DETERMINATION OF ARAB GULF FISH QUALITY AND FRESHNESS INDICES DURING COLD STORAGE

تتبع جودة وطزاجة أسماك الخليج العربي أثناء التخزين في جو بارد

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Summary :

The results obtained through out this work declared that the freshness indices of Arabian Gulf fish were decayed markedly and its quality were decreased during cold storage period and were unacceptable after 8 days of cold storage.

The chemical analysis proved that determenation of total volatile nitrogen, total volatile bases, tyrosin value and the refractive index of the eye fluids as well as bacterial load of fish is an accurate index for evaluating fish freshness and quality as it was parallel with the organoleptic test.

Introduction :

The consuming of fish as a rich source of proteins and minerals is markedly going towards great increase all over the world.

Farber, (1952) reported that volatile bases volatile nitrogen as well as tyrosin value gave an accurate indication of fish freshness.

Moorjani et. al., (1958) studied the bases, volatile nitrogen as well as tyrosin the volatile bases content, tyrosin value and load. Hilling (1964) mentioned that volatile bases and volatil amines increased as fish quality decresed with fogel, (1953) found that when bacterial count reached $7x10^5$, the fish became enedible.

Hillig, (1964) mentioned that volatile quality decreased.

Wittfogel, (1953) found that when bacterial count reached $7X10^5$, the fish be came enedible.

Proctor et. al., (1959) noted that there were changes in the refractive index and optical density of eye fluids of stored fish.

Materials and Methods :

1. **Materials.**

Three varieties of Gulf fish were chosen for this work because of their economical in the local markets.

(a) Hamur (Epinepheleus aereolatus).

(b) Safi (Siganus oramin.

(c) Bori (Mugil dussumieri).

Cold storage.

25 Kgm. of each variety were kept in refregerator at 34—38°f. inthe first day of fishing.

Samples were taken daily for chemical and bacteriological tests for 8 days, till the fish became enedible after this period.

Organoleptic tests were carried out in the same time.

2. **Methods :**

(a) Volatile bases : Were estimated according to the method of Gagnon and Fellers, (1958) as mg/100 g. of flesh.

(b) Tyrosin value : Was determined as mentioned by Quadrat and Kuda, (1960).

(c Total volatile nitrogen : Was carried out by the method cited by Winton, (1947) expressed as mg/100 g. of flesh.

(d) Refractive index of eye fluids : Was determined as cited by Proctor et al., (1959).

(e) Bacterial load : The total count of micro organisms was carried out using total count agar midia as reported by Sharf, (1966).

(f) Organoleptic tests : The samples were examined for odor, texture and appearance and recorded as fresh or not fresh. The tests were made by persons did not know the history of the fish.

3. **Results and Discussion :**

Results obtained in Tables, 1, 2 and 3 showed that during cold storage of the Gulf fish under investigation, there were chemical changes occured for varieties of fish as well as changes in all fish freshness. Regarding the level of the volatile bases it showed a gradual increase as it was 11.6 mg/100 g. to fresh Hamur fish, 11.2 mg/100 g. of Safi fish and 10.9 mg./100 g. of Bori fish in fresh samples.

On the progress of cold storage period volatile bases raised markedly to reach 75.6 mg/100 g. of flesh to Hamur fish, 72.4 mg./100 g. and 71.6 mg/100 g. of fresh to Safi and Bori fish respectivilt, at the end of storage period that were 8 days.

The obtained results proved that there were high accumilation of ammonia bases in fish flesh during cold storage which may be a reason of fish freshness and the decrease in quality. The accumilation of volatile bases in fish flesh may be due to protein autolysis by enzymatic reactions or by bacterial hydrolysis.

Concerning the content of tyrosin values to the mentioned varieties of Gulf fish and the deterioration occured it could be seen from the same tables that tyrosin value was parallel to volatile bases as it increased in fish flesh during cold storage.

Tyrosin value to fresh Hamur was 12.4 mg./100 g. of flesh and were 12.1, and

11.8 mg/100 g. of flesh to fresh Safi and Bori fish, while, it raised after the end of storage to 86.8, 84.7 and 83.5 mg/100 g. of flesh for Hamur, Safi and Bori fish respectively.

This leeds us to suggest that during cold storage chemical and bacteriological changes happened and resulted of protein analysis and lead to the increase of tyrosin value which is an indication of protein damage. When total volatile nitrogen was estimated, it gave similar results, because it showed noticeable increase at the end of storage period. Total volatile nitrogen values were 14.6, 14.3 and 12.8 mg/100 g. of fish flesh to Hamur, Safi and Bori fish respectively. At the end of storage it remarkably increased and reached 110, 106 and 103 mg/100 g. of flesh to the same fish varieties respectively.

These results may be due to protein fragmentation that happened during cold storage and that enzymatic reactions can proceed in its hydrolytic effect on fish flesh at low temperature of refregeration. Refractive index of eye fluids was changed after cold storage, to give us a good index of freshness as it was 1.3380 to Hamur fish and changed to 1.3394 after the end of storage and was 1.3383 to Safi fish and became 1.3398 and was 1.3384 and altered to 1.3398 to Bori fish at the end of storage period because of the protein autolysis and resulted in the change of the appearance of the eyes of stored fish.

