IMPACT OF PROCESSING METHODS ON QUALITY OF CAULIFLOWER PICKLE

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ABSTRACT

The research work was accomplished for the exploration of appropriate method of pickling of cauliflower. The study also implies the prospects of processing and preservation of cauliflower. The study was concerned with 3 samples for preparing the pickling of cauliflower and self-life quality of cauliflower pickles were analyzed for proximate composition, microbiological status, sensory attributes and overall storage stability. Fresh cauliflowers were processed in sugar, oil and various types of spices. The proximate composition of fresh cauliflowers were moisture content 92.3%, ash 0.8%, fat 0.1% and vitamin-C 46mg/100gm. But the chemical analysis of developed pickles showed that moisture content varied from 45.20%-52.06% for pickle of sugar, oil and salt. Sugar and salt were resulted the losses in moisture content were observed in all the samples. Vitamin-C decreased in all the samples. The microbiological studies revealed that total viable counts (bacteria, yeast and mold) were high in pickles processed in sugar and were low processed in oil and salt respectively. The panelists tested the products and assigned marks for color, flavor, texture and overall acceptability. The test score indicated that among three samples, the pickle processed in sugar (sample-1) was the most acceptable storage studies were carried out for up to 6 month at room temperature (27°C) at an interval of 1 month up to first 2 months and at an interval of 2 months for the consecutive 4 months. All the pickles became softer with the passing time.

Key words: Cauliflower pickle, processing, preservation,

INTRODUCTION

Cauliflower (*Brassica oleracea botrytis*) is an important vegetable crop which belongs to the family *Brassicaceae* and is grown in many countries. Cauliflower is generally used as cooked vegetable either singly or mixed with potato, carrot, and peas. In raw form, it is also mixed with green salad or its pieces are dipped into sauces. It is also used in the preparation of pickle or mixed pickle with other vegetables (Sharma *et al.* 2005). Cauliflower is nutritious, and may be eaten cooked, raw or pickled. Preserved foods are found as a significant component of diets for populations in the highly industrialized nations. As a result, people are leaving the farm areas and moving into the zones where industrial opportunities and the possibilities for a better life exist. Commercial food preservation improves food supplies.

There are a number of methods for the preservation of perishable items. Pickling is one of them. Though the preservation of vegetables and fruits in pickled form began as a household art. Pickles can be obtained by plain immersion of raw, blanched or pre-cooked pieces (or entire portion) of vegetables in aqueous solution of food grade organic acids (e.g. acetic, citric, or lactic acid). Fermented vegetables (including vegetable pickles) have a great importance in Europe as does fermented meat (Kato *et al.* 1994; Katsaras and Dresel 1994). At present most of the world's supply of pickles is produced in commercial plants. When any food (fruits, vegetables, fish or meat) is preserved by natural salt or vinegar or oil or spices, then the processed food is called pickles. Pickles are widely acceptable and usable food item in Bangladesh as well as over the world.

Pickles are generally consumed by everyone whether a child or old, a labour, or a rich man. The pickle makes the dish or food taste better. The pickle generally acts as appetizer. The assimilation of gastric is better thereby improving the digestion. The

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pickles production on commercial scale is quite expensive. Pickles can be classified based on the taste of the final product obtained (Binsted *et al.* 1962): sour, sweet and dills pickles. Keeping these views in consideration, the study was carried out with the following objectives: i) to prepare cauliflower pickles with different recipes, ii) to determine the proximate composition (moisture, ash, protein, fat and vitamin-C) of fresh cauliflower and cauliflower pickles, and iii) To assess the overall acceptability of the processed pickles.

Table 1. Recipe of Cauliflower Pickle

Ingredients	Sample -1	Sample -2	Sample -3
Cauliflower (g)	500	500	500
Salt (g)	75.0	75.0	75.0
Ginger (g)	12.0	11.0	12.0
Onion (g)	25.0	25.0	25.0
Garlic (g)	5 .0	5 .0	5.0
Red chili (g)	7.0	6 .0	7.0
Turmeric (g)	5.0	5.0	6.0
Cinnamon (g)	5.0	4.0	3.0
Black peeper (g)	5.0	5.0	5.0
Cardamom (g)	5.0	5.0	5.0
Cumin (g)	5.0	4.0	6.0
Aniseed (g)	5.0	6.0	6.0
Clove (g)	3	3	3
Tarmarind pulp (g)	25.0	25.0	20.0
Mustard (g)	25.0	25.0	25.0
Vinegar (ml)	55.0	55.0	55
Mustard oil (ml)	200	200	200
Sugar (g)	50.0	49.0	48.0

MATERIALS AND METHODS

The study was conducted in the laboratory of the Department of Food Engineering & Technology of the Faculty of Agro-Industrial and Food Process Engineering, Hajee Mohammad Danesh Science and Technology University, Dinajpur, Bangladesh.

