

Effect of Fruit Juices with Acetic Acid on the Quality and Storage Stability of Pickled Fish

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The results of pickling fish with fruit juices and acetic acid in comparison with acetic acid alone are reported. Tamarind juice, lime juice and gooseberry juice were tested for their pickling effect along with acetic acid. The biochemical and microbiological qualities of all the experimental samples remained good throughout the 6 months of study. The pickles prepared with tamarind juice along with acetic acid were superior to other pickles in colour, taste and texture. The pickle prepared using gooseberry juice and acetic acid was poor and unacceptable.

Pickling is one of the oldest methods of preserving food materials. Even though initially formulated to preserve vegetable products, pickling is today widely used as a method of preserving ready to eat products from fish and meat. A careful observation of the formulary and preparation of most of these pickled products reveals that they largely rely on methods developed on a trial and error basis. There are very effective and time tested procedures for pickling fish and shell fish (Balachandran & Muraleedharan, 1975; Vijayan *et al.*, 1982; Devadasan *et al.*, 1975), but still the chances for a better method cannot be ruled out.

In pickling the preservation is provided by salt and acid ingredients. Most often acetic acid and common salt are used for this purpose. Certain organic acids like propionic acid, tartaric acid, citric acid, ascorbic acid etc. can bring about similar preservation effect. These acids are widely distributed in nature in fruits and berries. If the juices of these fruits are incorporated they will not only provide the preservative effect due to their acidity but also impart suitable and delicate tastes to the pickled product. The present paper reports the result of a study on the effect of various

fruit juices and acetic acid on the quality and shelf life of pickled fish.

Materials and Methods

Fish used for this experiment was Pulli Kalava (*Epinephelus* spp.) with an average weight of 3 kg and was fully matured. The fish was cleaned well, cut into small pieces and fried in refined gingeli oil at 160-180°C till the pieces floated. The fruit juices used were lime, gooseberry and tamarind. The juice was extracted with the help of hand operated juice extractor. Tamarind juice was prepared by extracting tamarind pulp with boiled and cooled water in 1:1 proportion. All juices were filtered through a sieve before incorporation.

The method and composition for pickling were as suggested by Vijayan *et al.* (1982), the only change being the addition of fruit juice and vinegar in the ratio 1:1 instead of vinegar alone. A control pickle was also prepared with vinegar. The experimental samples contained 200 ml fruit juices and 200 ml acetic acid and the control sample contained 400 ml acetic acid.

After mixing together all the prepared ingredients the pickle was left to mature

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for 2 days and packed in clean dry bottles with a thin top layer of heated and cooled gingeli oil and sealed air tight with acid proof caps. The products were stored over a period of six months at room temperature and samples were drawn monthly and organoleptical, bacteriological and chemical analysis were carried out.

Moisture, ash and total nitrogen were estimated by the AOAC method (1980). TCA extract of homogenised pickle was prepared according to Umbriet and Burris (1959). α amino nitrogen was determined according to Pope and Stevens (1939) and total volatile nitrogen was determined according to the method of Betty and Gibbons (1937). Total lipids were extracted from the pickled fish muscle by the method of Bligh and Dyer (1959). Peroxide value of extracted lipids was determined according to AOAC (1980). For determination of pH a representative sample of 10 g including meat, oil, spices etc was ground thoroughly to a smooth paste, diluted with 20 ml water and the pH of the resulting solution was measured using a digital pH metre.

The Indian standard method for total plate count (TPC) of bacteria in food stuffs (IS:5402-1969) and the Indian standard method for yeast and mould count of food stuffs (IS:5403-1969) were followed to determine the microbiological quality of the pickles. Sabouraud's Dextrose agar (pH 3.5) was used to determine yeast and mould count.

The organoleptic quality of the pickles was evaluated by a taste panel of 10 members and the scoring was done according to Swaminathan (1979).

Results and Discussion

The fish used for the studies contained moisture 79.3%, fat 0.8%, protein 18.8% and ash 0.6%. The changes in chemical and bac-

teriological parameters of the pickled products during storage at room temperature are given in Table 1. There were no appreciable changes in pH of the pickles during storage and throughout the experiment the pH of the pickle remained below 4.5. However there was a steady increase of total volatile nitrogen (TVN) and α amino nitrogen which might be due to the slow hydrolysis of fish protein under acidic pH. These changes were highest in product B. Peroxide value also increased during storage but no rancid flavour was detectable. The changes in bacterial counts were marginal in all the products. The total mould count showed an increase with storage time. But even after 6 months storage there was no visible fungal growth on the pickles or any appreciable difference in the taste. Further the TPC and total mould count remained within permissible limits as per ISI standards. (IS:5402 & IS:5403, 1969).

