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Research Article

Effect of Treatments, Packaging and Storage on the Chemical Composition of the Papaya Chutney

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Abstract

Introduction: Papaya (Carica papaya), popularly known as wonder fruit of tropics At the time of harvest there is glut in the market and being highly perishable and fast ripening, it cannot be stored for a longer time. Lack of proper storage and transportation facilities ultimately leads to low economic returns to the grower. Although papaya is a nutritious fruit but it is not widely used in the product preparation because of its odd flavor. Packaging material plays an important role in preserving the flavor and protection of the product till it reaches the consumer.

Hence there is a dire need to develop value added products by utilizing such a valuable crop. Chutney is one of the value added product which can be prepared from raw papaya.

Methods: Effect of various treatments i.e. ingredients, packaging material and storage period on the chemical composition of papaya chutney was observed. Two different packaging materials were used i.e. polyethylene terepthalate (PET) containers and glass containers. Parameters studied were total sugars, reducing and non reducing sugars, total soluble solids, pH, and acidity.

Results: With increase in storage period the pH, TSS, Reducing sugars increased in the chutney packaged in glass containers as compared to the chutney that was packaged in plastic containers. Whereas the values for the non- reducing sugars, ascorbic acid and acidity decreased with the advancement in the storage period. Glass containers were better packaging material as compared to the PET containers.

Keywords: Papaya; Papaya Chutney; Packaging Materials; TSS; Acidity; Total Sugars; Storage and Treatments

Introduction

Papaya (*Carica papaya*), popularly known as wonder fruit of tropics, belongs to family *caricaceae* [2]. Papaya tree is a large, quick growing, soft stemmed plant. The fruits can be harvested with in a year [7]. At the time of harvest there is glut in the market and being highly perishable and fast ripening, it cannot be stored for a longer time [4]. Lack of proper storage and transportation facilities ultimately leads to low economic returns to the growers [1].

Papaya is a very wholesome fruit ranks second only to mango as a source of beta carotene [3,4]. It is a good source of natural sugars, vitamin C and also contains fair amounts of calcium and phosphorus [4,5,16] but is low in calories and has got medicinal value. It has been used a laxative since ancient times. It is used for the treatment of various digestive disorders, diabetes mellitus and is also effective in lowering blood cholesterol level [8]. Though papaya is a nutritious fruit but it is not widely used in the processed product preparation because of due to presence of enzyme papain and other volatile componds its has an odd flavour [1,5] which is not acceptable to many peoples. But processing of the papaya can decrease the odd flavour as the volatile components evaporate during processing and thus become more acceptable [5-7]. Hence there

is a dire need to develop value added products by utilizing such a valuable crop, having excellent nutritional and medicinal properties. Investigation on its potential of value addition and processing clearly indicate that acceptable products can be prepared and marketed successfully along with fresh fruit [6,7]. Value addition through processing of papaya for food will open up marketing alternatives to sale fresh produce, reduce post harvest losses, regulate price during peak period of production, raise farm income and create employment opportunities. Moreover, being highly perishable fruit its value addition can popularize the fruit intensely and will provide the consumers a new health food. Use of proper packaging material will help in improving the shelf life of the product. Chutney is an savory accomplishment served along with food. It has got a tangy taste and is both sweet and sour. It is a mixture made from fruit, spices, sugar and vinegar, or dried mango powder or tamrind. Chutney can be made from raw mango, tomato, peanut. Coconut Mint, coriander leaves etc. It can be prepared fresh or stored for longer time. Papaya raw fruits are also used for making chutney at household level, Food packaging material plays an important role in storage and self life of food. Use of good packaging material can be help in improving the shelf life of the product. In present study an attempt has been made to evaluate of papaya chutney and effect of different packaging materials on the nutritional quality on storage life of papaya chutney.

