

ORIGINAL ARTICLE

Effect of Packaging on the storage studies of instant ready-to-use (RTU) Kachri (*Cucumis callosus*) Chutney Mix

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ABSTRACT

Kachri (Cucumis callosus) is an underutilized fruit of India widely found in the western part of Rajasthan during the rainy season. In this study dried kachri fruit powder with coriander leaf powder were used as major ingredients in the preparation of instant ready-to-use (RTU) kachri chutney mix along with other ingredients such as red chilli powder, cumin seed powder, turmeric, common salt, mint leaf powder, water, and oil. The best formulation was selected based on organoleptic evaluation and subjected to storage study for 180 days. Biochemical analysis such as TSS, pH, colour and vitamin-C content of stored products was carried out at an interval of 60 days during the storage study. The experimental results found that the kachri powder and coriander powder used in the ratio of 90:10 found the highest overall acceptability value of 8.79 followed by a control sample of 8.20. The product packed in a glass bottle stored at refrigerator condition was found a highest value of TSS (8.47), pH (3.72), colour (L 65.14, a* 7.34 b* 21.98) and vitamin-C (57.24 mg/100g) at 180th day compared to other treatments and the product found shelf stable up to 180 days without using chemical preservatives.*

Keywords: *Cucumis callosus, Kachri chutney, RTU, Storage study, Vitamin-C,*

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INTRODUCTION

Kachri is a green fast growing climber plant belongs to family cucurbitaceae [1]. It is harsh, drought tolerant crop grown in arid and semiarid regions of Rajasthan particularly in Nagaur, Churu, Jaisalmer, Jodhpur, and Barmer districts. It grown naturally as wild crop or cultivated has intercrop/main crop particularly during rainy season. Fruits are small, ovoid and ellipsoid in shape of 60-550 g in weight, light green, yellow and brown in colour with uniformly spaced white strips over surfaces. Mature raw kachri has a tangy taste but when it ripens its changes to slight yellow colour and taste changes to sweetness with good aroma [2]. Some immature unripen fruits experiences bitter taste due to presence of cucurbitacin compound, the presence of which depends on type of stress during plant growth like dry condition, lean soil, type of mulching and sunlight. This bitterness can be removed by some traditional techniques like removing small portion of fruit at the both edges and rubbing [3]. Kachri supplies good amount of carbohydrates, fibre, protein, moisture, mineral, vitamin-C [1] and contains polyphenolic compounds, ascorbic acid and carotenoids. Also, the fruit seeds contain vitamin E and omega-3 fatty acids [4]. Underutilized fruits have been used as a major source of raw material in pharmaceutical industry in preparing drugs for various diseases like cancer, diabetes, jaundice and nutritional deficiency [5]. Kachri has good herbal medicinal and therapeutic value and used to cure certain health problems. Fruits were

used as preliminary treatment for burns and abrasions and also used as a cooling light cleanser or moisturizer for skin. Kachri seeds has a property of curing digestion and urinary problems. It also possesses significant anti-inflammatory, antioxidant and painkiller [6]. Dried kachri powder with other spices is used to cure stomach pain, vomiting, nausea and constipation. Dried kachri has a property of vermicide, coughicide, cooling, diuretic and gastric stimulant [7]. The fruit consists of a thin layer of peel, seed cavity and pulp between them. Mature unripen fresh as well as dried fruits of kachri were used in the preparation of curry, chutney, pickle and salad. It is used as one of the major components in the preparation of delicious food called 'Panchkuta' (consist of dehydrated pods of khejri, kachri, ker, lasoda and kumatia) in the desert region of Rajasthan [6]. Dried kachri powder is used as souring agent and mixed with other spices in the preparation of curries and mouth freshener [7].

MATERIAL AND METHODS

The experiments were performed by using a kachri of cultivar AHK 200. Fresh, matured, raw kachri were harvested from Central Arid Zone Research Institute, Jodhpur, Rajasthan. The samples were washed, peeled and cut into thin slices of uniform size followed by drying in a heat pump dryer at different temperatures. The dried product was grind into a powder using a grinder and used for the development of an instant ready to use (RTU) kachri chutney mix. Other ingredients, such as red chilli powder, turmeric powder, salt, and spices, were procured from a local market. The recipe will be standardized by preparing several treatments with varying quantities of kachri powder and coriander leaf powder in order to obtain good palatability and retain the natural tangy taste.