The fresh cauliflower and other raw materials were collected from local market. The glass bottles and other chemicals of laboratory stock required for processing of products were used.

Fresh cauliflower was washed properly. These were cut into 2.5 cm long pieces. Then these were fried at 70º-75ºC for 5-10 minutes. After frying with spices

and with other ingredients, pickles were stored in the bottle and jars.

Chemical analysis:
The raw and processed samples were analyzed for moisture, ash, titrable acidity, pH, total soluble solids and peroxide value. All the determinations were done in triplicate and the results were expressed as mean value.

Microbiological Examination
For total viable count of microorganism present in cauliflower pickles, standard plate count method was followed according to the method. Test and mould count of cauliflower pickles was done according to the method as described in the recommended method for the Microbiological Examination APHA (2005).

Sensory evaluation
The consumer's acceptability of developed pickles was evaluated by a taste-tasting panel. The hedonic rating test was used to determine this acceptability. The panelists were selected from the teachers, students and lab attendant of the faculty of Agro-Industrial and Food Process Engineering, Hajee Mohammad Danesh Science and Technology University, Dinajpur. Samples were served to the panelists and were asked to assign appropriate score for characteristics color, flavor, texture and overall acceptability of processed cauliflower pickles. The scale was arranged such that: 9= Like extremely, 8= like very much, 7= like moderately,　6= like slightly, 5=neither like nor dislike,
4= dislike slightly, 3=dislike moderately, 2= dislike very much, 1= disk like extremely.

Storage studies
The pickles were stored at room temperature. The different parameters of assessing the deterioration of the products were observed at a regular interval of 15 days and at an interval of one month for the next three months. The color, flavor, texture, moisture content, acidity and visual fungal growth etc. were observed up to the whole storage period.

RESULTS AND DISCUSSION

Chemical Composition of Fresh Cauliflower and Cauliflower Pickles
During commercial processing of fruits and vegetables by canning, dehydration, brining, pickling and by other methods affects the composition of fruits and vegetables and their products which is reflected in the nutritional value. Some of the losses in sugar, acid, vitamin C and minerals are compensated by the addition of these materials are compensated by the addition of materials during processing (Woodroof 1975). When fruits and vegetables are peeled, sliced, diced or pressed, oxidation is stimulated; when fruits and vegetables are subjected to such unit operations, the composition of these are changed. The proximate

composition of fresh cauliflower was moisture content 92.3%, protein content 1.8%, fat content 0.1%, ash content 0.8% and vitamin-C 46 mg/100gm. The chemical composition of cauliflower pickles (Table 2) varies to a little bit depending on the media at which cauliflower are processing. This may also differ due to climatic condition, growing season, intercultural operations involved, varieties and stage of maturity as well.

The chemical compositions of cauliflower pickles vary to a little bit depending on the media at which

cauliflower is processed and the method of processing, maturity stage, processing temperature etc. However, the composition remain very closer covering oil and sugar as well as salt prevent microbial contamination. Usha *et al*. (1992) found that the safe moisture content in mango pickles to be as high as 61.0% which is closed to the result obtained for cauliflower pickles. Lower moisture content means higher amounts of nutrients. This fruit contains an appreciable amount of ascorbic acid (41 mg/100 g) which is very important for proper nourishment and maintenance on healthy teeth.

Table 2. Chemical composition of fresh cauliflower and cauliflower pickle

Sample code	Moisture content (%)	Protein (%)	Ash (%)	Fat (%)	Vitamin C (mg/100 g)
Fresh cauliflower	92.30	1.8	0.8	0.1	46
S-1	52.60	1.54	3.61	7.74	97.90
S-2	45.20	2.69	3.65	7.90	96.50
S-3	40.07	2.34	2.00	7.95	92.30

The results shown in Table 2, reveals that the highest moisture content 52.60% was given by sample-S-1, whereas the lowest amount of moisture content was found in sample S-3 (40.07%). It is shown from Table 2 indicates that ash content was substantially increased in all the samples. Very few literatures are available on composition of cauliflower pickles. So, it is a few difficult to compare the proximate composition of the fresh and processed products (cauliflower pickle).

