Effect of Corn Oil on the Quality and Storage Stability of Pickled Fish

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The results of preparing fish pickles using corn oil and gingili oil are reported. Results showed that the pickle made using corn oil and acetic acid was superior in keeping quality, taste and texture than the pickle prepared using gingili oil and acetic acid. In addition the production of alpha amino nitrogen and free fatty acid during storage was found to be much less in corn oil and acetic acid treated pickle.

Pickling fish with salt, acetic acid and spices, forms a method of fish preservation. Gingili oil is commonly used for frying as well as for pickling fish commercially. Vasavan & Varma (1959) reported their experiments on pickling fish with gingili oil, vinegar and Malabar tamarind. Corn oil is reported to contain significant amounts of essential fatty acids (EFA) and poly unsaturated fatty acids (PUFA) which are reported to exert a hypocholesterolemic effect on human beings (Stansby, 1982). However, corn oil is not used in the preparation of fish pickles. The present paper reports the results of the experiments carried out on the effect of corn oil on the quality of fish pickle. Since different oils may have varying effects on shelf life, flavour and taste it is useful to study how far each oil affects the quality of pickles.

Materials and Methods

Fish used for the studies was pulli kalava *(Epinephelus* spp.). The fish was divided into two lots. One lot of fish was fried in refined gingili oil and the other lot was fried in refined corn oil and processed into pickles using acetic acid and spices.

The method and recipe of pickles were as suggested by Vijayan *et al.* (1982), the only change being the type of oil used for frying the fish and layering at top. The pickle obtained with corn oil and acetic acid was designated B and the other A.

After mixing together all the ingredients the pickle was left to mature for two days and then packed in clean dry bottles and sealed air tight with acid proof caps. While packing care was taken to prevent the exposure of meat for which a layer of oil was always ensured at the top covering solids. The products were stored for a period of six months at room temperature and samples were drawn every month for examination.

Moisture, ash and total nitrogen were estimated by the AOAC method (1980). Trichloracetic acid extract of homogenised pickle was prepared according to Umbriet & Burris (1959). α-amino nitrogen and total volatile nitrogen were determined using the TCA extract, according to Pope and Stevens (1939) and Beatty & Gibbons (1937) respectively. Total lipids were extracted from the pickled fish muscle by the method of Bligh &

Dyer (1959). Free fatty acids were estimated according to Dyer & Morton (1956). Peroxide value was determined on a portion of the total lipid by the AOAC (1980) method. For determination of pH a representative sample of 10 g including meat and gravy was taken and made into a paste. This paste was diluted with water in the ratio 1:2 and the pH of the resulting solution was measured using a digital pH meter.

The total plate count is determined by the method of IS: 5402 (1969) and yeast and mold count by method of IS: 5403 (1969).

The organoleptic quality of the pickle was evaluated by a panel consisting of 10 experienced members and the quality characteristics considered for the pickle were colour, texture, odour and taste. The scoring was done according to Swaminathan (1979).

Results and Discussion

The organoleptic scores for the two types of pickles in relation to storage period are shown in Table 1. It showed that the colour, texture, odour and taste of the products were good at the beginning of the storage period. After one month the taste and texture of product B showed considerable improvement.

Corn oil is reported to be highly stable against oxidation during frying due to the presence of significant amounts of tocopherol and ferulic acid (Swern, 1979). This property can reduce polymerisation of the oil on frying. Consequently the fried fish will be hard initially but on subsequent soaking in aqueous acidic medium it will become soft. Other frying oils due to low level of such antioxidant components may

Table 1. *Organoleptic scores*

Storage period	Treatment	Colour score	Texture score	Odour score	Taste score
0 day	A	34	26	22	30
	B	36	27	36	28
1 month	A	31	26	30	30
	B	33	34	35	40
2 months	A	31	26	31	30
	B	32	35	35	36
3 months	A	28	25	29	28
	B	30	30	33	33
6 months	A	30	23	32	31
	B	32	29	31	32
Mean score	A	30.8 ± 1.118	25.2 ± 1.206	30.8 ± 1.179	29.8 ± 1.545
	B	32.6 ± 1.118	31.2 ± 1.206	34.0 ± 1.179	33.8 ± 1.545
Critical difference		3.1002	3.3433	3.2685	4.2828

A = Gingilli oil with acetic acid; B = Corn oil with acetic acid

Key to score: Excellent 5; Very good 4; Good 3; Fair 2; Poor 1; Very poor 0; Maximum score 5