Method of Preparation

The kachri chutney was prepared by using kachri powder and coriander powder as major ingredients [Table 1] along with red chilli powder (6 g), cumin seed powder (1 g), turmeric (0.5 g), common salt (6 g), mint leaf powder (1 g), water (400 ml), and oil (10 ml) were kept constant for all the formulations (fixed based on preliminary trials). The method of preparation of instant RTU kachri chutney mix [Fig.1] and instant RTU kachri chutney [Fig.2] as shown below.

Table 1: Proportion of kachri and coriander powder used in instant RTU kachri chutney mix

Ingredients	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	T ₇
Kachri powder (g)	40	50	60	70	80	90	100
Coriander leaf powder (g)	60	50	40	30	20	10	0

Where,

T₁ = kachri : coriander (40:60) T₂ = kachri : coriander (50:50) T₃ = kachri : coriander (60:40) T₄ = kachri : coriander (70:30) T₅ = kachri : coriander (80:20) T₆ = kachri : coriander (90:10) T₇ = Control (kachri : coriander 100:0)

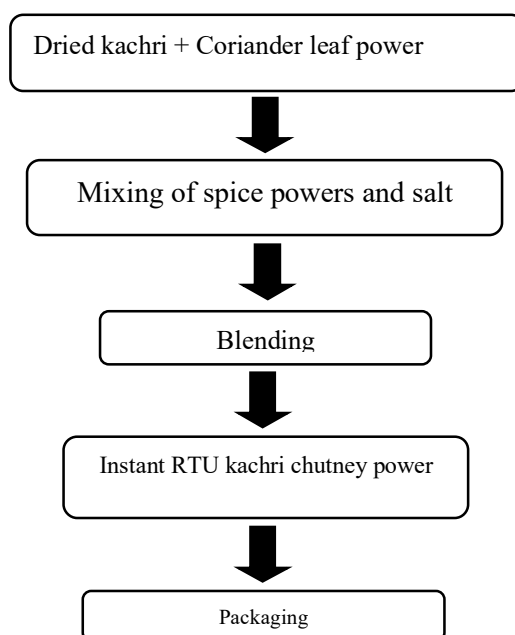


Fig. 1: Process flow chart for the development of instant RTU kachri chutney mix

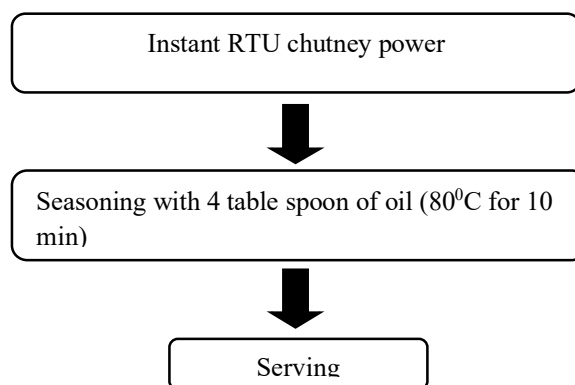


Fig. 2: Flow chart for the preparation of instant RTU kachri chutney

Sensory analysis

The organoleptic evaluation of the developed instant RTU kachri chutney mix was carried out for sensory attributes such as appearance, colour, flavour, texture, taste, and overall acceptability. It is performed by panel of 10 judges using a nine-point hedonic scale it ranges from like extremely to dislike extremely [8, 9, 10].

Storage study of developed instant RTU kachri chutney

The quality of the standardized and optimized instant RTU kachri chutney mix was packed in two different packaging material (PET and Glass jar) and kept at ambient and at refrigerator for a period of 6 months and the analysis were carried out at an interval of two months. The changes in biochemical properties such as TSS, pH, colour and vitamin-C were determined during storage period according to [11] method.

Statistical analysis

Experimental storage data of RTU kachri chutney was statistically and graphically analysed with the help of software SPSS 25 (Statistical Package for the Social Sciences) and Microsoft excel 2010. These experiments were performed thrice and the data obtained was then subjected to one-way analysis of variance (ANOVA).