Material and Methods

Unripe Papaya fruits procured from local grower were sorted for uniformity in colour and size. Healthy and disease free fruits were selected for the study. The fruits were washed with water to remove adhering dust and foreign particles. Then these were laid on the flat surface for aeration and removing excess of water. The fruits were peeled with the help of a steel peeler; seeds were removed and fruits were cut into small pieces. Pulp was made in a stainless steel mixer grinder and used for preparing Chutney. Juice was extracted from papaya ripe fruits and left over Pomance was also used for making the chutney. Ingredients used were papaya pulp 1000gm, sugar 750 gm salt 15gm, vinegar 25 ml, spices (ginger (20 gm), ginger garlic (10 gm each) black pepper and cloves 2.5 gm and red chili powder 10 gm.) The papaya pulp was cooked with addition of all the spices and ingredient except vinegar. Cooking was continued till a smooth consistency was obtained. Then vinegar was added and cooking was done for five minutes. Two hundred gm prepared chutney was packed in pre sterilized jars in triplicate. (SPC1 papaya ginger, chutney packaged in plastic jars, and SPC2 papaya ginger garlic chutney packaged in plastic jars. SPC3 papaya pomace, ginger and garlic packaged in plastic jars. SGC1 papaya ginger chutney packaged in glass jars and SGC2, papaya ginger garlic chutney packaged in glass jars. SGC3 papaya pomace, ginger and garlic packaged in glass jars. Storage was done at ambient temperature for six months.

Treatments and sub-treatments for chutney

The chutney so prepared was assessed for various chemical parameters like acidity, ascorbic acid, total sugars and reducing sugars by the method of [15] whereas the difference between total sugars and reducing sugars gave the value for non reducing sugars. the TSS was assessed by the abbe hand refractometer [9]. The pH was evaluated with the help of pH meter. The stored samples were also assessed for above mentioned chemical parameters at an interval of one month for a period of six months. The data was analyzed statistically using computer programme).

Chutney	Spices	
SPC1	Ginger	Plastic container
SPC2	Ginger and garlic	
SPC3	Pomace, ginger and garlic	
SGC1	Ginger	Glass container
SGC2	Ginger and garlic	
SGC3	Pomace, ginger and garlic	
Pickle	Acid source	

Table a

Results and Discussion

pH

A glance at the data in Table 1 shows the pH of the chutney packaged in different packaging containers. The pH of the chutney was 3.72, 3.61, and 3.49 in the SPC1, SPC2 and SPC3 treatments, respectively at the initial day of storage. The variation in the pH of chutney was due to different raw material and slight variation in spices used. The pH of the chutney increased with the advancement in the storage period. After six months of storage period the values were 3.88, 3.71 and 3.62 for the SPC1, SPC2 and SPC3 treatments, respectively when packaged in the plastic containers. The values for the pH in case of the glass jars were 3.89, 3.72, and 3.84 for the

Treatment	Storage period (in months)						
	0	1	2	3	4	5	6
SPC1	3.72	3.74	3.78	3.81	3.85	3.85	3.88
SPC2	3.61	3.63	3.65	3.65	3.68	3.69	3.71
SPC3	3.49	3.51	3.53	3.55	3.57	3.61	3.62
SGC1	3.72	3.75	3.80	3.82	3.87	3.87	3.89
SGC2	3.61	3.65	3.66	3.67	3.69	3.70	3.72
SGC3	3.49	3.53	3.56	3.57	3.60	3.62	3.64

Table 1: Effect of treatments, packaging and storage on the pH of chutney.

CD(P ≤ 0.05), Treatments (T): 0.008; SXP: 0.01, Packaging (P): 0.004; SXT: 0.02, Storage Period (S): 0.005; PXT: NS, PXSXT: NS

SGC1, SGC2 and SGC3 treatments, respectively after six months of the storage period. The pH of the chutney varied significantly (P ≤ 0.05) when all the treatments were compared with each other, but a non significant (P ≤ 0.05) difference was noted in the chutney packaged in the plastic and glass containers at the initial day of storage. The minimum pH was observed in SPC3 and SGC3 that is the chutney prepared from papaya Pomance Which might have been due to reason that juice was not there in Pomance as a result pH was affected. Slightly higher pH was observed in the samples packed in glass containers. Packaging material had less effect on pH value of Chutney. The increase in the pH might have been due to the decrease in the acidity of the chutney.

