Storage study of standardized Kajukatli

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Abstract- *Effect of storage at room and refrigerated conditions was studied on standardized Kajukatli samples. The samples were packed in commercially available PVC container for Kajukatli. Moisture content, water activity, sensory, microbial and textural attributes were determined periodically. The prepared/standardized Kajukatli, without any chemical preservative, had acceptable keeping quality/shelf life up to nine (9) days at room (30±2˚C and 65% RH) while it lasted for more than thirty (30) days at refrigeration (7±2˚C and 90% RH) conditions.*

Keywords- Kajukatli, keeping quality, PVC container, storage.

I. INTRODUCTION

Kajukatli a popular Indian sweet manufactured and sold in large quantities in both in India and abroad. It is made by kaju fada and sugar with/without milk solids and has limited shelf life of ~4-8 days under normal conditions and depends on preparation method. Recipe and preparation process of Kajukatli was standardized based on market survey and sensory analysis (Parmar and Sharma, 2016). Brahmbhatt et. al. (2017) standardized grinding and cooking parameters based on highest sensory scores and textural attributes in comparison of commercially available samples.

A food product must have adequate keeping quality, so that it could withstand the external environmental conditions and reach to the consumers with satisfactory quality. A variety of spoilage changes are expected to occur in the product as the storage period progresses. These changes are influenced by variety of factors like composition, storage temperature, packaging material, humidity and environment. So, as to have a glance towards the changes that might be taking place, this investigation was planned and conducted to study the storage life of the standardized product at room (30±2 ^{o}C) and refrigerated (7±2 ^{o}C) conditions (Brahmbhatt, 2013).

II. MATERIALS AND METHODS

Materials

Cashewnut splits (locally known as kaju fada (broken into not more than 4-5 pieces), off white in color, without stalks, free from rancid off flavour) and commercially available white crystalline sugar, free from dirt, were obtained from Sardarganj local market, Anand, Gujarat.

Methods

Soaked cashewnut splits 250 g was ground for 1 min using a laboratory mixture grinder (Make: Sumeet, 4 blades, 400 watts) before 28% water addition. The sample was then further ground for 12 min to average particle size of about 3.35µm. After that the cashewnut paste was transferred into thick bottom S.S. top. Sugar was added and mixed manually with help of a hand scraper while heating using a hot water bath for desired temperature of 100 °C. The mixture was stirred manually with help of scraper until it starts leaving the surface of the vessel. The cooked mixture was then cooled in another vessel up to 45 °C with continuous stirring for about 7-8 min. The tempered mass was then rolled using hand roller (bellan) to the thickness of 5 mm and cut by knife in the diamond shape having size of 3×3 cm. Preparation steps with fixed parameters are shown in the Fig. 1.

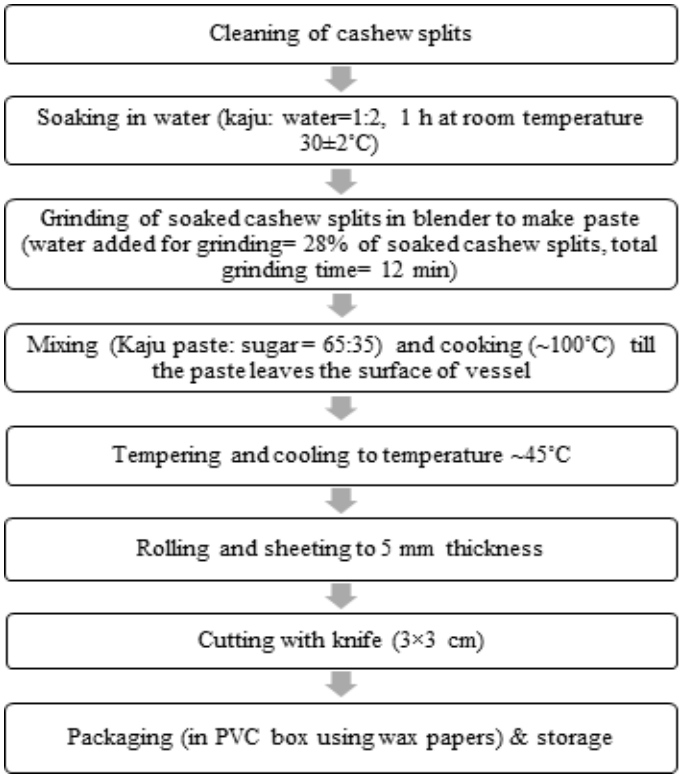

Figure 1. Standardized flow chart for preparation of kajukatli (Parmar and Sharma, 2016 and Brahmbhatt et. al., 2017)

Prepared diamond shaped Kajukatli (~250 g) were then packed in commercially available diamond shaped PVC box using wax paper as separators. The boxes were then kept in the desiccators for the study. Saturated salt solutions of potassium iodide and potassium chloride were used to maintain the relative humidity at 65% approx at a 30±2 ℃ temperature and 90% approx at a 7±2 ℃, respectively (Greenspan, 1976). The desiccators were then placed inside temperature-controlled chamber at room condition at 30±2˚C, 65% RH and samples were drawn from PVC container under laminar flow chamber at an interval of 3 days. Whereas, samples stored at refrigerated condition 7±2˚C, 90% RH were drawn at an interval of 6 days for analysis.