RESULTS AND DISCUSSION

Sensory analysis of developed instant RTU kachri chutney mix

For ten members of panellists provided with instant RTU kachri chutney at a time for the evaluation. Panellists were asked to mark the score accordance with their in a score sheet which is given along with product. The evaluation was carried out for sensory attributes viz., appearance, colour, flavour, taste and overall acceptability. The mean sensory score of instant RTU kachri chutney are shown in [Table 2]. The detailed results are presented here under

Table 2: Effect of different proportion of kachri powder on sensory attributes of instant RTU kachri chutney

Formulations	Sensory score				
	Appearance	Colour	Flavour	Taste	Overall acceptability
T ₁	7.33	7.39	7.44	7.22	7.39
T ₂	7.00	7.06	7.28	7.16	7.22
T ₃	7.28	7.33	7.56	7.50	7.50
T ₄	7.33	7.33	7.83	7.77	7.61
T ₅	7.61	7.61	7.56	7.72	8.00
T ₆	8.24	8.1	8.36	8.62	8.79
T ₇	8.11	8.00	7.94	8.33	8.20
Total	52.9	52.82	53.97	54.32	54.71
F value	3.5977	8.2395	67.0342	51.7364	2.6912
Sig.	0.000*	0.000*	0.000*	0.000*	0.000*
SEm±	0.0115	0.0095	4.9776	4.8980	0.0138
C.D. at 5%	0.2818	0.2233	12.14	11.9470	0.0337
*Significant at 5% level of significance T ₁ = kachri : coriander (40:60); T ₂ = kachri : coriander (50:50); T ₃ = kachri : coriander (60:40) T ₄ = kachri : coriander (70:30); T ₅ = kachri : coriander (80:20); T ₆ = kachri : coriander (90:10) T ₇ = Control (kachri : coriander 100:0)					

From the table, it was observed that the values of appearance, colour, flavour, taste and overall acceptability ranged from 7.0 to 8.24, 7.06 to 8.1, 7.28 to 8.36, 7.16 to 8.62, and 7.22 to 8.79 respectively for all the treatments. Among the all-overall acceptability values of 8.79 was found highest for treatments T₆ (8.79) followed by T₇ (8.20, control). On the basis of organoleptic score, the overall acceptability of 8.79 for T₆ i.e. kachri powder: coriander powder (90:10) was found best instant RTU kachri chutney mix compared to other formulations.

Shelf life study of developed and optimized instant RTU kachri chutney mix *viz.*, kachri powder: coriander powder in the ratio of 90:10 was kept for storage of six months (180 days) packed in glass and PET bottles and kept at refrigeration and ambient temperature. The stored products were drawn bimonthly for biochemical analysis.

Effect of storability on the TSS (⁰Brix) of stored instant RTU kachri chutney mix

The observations of TSS were recorded by using hand refractometer at initial stage and during storage period up to six months and presented in the [Table 3]. From the table it was observed that there was an increasing trend in the values of TSS throughout the storage for all the treatments. The TSS values of instant RTU kachri chutney ranges from 5.8 to 8.47 among the treatments during storage. The maximum TSS (8.47 ⁰Brix) was observed in product stored in glass at refrigerator at 180th day, among the all treatments during storage period. Similarly, the minimum TSS (8.1⁰Brix) content was observed in product stored in PET bottle at ambient temperature at 180th day of storage compared to other treatments and the statistical analysis showed that there was a significant variation in the TSS of stored RTU kachri chutney mix. The total soluble solid in kachri chutney mix increased slightly during storage this is due to acid hydrolysis of insoluble polysaccharides, especially gums and pectin, and its conversion into soluble sugars. Similar results were observed by [12] in wood apple chutney and [8] in ready to eat amla chutney.

Table 3: Effect of storability on the TSS (⁰Brix) of stored instant RTU kachri chutney mix

Treatments	Storage in days			
	0 th days	60 th day	120 th day	180 th day
GA	5.8	6.1	7.81	8.23
GR	5.81	6.26	7.9	8.47
PA	5.9	6.8	7.2	8.1
PR	5.85	6.92	7.34	8.27
Total	23.36	26.08	30.25	33.07
F value	0.2142	0.0962	0.0569	0.1388
Sig.	0.000*	0.000*	0.000*	0.000*
SEM ±	0.1386	0.1524	0.1834	0.1984
C.D. at 5%	0.3516	0.3864	0.4649	0.5031
*Significant at 5% level of significance GA = Instant RTU kachri chutney mix packed in glass bottle and stored in ambient temperature GR = Instant RTU kachri chutney mix packed in glass bottle and stored in refrigerator PA = Instant RTU kachri chutney mix packed in PET bottle and stored in ambient temperature PR = Instant RTU kachri chutney mix packed in PET bottle and stored in refrigerator				

Effect of storability on the pH of stored instant RTU kachri chutney mix

Observation on pH for instant RTU kachri chutney were recorded by using pH meter at initial stage and during storage period up to six months and presented in the [Table 4]. From the table it was observed that there was a decreasing trend in the values of pH throughout the storage for all the treatments. The value of pH for the product stored in glass at refrigerator ranges from 4.83 to 3.72, and for the product stored in glass kept at ambient temperature ranges from 4.84 to 3.9. Similarly, the values of pH for the product stored in PET bottles at ambient temperature and refrigerator were ranges from 4.79 to 3.84 and 4.75 to 3.81 respectively. Statistical analysis showed that there was a significant variation in the pH of stored RTU kachri chutney mix. The reduction in values of pH is due to the enhancement in acidity of kachri chutney while storage. This was in agreement with [12] for wood apple chutney and [13] for guava-papaya chutney.