Table 2. *Chemical indices of spoilage*

Storage period	Treatment	pH of pickle	pH of muscle	TVN mg/100g	Alpha amino nitrogen mg/100g	Peroxide value N/500 thiosulphate per g fat	Free fatty acid, as oleic acid %
0 day	A	4.26	4.20	5.98	129.91	2.076	2.47
	B	4.20	4.05	5.85	107.59	3.530	0.74
1 month	A	4.29	4.27	8.20	149.33	8.45	4.07
	B	4.43	4.36	8.00	177.33	3.94	0.98
2 months	A	4.27	4.26	8.59	641.93	7.73	8.69
	B	4.38	4.36	9.28	323.72	4.00	1.52
3 months	A	4.22	4.20	22.63	779.02	9.81	8.376
	B	4.25	4.28	13.91	363.88	5.00	1.490
6 months	A	4.25	4.21	26.00	840.00	10.54	17.150
	B	4.51	4.25	23.33	373.33	7.19	2.54
Mean score	A	4.258 ± 0.090	4.228 ± 0.087	14.28 ± 2.018	508.038 ± 108.543	7.727 ± 0.695	8.1512 ± 0.729
	B	4.554 ± 0.090	4.460 ± 0.087	12.074 ± 2.018	269.17 ± 108.543	4.732 ± 0.695	1.454 ± 0.729
Critical difference		0.24854	0.25088	5.5949	300.867	1.9509	2.0225

A=Gingili oil with acetic acid; B=Corn oil with acetic acid

Table 3. *Microbiological analysis*

Storage period	Treatment	Total bacterial count/g	Total mold count/g
0 day	A	1.85×10^2	0
	B	2.16×10^2	0
1 month	A	2.12×10^2	0
	B	2.44×10^2	1
2 months	A	4.12×10^2	0
	B	2.77×10^2	14
3 months	A	3.87×10^2	7
	B	2.98×10^2	31
6 months	A	4.48×10^2	38
	B	3.35×10^2	47
Mean score	A	3.288 ± 0.992	0.62355 ± 0.180
	B	2.740 ± 0.992	1.666 ± 0.180
Critical difference		2.5565	0.3273

A = Gingili oil with acetic acid
B = Corn oil with acetic acid

polymerise significantly on frying and this polymerised oil will keep the fried material resistant to water and acid keeping its tough texture. This may be the cause for softening of corn oil fried fish on pickling and storage. After 6 months storage the product B was superior in organoleptic qualities to product A and was significant at 5% level. The colour of the pickle B was also better compared to A.

The changes in biochemical characteristics of pickles during storage at room temperature are given in Table 2. There was no appreciable change in pH of the pickle during storage and throughout the entire storage period pH remained between 4 and 5. Steady increase in TVN and α amino nitrogen were found during storage. High values of α - amino nitrogen may be due to the acid hydrolysis of fish protein.

However the amounts of α -amino nitrogen and TVN formed were more in sample A than in B, the level of former being more than double than that in B. α - amino nitrogen is an index of the extent of protein hydrolysis and this wide difference in α - amino nitrogen formed is indicative of the protein protective effect of corn oil or the catalytic effect of gingili oil on proteolysis.

Peroxide values also increased considerably during storage but no ancid flavour was detectable throughout storage period. The extent of FFA formed also showed significant difference (Table 2). In sample A the amount of FFA increased by seven fold while it was only three fold in B. FFA is indicative of lipid hydrolysis and hence corn oil appears to retard lipolysis.

Thus, of the two products compared, corn oil with acetic acid gave a better product than gingili oil with acetic acid and the significant difference was above 5% in most of the indices.

The results of the microbiological evaluation of the products are presented in Table 3. The changes in the bacterial and mould counts were not significant. The total plate count of the two products did not show any significant difference. Eventhough in the first month, product B showed a slight higher level of bacterial count compared to product A, during the subsequent storage the total plate count of product A increased to 4.48×10^2 compared to 3.35×10^2 of product B. There is a gradual increase in total count with storage time. This increase in the total count may be due to the presence of acidophilic bacteria in the sample. However in both products the total plate count remained much less than the permitted level.

In product A moulds started appearing only during the third month whereas in product B it appeared during first month and showed a gradual but slow increase. These changes also were not very significant. Neither samples showed any visible fungal growth or decomposition even after 6 months' storage.

It can be seen that both the treatments are effective in producing quality pickles from fish. However, the deteriorative changes on storage were minimum in corn oil and acetic acid treated pickles. Moreover the bacterial count was also less in corn oil treated sample. The results also clearly reveal the remarkable capacity of corn oil to minimise the proteolysis and lipolysis of the pickled fish.

The authors are thankful to Dr. M.J. Sebastian the Dean, College of Fisheries for his keen interest and encouragement in this work.

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