TSS

The data regarding the TSS of the chutney is given in Table 2. The TSS of the chutney at the beginning of the storage was 50.20, 47.33, 45.13 ^{0}B for the SPC1, SPC2 and SPC3 treatments, respectively. The TSS of the chutney increased significantly (P ≤ 0.05) with the advancement in the storage period in all the treatments. The TSS of the SPC1 treatment was significantly (P ≤ 0.05) higher from the SPC2 and SPC3 treatments. A similar trend in the values of the TSS was observed throughout the storage period. After six months of the storage the values for the TSS were higher i.e. 53.40, 50.40 and 48.73^{o}B for the chutney packaged in the of the SPC1,

Treatment	Storage period (in months)						
	0	1	2	3	4	5	6
SPC1	50.20	51.32	51.77	52.03	52.33	52.57	53.05
SPC2	47.33	48.33	48.65	49.40	49.57	49.92	50.20
SPC3	45.13	46.27	46.58	46.88	47.43	47.93	48.57
SGC1	50.20	51.40	51.90	52.17	52.50	52.70	53.40
SGC2	47.33	48.40	48.73	49.87	50.00	50.10	50.40
SGC3	45.13	46.29	46.70	46.97	47.63	48.03	48.73

Table 2: Effect of treatments, packaging and storage on the TSS (^{0}B) of the chutney.

CD(P ≤ 0.05), Treatments (T): 0.008; SXP: 0.01, Packaging (P): 0.004; SXT: 0.02, Storage Period(S): 0.005; PXT: NS, PXSXT: NS

SPC2 and SPC3 treatment. The chutney packaged in the glass jars had comparatively less TSS i.e. 53.05, 50.20 and 48.57^{o}B, respectively for the SGC1, SGC2 and SGC3 treatments, after six months of the storage. The increase in the TSS might have due to the gradual loss of the moisture content which has resulted in the increase in the concentration of the soluble fraction of the chutney. The findings of the present investigation are in conformation with those reported by [6,10].

Acidity

The data pertaining to the acidity of the chutney is given in Table 3. The acidity of the chutney was 0.63, 0.76 and 0.78 per cent in the SPC1, SPC2 and SPC3 treatments, respectively at the initial day of storage. The acidity of the chutney after six months of the storage was highest in the chutney packaged in the glass jars i.e. 0.44, 0.60, 0.66 per cent for the SGC1, SGC2 and SGC3 treatments. The acidity of the SPC1, SPC2 and SPC3 treatments was lowest i.e. 0.42, 0.57, 0.64 per cent in the chutney packaged in the plastic containers. The acidity of the chutney varied significantly ($P \leq 0.05$) with the storage in the SPC1, SPC2 and SPC3 treatments and SGC1, SGC2 and SGC3 treatments. The acidity of the chutney was significantly ($P \leq 0.05$) higher in the glass containers as compared to the plastic jars The decline in the acidity of the chutney might be due to the neutralization of the acid during storage and probable interaction with the natural chemical constituents of the chutney. Breakdown of the organic acids during storage may be one of the reasons for this decrease in the acidity. The higher values for the acidity in case of the glass Jars might have been due to the less enzymatic and biochemical changes occurring in these as compared to the PET jars due to its less permeability. The findings of the present investigation are at par with those reported by [4,6,9,11].

Treatment	Storage period (in months)						
	0	1	2	3	4	5	6
SPC1	0.63	0.61	0.58	0.55	0.51	0.47	0.42
SPC2	0.76	0.74	0.73	0.70	0.66	0.63	0.57
SPC3	0.78	0.76	0.74	0.71	0.68	0.67	0.64
SGC1	0.63	0.62	0.59	0.57	0.52	0.49	0.44
SGC2	0.76	0.75	0.73	0.71	0.67	0.64	0.60
SGC3	0.78	0.77	0.74	0.73	0.69	0.68	0.66

Table 3: Effect of treatments, packaging and storage on the acidity (%) of chutney.