Samples were analysed for moisture content, water activity (a_w), sensory, microbial and textural attributes (TA-HDi Texture analyser of Stable micro system, UK fitted with 5 kg load cell and Warner Bratzler blade probe-HDP/BS) following standard methods (Brahmbhatt, 2013; Parmar and Sharma, 2016; Brahmbhatt et. al., 2017).

IV. RESULTS AND DISCUSSIONS

Physicochemical, textural and microbial attributes of standardized and popular market samples were analysed and presented in the table 1. Data indicates that freshly prepared samples following standardized recipe and process were softer due to higher amount of kaju than sugar and moisture content (Brahmbhatt et. al. 2017).

Table 1. Physicochemical, textural and microbial attributes of standardized and popular market samples

Parameters	Standardized sample	Popular market sample
Moisture, %	9.62 ± 0.078	7.6 ± 0.05
Fat, %	26.43 ± 0.20	23.0 ± 0.30
Protein, %	24.80 ± 0.13	22.0 ± 0.51
Carbohydrate, %	38.26 ± 0.11	46.57 ± 0.19
Ash, %	0.98 ± 0.006	0.83 ± 0.01
FFA, % oleic acid	1.22 ± 0.008	1.34 ± 0.02
Water activity (a_w)	0.783 ± 0.0008	0.754 ± 0.002
Hardness, N	3.96 ± 0.272	4.97 ± 0.3078
Stickiness, Nmm	2.843 ± 0.63	0.126± 0.025
Standard Plate Count (SPC), cfu/g	150	40,000
Yeast and Mold Count (YMC), cfu/g	Absent	Absent
Coliform, cfu/g	Absent	975

Effect on moisture content and water activity of the stored Kajukatli samples

The moisture content and water activity known to be important factors to affect the keeping quality and texture of the product. The slight deviation in the moisture content can result in softer or harder texture. Similarly change in water activity (aw) may favour growth of bacteria and fungi which requires minimum aw of 0.914 and 0.7, respectively (Parmar, 2012; Macwan, 2012). Table 2 & 3 showed that moisture

content of samples stored in room and refrigerated conditions decreased from initial level of 9.62 to 6.73% (w/w) on 12th day and 9.62 to 7.90 %(w/w) on 30th day, respectively. The change in values was significantly different to each other consecutively and from initial value. Similarly, water activity of the stored samples decreases from 0.78 to 0.72 as storage period progressed. But it remains higher on 12th day of storage than safe value of 0.70. The changes are due to loss of product's moisture, thereby decrease in water content and activity. After ninth day of storage, visible fungal growth was observed in the samples stored at room condition (Brahmbhatt, 2013). Parmar (2012 & 2013) also reported similar, during storage study at room and refrigerated condition for the period of ten days.

Effect on sensory attributes of the stored Kajukatli samples

Sensory scores of the samples stored at room (30±2˚C) and refrigerated (7±2˚C) conditions in terms of colour and appearance, flavour, body and texture and overall acceptability were observed in the range of 8.8-4.7, 8.7-4.2, 8.7-4.7 and 8.7-4.5, respectively (Table 2 and 3). The consecutive changes in overall acceptability score were not significant up to six days. After that decreased to 4.5 ($p \leq 0.05$). Which indicated that product was no more acceptable for consumption. This was attributed to discoloration (characteristic white to slight dark), change in flavour and hardness due to moisture loss and slight rancidity in the samples stored at room condition. Whereas, in refrigerated condition, change in overall acceptability scores was not significant up to eighteen days. Thereafter, in successive evaluations, change were significant. Score above 6, after thirty days of storage, suggested that the samples were acceptable and consumable.

