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Preservation of Gherkin (*Cucumis anguria* L.) in Brine

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ABSTRACT

An experiment on Gherkin (*Cucumis anguria* L.) was carried out during 2007 and 2008 at Post Harvest Technology Laboratory and Department of Horticulture, College of Agriculture, Rajendranagar, Hyderabad to study the effect of different concentrations of brine on the preservation of gherkin. The study revealed that, fruits preserved in twelve per cent brine recorded highest total sugar content and ascorbic acid content and were found to be superior organoleptically in terms of colour, flavour, texture and overall acceptability. Maximum pH and minimum acidity of the brine solution were recorded with higher concentration of brine (12 per cent). Lower concentrations of brine below 8 per cent resulted in fading of the natural colour of fruits and lowered the acceptability of the product. There was a gradual decrease in the pH of the brine solution, total sugar content and ascorbic acid content of fruits as the storage period advanced, whereas the acidity of the brine solution increased with increase in days of storage.

Key words : Brine, Concentration, Gherkin, Preservation, Quality, Shelf life.

Gherkin (*Cucumis anguria* L.) (2n=24), commonly called as 'pickling cucumber', is an important cucurbitaceous vegetable crop. It is a monoecious annual, trailing or climbing vine, which branches freely with slender, rough hairy, angled stems and tendrils. The leaves are 3 to 5 angled, shallow lobed with acute sinuses and 7 to 15 cm in length. The fruits are 3 to 5 cm in length and oval to oblong in shape and borne on long slender stalks. They are light green and turn yellowish when fully matured with or without spiky surface covered with long sharp glistering hairs. The flesh is greenish in colour with many seeds. Seeds are small, white, smooth, 3 to 5 mm long. The immature fruits are used for the preparation of pickles, eaten as a cooked vegetable and are used in curries (Purseglove, 1969). The fruits and seed possess cooling properties. The fruit is also used as an astringent and antipyretic. The seed oil is used as antipyretic. Fruits are good for people suffering with constipation, jaundice and indigestion. Gherkins pickled in brine are a favourite lunch substitute in West. It is commonly grown in USA, Australia and Srilanka and was introduced in India during late eighties for export oriented production (Anon, 1975).

Brining with or without fermentation is a low cost method of preservation of vegetables (Sethi, 1990). In many European and Western countries storage of fermented pickling cucumbers in brine solution for subsequent usage in preparation of various pickled products such as hamburger slices, relishes etc., has become a generally adopted commercial practice (Etchells *et al*., 1974). In USA, about 40-60 per cent of the pickling cucumbers are converted into salt stock pickles by natural fermentation (Etchells *et al*., 1974; Fleming, 1984). The present investigation was conducted to find out optimum concentration of brine for preserving gherkin.

MATERIAL AND METHODS

The field experiment was taken up during April 2007 to December 2008 at Students Farm, College of Agriculture, ANGRAU, Rajendranagar, Hyderabad. The present investigation was conducted in the Post Harvest Technology Laboratory and Department of Horticulture, College of Agriculture, Rajendranagar, Hyderabad. The experiment was designed in completely randomized design with factorial concept and each treatment

was replicated thrice. Brine solutions of different concentrations (4%, 6%, 8%, 10% and 12%) were studied along with a control for their efficacy in preserving gherkins. Same treatments were repeated for destructive sampling, for physiological and biochemical studies and the experiment was conducted twice for confirmation of the results.

Four grams of Sodium Chloride (NaCl) was dissolved in 100 ml of distilled water to get 4 per cent brine solution. Similarly 6, 8, 10 and 12 grams of salt was dissolved in 100 ml of distilled water to get brine of respective concentration. While in case of control, the fruits were stored in only distilled water. $CaCl_2$ (0.2 per cent) was added to all the treatments including control. The fruits (5 cm in length) were arranged in 500 ml glass jars containing brine solutions. The jars were hermatically closed and stored at ambient temperature. Observations on pH of the brine solution, acidity of the brine solution (%), total sugar content of the fruits (%) and ascorbic acid content of the fruits (mg/100g) were recorded at seven days interval whereas organoleptic scores on colour, flavour, texture and overall acceptability were recorded at monthly interval. The data were subjected to statistical analysis as per the procedure outlined by Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

Brining is one of the oldest methods of preservation and many vegetables can be preserved by this technique. Commercial bulk storage of vegetables by brine with or without fermentation has long been in practice in several countries as a low energy means of storage (Fleming and Mc Feeters, 1981).