**Microbiological study of shelf stable cauliflower pickles**
The Growth of total viable count of bacteria at different storage period
The study was performed by standard plate count (S.P.C) method. The total viable bacterial load was not uniform. The total bacteria were counted as total number of bacteria per gram of sample. The total number of viable bacteria was counted by multiplying the colony forming unit (C.F.U) with dilution number. The total number of viable bacteria in different samples at different storage period and variations of bacterial load in different cauliflower pickles were shown in Figure 1. Pickle sample S-2 showed maximum count and sample S-1 showed minimum count after 1 month storage of cauliflower pickles by bottling with preservatives. Very little difference was observed in microbiological load compared to that of 15 days storage for both cases.
**The growth of total viable count of mold and yeast at different storage period**
The total number of mold and yeast found in cauliflower pickles are shown in Figure 2 and Figure 3. The number of mold and yeast were the maximum in pickle sample-2 and minimum in sample-1. The figure shows that the growth of mold and yeast

increases very slowly with respect to bacteria during storage.
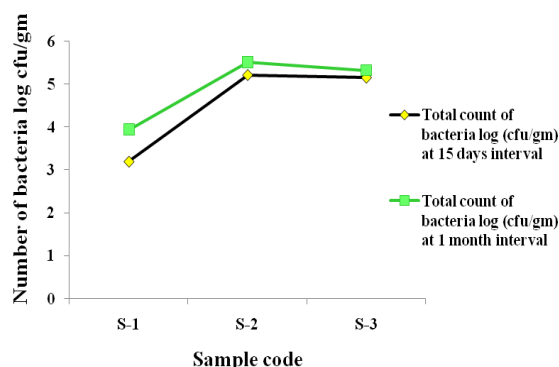
Figure 1. Total number of viable bacteria of cauliflower pickles at different storage period at room temperature
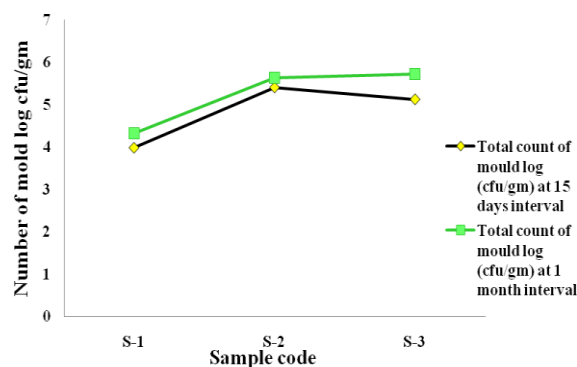
Figure 2. Total number of viable mold in cauliflower pickles at different storage period at room temperature
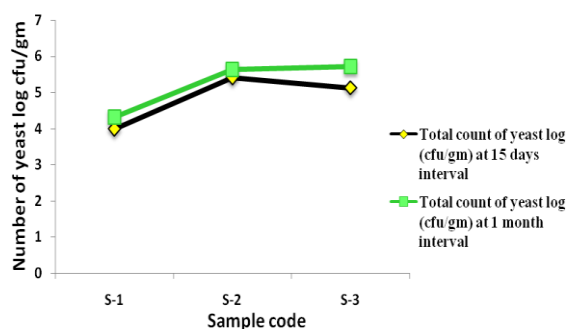
Figure 3. Total number of viable yeast in cauliflower pickles at different storage period at room temperature

Sensory evaluation of cauliflower pickles

The mean scores for color, flavor, texture and overall acceptability of cauliflower pickles are presented in Table 3.

Table 3. Mean score for color, flavor, texture and overall acceptability of various cauliflower pickles

Sample code	Sensory attributes			
	Color	Flavor	Texture	Overall Acceptability
S-1	7.64a	7.29a	7.29a	7.64a
S-2	7.00a	7.14a	7.00a	7.36a
S-3	6.857b	6.43b	7.00a	6.71b

Sample means having the same letter suffix do not differ at 5% (p<0.05) level of statistical significance. A two-way analysis of variance (ANOVA) was carried out for color preference and results revealed that there were slightly significant (p<0.05) difference in color acceptability among all the samples. In case of flavor preference among the samples a two-way analysis of variance (ANOVA) showed that there was significant (p<0.05) difference in flavor acceptability among the cauliflower pickles.