Effect on microbial attributes of the stored Kajukatli samples

Standard plate count (SPC) and yeast and mold count (YMC) represent collective enumeration of the overall microbial quality of the product, just after preparation and during storage period. The separate analysis for the presence of coliform was showed its absence throughout storage period at room and refrigerated conditions. During the course of storage at room condition SPC and YMC both were increased significantly ($p \leq 0.05$). At the end of ninth day cottony (fungal) growth was clearly visible on the

Table 2. Physical, sensory and microbial attributes of standardized samples stored at 30±2˚C, 65% RH

	Attributes	Days 0	3	6	9	12	SE_m	$CD_{(0.05)}$	C.V. %
	Moisture Content	9.62	8.66*†	8.18*†	7.64*†	6.73*†	0.032	0.356	13.262
	Water Activity	0.78	0.77	0.75†	0.74*†	0.73†	5.29E-05	0.015	2.940
Sensory	Color & appearance	8.8	8.2	7.7†	6.0*†	4.7*†	0.142	0.752	24.087
Sensory	Flavor	8.7	8.5	8.0	5.5*†	4.2*†	0.163	0.805	28.976
Sensory	Body & Texture	8.7	8.2	7.8	5.3*†	4.7†	0.300	1.094	26.035
Sensory	Overall acceptability	8.7	8.3	7.7	5.7*†	4.5*†	0.254	1.007	25.899
Microbial	SPC (log cfu/g)	2.42	3.40*†	4.14*†	4.35†	ND	0.0478	0.489	24.44
Microbial	YMC (log cfu/g)	0.00	1.73*†	1.97†	2.38†	ND	0.0361	0.424	68.97
Microbial	Coliform count (log cfu/g)	Nil	Nil	Nil	Nil	ND	-	-	-
Textural	Hardness (g)	388.09	435.86	573.96	653.54	719.26	67.21	16.37	25.38
Textural	Yield point (g)	368.17	396.46	415.57	536.06	673.99	505.05	44.88	26.54

* Significantly different from previous analysis ($p \leq 0.05$),
† Significantly different from fresh sample ($p \leq 0.05$)
ND: Not determined.

Table 3. Physical, sensory, microbial and Textural attributes of standardized samples stored at 7±2˚C, 90% RH

	Attributes	Days 0	6	12	18	24	30	SE_m	$CD_{(0.05)}$	C.V. %
	Moisture Content	9.62	9.42	8.67*†	8.39†	7.99*†	7.90†	0.0316	0.364	7.791
	Water Activity	0.78	0.77	0.76*†	0.74*†	0.72*†	0.72†	3.28E-05	0.011	3.593
Sensory	Color & Appearance	8.80	8.20*†	7.20*†	7.00†	7.00†	6.30*†	0.042	0.381	12.288
Sensory	Flavor	8.70	8.30	8.00	7.30†	6.50*†	6.20†	0.158	0.742	13.481
Sensory	Body & Texture	8.70	8.20*†	8.00†	7.30*†	7.00†	6.30*†	0.058	0.450	11.271
Sensory	Overall acceptability	8.70	8.20	7.80	7.20†	6.70†	6.20†	0.181	0.792	12.717
Microbial	SPC (log cfu/g)	2.42	3.29*†	3.95*†	4.18†	4.25†	4.32†	0.04	0.36	19.99
Microbial	YMC (log cfu/g)	0.00	1.20*†	1.13†	1.59†	1.73†	1.82†	0.17	0.77	20.58
Microbial	Coliform count (log cfu/g)	Nil	Nil	Nil	Nil	Nil	Nil	-	-	-
Textural	Hardness (g)	388.09	402.75	465.85	552.85*†	619.52†	681.63†	2130.15	86.03	23.01
Textural	Yield point (g)	368.17	387.26	374.00	464.55*†	474.52†	506.37†	652.17	47.60	13.90

* Significantly different from previous analysis ($p \leq 0.05$),
† Significantly different from fresh sample ($p \leq 0.05$).

surface. Average YMC and SPC values of the samples were 2.38 and 4.35 log cfu/g, respectively. Therefore, further study was discontinued and concluded that product stored at room condition became unsafe for consumption. During refrigerated storage, the rate of increase in YMC and SPC values was lower and at end of thirty days there was no visible fungal growth on the samples. Macwan (2012) reported shelf life of standardized khoa based kajukatli as two (2) days and more than twenty eight (28) days when stored at room

temperature (30±2 ˚C) and at refrigeration temperature (7±2 ˚C), respectively.

Effect on textural attributes of the stored Kajukatli samples

Hardness refers to the maximum peak force during the first compression cycle in Texture Profile Analysis (TPA) graph. Higher value is indicative of greater hardness value. Yield point is defined as the point where the force deformation curve starts to level off. The increase in force is not proportional to the increase in deformation (Christensen, 2012). The values of textural attributes (Table 2 and 3) depicted that the hardness and yield point were significantly increased from initial values of 388.09 (3.805) and 368.17 g (3.610 N), respectively over the storage period in both conditions. The increase may be attributed to the loss of free moisture from the product and explain lower sensory score particularly body and texture. When compare with control (0 day) sample, yield point remains lower at the end of nine and thirty days of storage at room and refrigerated conditions, respectively.

Therefore, it was concluded that the prepared/standardized Kajukatli, without any chemical, is suitable for consumption up to nine (9) days at room condition of 30±2˚C and 65%RH and more than thirty (30) days at refrigeration condition of 7±2˚C and 90% RH in commercially available PVC containers for Kajukatli.

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