CD($P \leq 0.05$), Treatments (T): 0.008; SXP: 0.01, Packaging (P): 0.004; SXT: 0.02, Storage Period (s): 0.005; PXT: NS,PXSXT: NS

Ascorbic acid

Table 4 shows the ascorbic acid content of the chutney. The ascorbic acid content of the chutney was 21.74, 22.81 and 13.64 mg/100g at the first day of the storage. The ascorbic acid content of the chutney decreased from its initial value at each interval of the storage. After the end of the six months of the storage the values were highest in the chutney, packaged in the glass Jarsas compared to that packaged in the plastic Containers. Highest ascorbic acid content i.e. 19.15 mg/100g was observed for the SGC2 treatment, followed by 18.98 for the SGC1 and 11.28 mg/100g in the SGC3 treatment respectively. Both the packaging containers had a significant ($P \leq 0.05$) impact on the ascorbic acid content of the chutney The variation in the ascorbic acid content might have been due to the variation in the treatments of the chutney. With the advancement in the storage duration the ascorbic acid content of the chutney decreased significantly in all the treatments but the more

Treatment	Storage period (in months)						
	0	1	2	3	4	5	6
SPC1	21.74	20.64	20.31	19.81	19.64	19.20	18.90
SPC2	22.81	21.73	20.66	19.98	19.82	19.25	19.01
SPC3	13.64	12.67	12.33	12.02	11.78	11.49	11.19
SGC1	21.74	20.65	20.36	19.87	19.69	19.21	18.98
SGC2	22.81	21.75	20.67	20.00	19.83	19.30	19.15
SGC3	13.64	12.70	12.37	12.10	11.86	11.54	11.28

Table 4: Effect of treatments, packaging and storage on the ascorbic acid (mg/100gm) content of the chutney.

CD($P \leq 0.05$), Treatments (T): 0.004; SXP: 0.009, Packaging (P): 0.003; SXT: 0.01, Storage Period (S): 0.006; PXT: 0.006, PXSXT: 0.01

retention has there in the glass jar packaged chutney as compared to the plastic jar. This might have been due to the higher oxidation of the ascorbic acid due to the higher permeability of the PET jars the oxygen which has resulted in the decrease in the concentration of the ascorbic acid as it is converted into the dehydroascorbic acid. Similar observations have been made by other researchers [5,6,9].

Sugars

Total sugars

The total sugar content of the chutney is given in figure. The total sugars of the chutney of the seeded papaya were 48.82, 45.63 and 43.71 per cent for the SPC1, SPC2 and SPC3 treatments, respectively at the beginning of the storage period. The values for the total sugar content of the chutney decreased with the subsequent increase in the storage period, in all the treatments. However, the decrease in the total sugar content was comparatively less of the chutney packaged in the glass containers. After six months of the storage, the values were 48.51, 45.37, 43.43 per cent in the SPC1, SPC2 and SPC3 treatments, respectively, packaged in the glass containers. The total sugar content of the chutney packaged in the glass jars was 48.54, 45.42, and 43.45 per cent for the SGC1, SGC2 and SGC3 treatments, respectively, after the end of six months of the storage period. The total sugar content of the chutney varied significantly ($P \leq 0.05$) when the treatments were compared with each other. The total sugar content of the chutney decreased slightly with the storage and packaging containers. However the more decrease has been recorded in the plastic containers as compared to the glass containers. A decrease in the total sugar content has also been observed by the [12] in case of the turnip pickle stored under different storage conditions. The decrease in the total sugar content of the chutney might have been due to the inversion of the sugars.

Treatment	Storage period (in months)						
	0	1	2	3	4	5	6
SPC1	21.55	21.79	22.00	22.40	22.72	22.95	23.15
SPC2	27.75	27.91	28.11	28.58	28.84	29.05	28.33
SPC3	20.15	20.47	20.76	20.93	21.01	21.50	21.85
SGC1	21.55	21.81	22.02	22.63	22.84	23.09	23.37
SGC2	27.75	27.92	28.13	28.62	28.91	29.13	29.54
SGC3	20.15	20.48	20.79	20.96	21.03	21.54	21.87

Table 5: Effect of treatments, packaging and storage on the reducing sugars content (%) of the chutney.