The organoleptic scores obtained by the taste panel during storage of the pickles are shown in Table 2. The colour, flavour and texture of the product C was better than product A (control), B & D. Initially the texture was hard but after 6 months storage the texture was very soft. The product D was dark in colour and the texture and odour was not very good. The taste was unpleasant due to the bitterness of gooseberry. At the end of 6 months storage no rancid odour was observed in any of the samples. Among the four samples product C (tamarind juice mixed with acetic acid) was the best in appearance, texture, odour and taste. The colour, odour and taste of products A & B were almost same except texture. The presence of taste producing components in tamarind juice may be the reason for the significant improvement in deliciousness of C compared to products with lime juice as well as vinegar.

Table 1. *Changes in chemical and bacteriological parameters of fish pickles during storage*

Storage period, months	Treatment	pH of the pickle	TVN mg/100 g	α - amino nitrogen, mg/100 g	Peroxide value, N/500 thiosulfate/g of fat	Total plate count/g	Total mould count/g
0	A	4.26	5.98	129.91	2.076	1.85x10 ²	0
	B	4.16	5.91	129.99	3.330	2.57x10 ²	0
	C	4.42	8.97	86.40	6.320	2.06x10 ²	0
	D	4.52	8.66	64.99	7.692	1.56x10 ²	0
1	A	4.29	9.20	149.33	8.48	2.12x10 ²	0
	B	4.18	12.00	149.33	9.92	4.40x10 ²	12
	C	3.87	16.66	121.33	12.91	3.72x10 ²	10
	D	4.42	18.00	116.55	8.95	2.32x10 ²	0
2	A	4.27	8.59	641.93	7.73	4.12x10 ²	0
	B	4.13	23.28	637.84	10.67	6.43x10 ²	57
	C	4.01	21.86	344.18	10.48	4.41x10 ²	63
	D	4.42	19.30	372.09	9.13	3.41x10 ²	63
3	A	4.22	22.63	779.02	9.81	3.87x10 ²	7
	B	4.10	27.94	666.58	9.28	11.34x10 ²	94
	C	4.10	27.84	413.32	11.14	4.64x10 ²	182
	D	4.35	23.22	867.99	11.31	3.77x10 ²	158
6	A	4.25	26.00	840.00	10.54	4.48x10 ²	38
	B	4.07	39.66	1073.33	9.98	13.49x10 ²	143
	C	4.00	32.66	560.00	11.34	5.33x10 ²	312
	D	4.31	28.66	896.66	12.02	4.61x10 ²	296
Mean Value	A	4.258±0.023	14.28±8.310	508.038±307.639	7.727±2.998	3.288±1.085	9.00±14.751
	B	4.128±0.040	21.758±11.894	531.214±355.001	8.636±2.689	7.646±4.137	61.20±52.822
	C	4.080±0.185	21.598±8.310	305.046±178.781	10.318±2.083	4.032±1.112	113.4±118.524
	D	4.404±0.072	19.658±6.596	463.656±357.430	9.820±1.601	3.134±1.077	103.4±112.331
Critical difference		0.0159	5.5949	300.867	1.951	2.5565	0.3273

A = Acetic acid; B = Lime juice & Acetic acid; C = Tamarind Juice & Acetic acid; D = Gooseberry juice & Acetic acid

Table 2 *Changes in organoleptic quality of the pickles during storage*

Storage period, months	Treatment	Colour	Texture	Odour	Taste
0	A	34	26	32	30
	B	36	28	31	32
	C	40	36	35	31
	D	13	24	24	18
1	A	31	26	30	30
	B	31	30	30	30
	C	37	33	39	37
	D	13	24	23	19
2	A	31	26	31	30
	B	32	31	27	30
	C	35	28	35	38
	D	12	24	22	17
6	A	28	25	29	28
	B	31	31	29	30
	C	33	24	34	35
	D	12	18	19	15
6	A	30	24	32	31
	B	30	30	30	32
	C	32	30	31	38
	D	9	20	21	13
Mean Score	A	30.8±1.939	25.4± 0.80	30.8±1.166	29.8± 0.980
	B	31.1± 2.638	29.6±1.020	29.4±1.356	30.8± 0.980
	C	35.4±2.871	30.2± 4.118	34.8±2.561	35.8±2.638
	D	11.8±1.470	22.0±2.530	21.8±1.720	16.4±2.154
Critical difference		3.1002	3.3433	3.2685	4.2828

Key - colour - Maximum	Score 50	Excellent - 50; Very good - 40-49; Good - 30-39; Fair - 20-29
Texture - "	50	Poor - 10-19; Very poor - 0-9,
Odour - "	50	Significant at 5% level
Taste - "	50	

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