The data on pH of brine solution of gherkin as affected by different concentrations of brine are presented in table 1. Decreasing trend was observed in pH of brine solution during fermentation. This may be due to production of organic acids like lactic acid by fermenting organisms such as *Lactobacillus plantarum*. Changes in pH is mainly due to changes in the amount of bound cations like Ca^{2+}, Mg^{2+}, Na^{+} and K^{+} in middle lamella and the results are in conformity with Buescher and Hudson (1986). Among the treatments, significantly maximum pH (4.37) was recorded with 12 per cent brine.

The per cent acidity of brine solution increased during fermentation from 0.38 to 0.96 on 28th day (Table 1). It decreased with increased concentration of NaCl with 12 per cent brine recording the lowest (0.40). Increase in acidity during fermentation might be due to production of organic acids by fermenting organisms like *Lactobacillus plantarum* which also helps in arresting the undesirable fermentation (Alian *et al*., 1974). Koli and kulkarni (1973) also reported increase in acidity of brine solution during fermentation of cucumbers and the present findings are in agreement with these earlier reports.

The changes in total sugar content of gherkin as influenced by different concentrations of brine are presented in table 2. There was a significant decline in the total sugar content during storage i.e. from 7th day (1.80%) to 28th day (0.32%). There were significant differences among the treatments also. Maximum total sugar content (1.26 %) was recorded with 12 per cent brine and the minimum (0.80%) with 4 per cent brine and control. This may be due to arrest of excess fermentation by undesirable microorganisms at higher salt concentrations. After fermentation, the total sugar content decreased irrespective of treatments. Sugar content of fruits acts as substrate for the fermentation causing organisms which might have resulted in reduction in total sugar content during storage. Alian *et al*., (1974) also observed similar results.

The data on changes in ascorbic acid content of gherkin during storage is presented in table 2. With the increase in the storage period, there was a significant decrease in ascorbic acid content. It decreased from 5.51 to 4.08 on 28th day of storage. Among the treatments, maximum ascorbic acid content (5.40) was recorded with 12 per cent brine. Use of higher salt concentration helps in retention of ascorbic acid content of fruits by reducing its degradation as reported by Sistrunk and Kozup (1982).

The results related to organoleptic score are presented in tables 3 and 4. There was a decline in the organoleptic score (colour, flavour, texture and overall acceptability) with the advancement of storage over a period of 90 days. It was observed that fruits preserved in 12 per cent brine were superior in terms of colour, flavour, texture and hence overall acceptability to the consumer. It might be due to desirable fermentation with the arrest of activity of spoilage organisms and softening

Table 1. Effect of different concentrations of brine on the pH and acidity (%) of brine solution during preservation of gherkin.

Treatments	pH					Acidity (%)				
	Days					Days				
	7	14	21	28	Mean	7	14	21	28	Mean
T_1 - 4 % Brine	4.00	3.67	3.41	3.22	3.58	0.50	0.84	1.08	1.12	0.89
T_2 - 6 % Brine	4.05	3.69	3.48	3.29	3.63	0.44	0.80	1.00	1.07	0.83
T_3 - 8 % Brine	4.10	3.89	3.65	3.44	3.77	0.40	0.76	0.98	1.02	0.79
T_4 - 10 % Brine	4.25	3.92	3.75	3.62	3.89	0.25	0.44	0.60	0.78	0.52
T_5 - 12 % Brine	5.05	4.20	4.15	4.08	4.37	0.18	0.35	0.47	0.59	0.40
T_6 – Control	4.00	3.68	3.40	3.21	3.57	0.51	0.80	1.10	1.15	0.89
Mean	4.24	3.84	3.64	3.48		0.38	0.67	0.87	0.96	
	S.Em±		CD (0.05)			S.Em±		CD (0.05)		
Days (D)	0.029		0.082			0.029		0.083		
Treatments (T)	0.035		0.100			0.036		0.102		
D×T	0.071		0.201			0.072		0.204		

* All the treatments were treated with 0.2% $CaCl_2$

Table 2. Effect of different concentrations of brine on total sugar content (%) and ascorbic acid content (mg/100g) in gherkin fruits during preservation.