CD ($P \leq 0.05$), Treatments (T): 0.44; SXP: NS, Packaging (P): NS; SXT: NS, Storage Period (S): 0.29; PXT: NS, PXSXT: NS

Reducing sugars

The reducing sugar content of the chutney is given in Table 5. As evident from the data that the reducing sugars were maximum (27.75%) in the SPC2 treatment, followed by SPC1 (21.55%). The lowest value i.e. 20.15 per cent was observed in case of the SPC3 treatment. The chutney packaged in the glass jarshad maximum reducing sugar content i.e. 23.37, 29.54 and 21.87 per cent, respectively for the SGC1, SGC2 and SGC3 treatment, but the reducing sugars of the chutney packaged in the PET jars were significantly ($P \leq 0.05$) less i.e. 23.15, 28.33, 21.85 per cent, respectively, in the SPC1, SPC2 and SPC3 treatments, after the end of the six months of the storage. The reducing sugar content of the chutney increased significantly ($P \leq 0.05$) with the advancement in the storage period in all the treatments This might have been due to the loss of moisture from the chutney and hydrolysis of the starch into sugars [6,9] observed similar observations in the kachnar chutney and in the papaya chutney during storage.

Non reducing sugars

The data pertaining to the non reducing sugars of the chutney is given in Table 6. The values for the non reducing sugars were 25.92, 16.99 and 22.38 per cent SPC1, SPC2 and SPC3 treatments, respectively at the beginning of the storage period. The non reducing sugars of the chutney decreased slightly with the advancement in the storage period in all the treatments.

The non reducing sugars after the six months of the storage period were higher i.e. 24.09, 15.24 and 20.50 per cent in the SPC1,

Treatment	Storage period (in months)						
	0	1	2	3	4	5	6
SPC1	25.92	25.62	25.37	24.95	24.59	24.32	24.09
SPC2	16.99	16.81	16.57	16.05	15.76	15.56	15.24
SPC3	22.38	22.04	21.73	21.52	21.39	20.87	20.50
SGC1	25.92	25.61	25.34	24.69	24.49	24.22	23.91
SGC2	16.99	16.80	16.58	16.04	15.75	15.52	15.09
SGC3	22.36	22.04	21.72	21.45	21.38	20.85	20.48

Table 6: Effect of treatments, packaging and storage on the non reducing sugar (%) content (%) of the chutney.

CD(P ≤ 0.05).,Treatments (T): 0.44; SXP: NS, Packaging (P): NS; SXT: NS, Storage Period(S): 0.29; PXT: NS, PXSXT: NS

SPC2 and SPC3 treatments, packaged in the plastic jars, whereas the values in case of the chutney packaged in the glass containers were 23.91, 15.09 and 20.48 for the SGC1, SGC2 and SGC3 treatments, respectively. The non reducing sugars of the chutney varied significantly (P ≤ 0.05) with the variation in the treatments. The non reducing sugars of the chutney decreased slightly with the advancement in the storage period in all the treatments. This might have been due to the conversion of the non reducing sugars to the reducing sugars. While comparing the overall effect of packaging on the non reducing sugars of the chutney, the less values has been analyzed in the chutney packaged in the glass jars as compared to the plastic ones. This might have been due to the faster rate of conversion of the non reducing sugars to the reducing sugars in the glass containers.

Conclusion

Chutney can be prepared from unripe papaya and also papaya pomance by using ginger and garlic combination without use of any chemical preservatives. Packaging material had a significant effect on the chemical characteristics of the papaya chutney. The chutney packaged in glass jars was more acceptable as compared to that of packaged in PET containers. From the results of the study it can concluded that storage period and type of packaging material used affected the chemical composition of the chutney. Papaya pomance (waste left over after extraction of papya juice can also be utilized for preparation of Chutney.

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