Bacterial Load :

The bacterial count was believed by many researchers to be the best of all spoilage oriteria and that it was superior to chemical tests in detecting early stage of spoilage.

Data reported in Table 4 declared the changes happened in bacterial count of Gulf fish during cold storage.

The initial bacterial count for Hamur fresh fish was $2.42X10^5$ per gram of fish, while it was $2.86X10^5$ per gram to Safi fish and was $2.72X10^5$ per gram to Bori fish. Regarding the rate of increase in bacterial count to all samples during cold storage, it was slowely at the first 2 days, then, gradual increase was noticed till the end of storage period when the samples became enedible after 8 days, as the total bacterial count increased to $7.64X10^5$ per gram of fish to Hamur, $8.25X10^5$ per gram to Safi fish and $7.75X10^5$ per gram to Bori fish.

The increasement of bacterial load caused the putrification of all samples of fish and the off odor that was noticed as the progress of storage time and the increase of bacterial load as a result of protein hyrolysis.

Organoleptic tests :

This test is considered an important test about the judgement on fish quality and freshness as well as it reflects the consumer acceptance of the stored fish.

Table 5 showed the organoleptic test of cold stored Gulf fish and the deterioration happened during that period from the view of the local consumer, and declared that cold storage decreased the fish quality of all samples, so its better to store fish at lower temperature like freezing to keep its quality and freshness as long as possible to be accepted to the consumer specially when it is needed to transfer fish for long distant specially in summer.

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TABLE No. (1) — CHANGES IN FRESHNESS INDICES OF HAMUR FISH DURING COLD STORAGE

Storage period in days	FRESHNESS INDICES			
	Volatile bases, mg/100 g.	Tyrosin value, mg/100 g.	Total volatile nitrogen, mg/100 g.	Refractive index of eye fluids.
1	11.6	12.4	14.6	1.3380
2	15.4	21.3	28	1.3381
3	22.7	35.2	43	1.3382
4	32.6	48.7	59	1.3384
5	44.2	56.4	72	1.3386
6	54.8	68.5	87	1.3388
7	65.5	78.6	100	1.3391
8	75.6	86.8	110	1.3394

TABLE No. (2) — CHANGES IN FRESHNESS INDIXES OF SAFI FISH DURING COLD STORAGE

Storage period in days	Volatile bases, mg/100 g.	Tyrosin value, mg/100 g.	Total volatile nitrogen, mg/100 g.	Refractive index of eye fluids.
1	11.2	12.1	14.3	1.3383
2	14.8	20.6	26	1.3384
3	21.5	33.7	40	1.3386
4	30.8	46.5	56	1.3388
5	42.6	55.8	70	1.3390
6	52.8	67.2	85	1.3393
7	63.7	76.4	98	1.33986
8	72.4	84.7	106	1.3398

TABLE No. (8 — CHANGES IN FRESHNESS INDICES OF BORI FISH DURING COLD STORAGE

	FRESHNESS INDICES			
Storage period in days	Volatile bases, mg/100 g.	Tyrosin value, mg/100 g.	Total volatile nitrogen, mg/100 g.	Refractive index of eye fluids.
1	10.9	11.8	12.8	1.3384
2	14.2	20.2	25	1.3385
3	20.7	32.6	38	1.3387
4	30.2	46.2	53	1.3389
5	41.8	54.6	68	1.3391
6	51.2	66.7	83	1.3394
7	62.4	75.3	96	1.3396
8	71.6	83.5	103	1.3398

TABLE No. (4) — THE BACTERIAL COUNT INCREASE OF GULF FISH AND BORI DURING COLD STORAGE

Storage period in days	GULF FISH		
	Hamur	Safi	Bori
1	$2.42X10^3$	$2.86X10^3$	$2.72X10^3$
2	$5.35X10^3$	$5.75X10^3$	$5.40X10^3$
3	$7.22X10^3$	$8.23X10^3$	$7.68X10^3$
4	$1.36X10^4$	$2.45X10^4$	$1.84X10^4$
5	$6.58X10^4$	$7.75X10^4$	$7.25X10^4$
6	$9.75X10^4$	$1.55X10^5$	$1.12X10^5$
7	$3.25X10^5$	$4.28X10^5$	$3.72X10^5$
8	$7.64X10^5$	$8.25X10^5$	$7.75X10^5$

TABLE No. (5) — ORGANOLEPTIC TESTS OF GULF FISH, HAMUR, SAFI DURING COLD STORAGE

Storage period in days	Organoleptic Tests
1	Very fresh, gills red, body rigid, eyes bright and clear, fish sink in water.
2	Fresh, rigor mortis passed off, gills red eyes clear.
3	Acceptable, gills redish brown, eyes clear.
4	Acceptable, very slightly off odor to Safi fish than Hamur and Bori.
5	Very slightly stale, slightly off odor to all varieties of fish, eyes opalescent, lost brilliancy.
6	Slightly Stale, gills brown, off odor, body flabby.
7	Stale, Slight redness along the bone, eyes sunken doubtful acceptability, Safi enedible.
8	Gills brown yellowish, smell stale and sour, eyes gray, redness along the bone, eyes sunken, body flabby, fish float in water, unacceptable enedible to all varieties of Gulf fish.

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