Treatments	Total sugar content (%)					Ascorbic acid content (mg/100g)				
	Days					Days				
	7	14	21	28	Mean	7	14	21	28	Mean
T_1 - 4 % Brine	1.71	1.01	0.30	0.19	0.80	5.41	4.85	4.36	3.68	4.58
T_2 - 6 % Brine	1.76	1.12	0.43	0.22	0.88	5.43	4.94	4.44	3.74	4.64
T_3 - 8 % Brine	1.80	1.22	0.60	0.35	0.99	5.50	5.03	4.62	4.01	4.79
T_4 - 10 % Brine	1.87	1.37	0.82	0.40	1.12	5.59	5.23	4.90	4.40	5.03
T_5 - 12 % Brine	1.94	1.50	1.03	0.57	1.26	5.72	5.53	5.33	5.00	5.40
T_6 – Control	1.70	1.00	0.30	0.18	0.80	5.40	4.87	4.33	3.65	4.56
Mean	1.80	1.20	0.58	0.32		5.51	5.08	4.66	4.08	
	S.Em±		CD (0.05)			S.Em±		CD (0.05)		
Days (D)	0.029		0.082			0.029		0.083		
Treatments (T)	0.035		0.100			0.036		0.102		
D×T	0.071		0.201			0.072		0.204		

* All the treatments were treated with 0.2% $CaCl_2$ [At 0^{th} day, fruits contain 2.25 % total sugar content and 5.89 mg/ 100g ascorbic acid content].

Table 3. Effect of different concentrations of brine on colour and flavour of gherkin fruits during preservation

Treatments	Colour				Flavour			
	Days				Days			
	30	60	90	Mean	30	60	90	Mean
T_1 - 4 % Brine	8.00	6.50	4.50	6.33	8.00	5.50	3.50	5.67
T_2 - 6 % Brine	8.00	7.00	5.00	6.67	8.50	6.00	4.50	6.33
T_3 - 8 % Brine	8.00	7.50	5.50	7.00	8.50	6.00	4.50	6.33
T_4 - 10 % Brine	8.50	7.50	5.50	7.17	9.00	7.50	5.00	7.17
T_5 - 12 % Brine	10.00	8.50	6.50	8.33	10.00	8.50	6.50	8.33
T_6 – Control	8.00	6.50	4.50	6.33	8.00	5.50	3.50	5.67
Mean	8.42	7.25	5.25		8.67	6.50	4.58	
	S.Em±	CD (0.05)			S.Em±	CD (0.05)		
Days (D)	0.087	0.250			0.084	0.242		
Treatments (T)	0.107	0.306			0.103	0.297		
D×T	0.213	0.612			0.207	0.593		

* All the treatments were treated with 0.2% $CaCl_2$

Table 4. Effect of different concentrations of brine on texture and overall acceptability of gherkin fruits during preservation.

Treatments	Texture				Overall acceptability			
	Days				Days			
	30	60	90	Mean	30	60	90	Mean
T_1 - 4 % Brine	8.00	6.50	4.50	6.33	8.00	6.50	4.00	6.17
T_2 - 6 % Brine	8.00	7.00	5.00	6.67	8.00	6.50	4.00	6.17
T_3 - 8 % Brine	9.00	7.00	5.50	7.17	8.50	7.50	5.00	7.00
T_4 - 10 % Brine	9.00	7.50	5.50	7.33	9.00	7.50	5.50	7.33
T_5 - 12 % Brine	10.00	8.50	6.50	8.33	10.00	8.50	6.50	8.33
T_6 – Control	8.00	6.00	4.00	6.00	8.00	6.50	4.00	6.17
Mean	8.67	7.08	5.17		8.58	7.17	4.83	
	S.Em±	CD (0.05)			S.Em±	CD (0.05)		
Days (D)	0.085	0.246			0.085	0.243		
Treatments (T)	0.106	0.301			0.104	0.298		
D×T	0.210	0.602			0.208	0.596		

* All the treatments were treated with 0.2% $CaCl_2$

enzymes. Lower concentrations of brine and control resulted in fading of the natural colour of fruits and lowered the acceptability of the product due to more activity of spoilage organisms and softening enzymes. Similar findings were observed by Breene *et al*. (1973), Taha *et al*. (1976) and Fleming *et al*. (1987).

Thus, fruits preserved in 12 per cent brine were found to be organoleptically superior in terms of colour, flavour, texture and overall acceptability and decrease in salt concentration reduced acceptability of the fruits.

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