In case of texture preference among the samples a two-way analysis of variance (ANOVA) showed that there was no significant (p<0.05) difference in texture acceptability among the cauliflower pickles.

The results revealed that the textures of difference samples were equally accepted.

The result of the ANOVA that there were significant (p<0.01) difference in overall acceptability of the sample tasted. It is shown that the sample-1 was the highly acceptable securing 7.64 out of 13. However, all the samples were acceptable to the panelists.

Storage studies of cauliflower pickles

Three different samples of cauliflower pickle were used for storage studies at room temperature (27ºC-33ºC) for 4 months. The effect of storage time (0, 1, 2, 3 and 4 months) on physical properties such as color, flavor and texture of the pickles were studied and shown in Table 4.

Table 4. Storage Studies of Cauliflower Pickles

Storage period (month)	Sample code	Color change	Off Flavor	Texture	Visual fungal growth	Remark
0	S-1	No	No	Firm	No	Good
	S-2	No	No	Firm	No	Good
	S-3	No	No	Firm	No	Good
01	S-1	No	No	Soft	No	Good
	S-2	No	No	Slightly soft	No	Good
	S-3	No	No	Slightly soft	No	Good
02	S-1	No	No	Soft	No	Good
	S-2	No	No	Soft		Good
	S-3	No	No	Soft	No	Good
03	S-1	No	Yes	Slightly soft	Slightly	Slightly spoiled
	S-2	No	Slightly	Slightly soft	Slightly	Slightly spoiled
	S-3	No	No	Slightly soft	Slightly	Good
04	S-1	Huge	Excess	Extremely soft	Excess	Spoiled
	S-2	Slight	Slightly	Slightly soft	Excess	Slightly spoiled
	S-3	No	No	Slightly soft	Slightly	Good

All the processed samples of cauliflower pickles were in good condition up to 4 months of storage except those samples which were processed in vinegar in ambient temperature and at the end of 5 months storage, all the samples were spoiled. This may be due to the lack of preservatives because no preservative was used in the cauliflower pickles. The oil and the spices influenced the shelf life of the pickles. Color variation observed huge in S-1 and slight in S-2 respectively but no color variations was observed in sample S-3 after 4 month of storage. All samples were texturally firm only first month of storage but after this time texture became slightly soft and thus it was quite unacceptable for extremely soft. No off flavor was observed up to 2 months of storage. But after the end of 4 months storage all samples were subjected to off flavor.

CONCLUSION

The proximate composition of fresh cauliflower was moisture 92.3%, protein 1.8%, fat 0.1%, ash 0.8%, fiber 0.72% and vitamin-C 46 mg/100gm. In processed pickles the compositions were moisture 52.60%, protein 1.54%, ash 3.61%, fat 7.74% and vitamin C 97.90mg/100g depending on the processing media. The chemical analysis of the pickles showed that moisture content was highly reduced in all the samples. But the compositions of fresh cauliflower and pickled cauliflower were found satisfactory. The analysis also showed that ash content and acid content were substantially increased in all samples. Sugar, salt and oil resulted the losses in moisture content were observed in all the samples. The acceptability of processed pickles was organoleptically evaluated by the panelist using 1-9 hedonic scale. The score of panel test indicated that among three samples, the sample S-1 is more acceptable. Storage studies were carried out for 4 months at room temperature (25℃. All the pickles became softer with the passing of some time. It also revealed that all the samples were found to be shelf stable up to six months. Cauliflowers are mainly used as vegetables but they may be turned to delicious processed food. During growing season farmers are bound to sell their vegetable at a very minimum price. But if farmers can preserve their vegetable by effective and economic way, they will be able to get proper price and get encouraged to capitalize on production. We should encourage processing and preservation of cauliflower commercially in our country. Thus a large number of skilled, semi-skilled and even unskilled persons would be employed in the relevant industries, which will help to remove unemployment problem of our country. Processed cauliflower pickle can be sold in off-season in both local and foreign exchange, which will enrich our national economy.

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