
On resalting	0.12	0.05	0.17	Compare with 0.18 before resalting.

rather sticky nature if dried without re-salting.

Table IV shows that the size of the slices does not affect the course of removal of urea and table V shows that ray fish also behaves in a similar manner as shark in these experiments. The figures in Table VI show that the removal of urea from shark flesh is by leaching out of the urea into the brine surrounding the flesh.

Summary

The incorporation of chemicals like sodium bicarbonate and sodium dihydrogen phospate in the curing salt, prolonging the salting time, and pickling the salted flesh in saturated brine had no beneficial effect for removing urea from elasmobranch flesh.

Desalting the heavily salted flesh in 5% brine has been found to be very effective in removing the residual urea from the flesh. The desalted sample has however to be resalted if it is to be dried and preserved. The size of the slices does not affect the course of removal of urea. Ray fish behaves exactly like shark in these experiments. The removal of urea is attained by leaching out into the brine. The technique of deslatation described in this paper is a simple and effeetive means to remove urea almost competely from the elasmobranch flesh, thus providing longer shelf life for the cured product.

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