Table 4: Effect of storability on the pH of stored instant RTU kachri chutney mix

Treatments	Storage in days			
	0 th days	60 th day	120 th day	180 th day
GA	4.84	4.42	4.21	3.9
GR	4.83	4.51	4.3	3.72
PA	4.79	4.61	4.34	3.84
PR	4.75	4.58	4.3	3.81
Total	19.21	18.12	17.15	15.27
F value	0.1946	0.2105	0.2136	0.1984
Sig.	0.000*	0.000*	0.000*	0.000*
SEM ±	0.1146	0.1074	0.1020	0.0902
C.D. at 5%	0.2906	0.2724	0.2587	0.2287

*Significant at 5% level of significance
GA = Instant RTU kachri chutney mix packed in glass bottle and stored in ambient temperature
GR = Instant RTU kachri chutney mix packed in glass bottle and stored in refrigerator
PA = Instant RTU kachri chutney mix packed in PET bottle and stored in ambient temperature
PR = Instant RTU kachri chutney mix packed in PET bottle and stored in refrigerator

Effect of storability on the colour of stored instant RTU kachri chutney mix

The variation in colour of the different treatments of instant RTU kachri chutney mix were measured using L*, a*, and b* values during storage was presented in [Table 5]. The change in colour of the instant RTU kachri chutney mix was observed for all the treatments. The slight colour variation might be due to the chemical degradation of KMS which imparts light product to the colour. From the table, it was observed that there is a significant decrease in L value at ambient temperature compared to slight changes in products stored in the refrigerator. Refrigerated stored chutney was found lighter in appearance than to the room temperature sample.

Overall the maximum colour value was found for the product stored in a glass bottle in a refrigerator (GR) of about L*, a*, and b* of 65.14, 7.34, and 21.98 respectively on the 180th day of storage. Similarly, the minimum value was found for the product stored in PET bottles at ambient temperature (PA) of about 56.27, 10.95, and 21.17 respectively for L*, a*, and b* values at 180th day of storage. Statistical analysis showed that there was a significant variation in the colour of stored RTU kachri chutney mix. Similar results of a decrease in colour have been reported by [8] for ready to eat amla during storage.

Table 5: Effect of storability on the colour of stored instant RTU kachri chutney mix

Treatments	Storage in days											
	0 th days			60 th day			120 th day			180 th day		
	L*	a*	b*	L*	a*	b*	L*	a*	b*	L*	a*	b*
GA	70.51	4.13	28.14	64.63	6.53	27.3	62.14	7.55	23.41	60.4	10.13	22.12
GR	70.42	4.12	28.41	69.32	5.55	25.47	67.8	6.2	23.78	65.14	7.34	21.98
PA	70.1	4.2	28.1	66.06	5.67	25.14	59.53	8.1	22.17	56.27	10.95	21.17
PR	69.92	4.18	28.15	68.44	5.26	24.99	66.19	6.52	23.21	63.21	8.4	22.34
Total	280.95	16.63	112.8	268.45	23.01	102.9	255.66	28.37	92.57	245.02	36.82	87.61
F value	0.2076	0.2128	0.2012	0.1328	0.0987	0.1888	0.0377	0.0212	0.0949	0.0304	0.0140	0.1341
Sig.	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
SEM ±	1.6740	0.0986	0.6729	1.6120	0.1372	0.6136	1.5520	0.1628	0.5568	1.4905	0.2067	0.5225
C.D. at 5%	4.2441	0.2499	1.7061	4.0869	0.3479	1.5558	3.9349	0.4129	1.4118	3.7789	0.5242	1.3248

*Significant at 5% level of significance
GA = Instant RTU kachri chutney mix packed in glass bottle and stored in ambient temperature
GR = Instant RTU kachri chutney mix packed in glass bottle and stored in refrigerator
PA = Instant RTU kachri chutney mix packed in PET bottle and stored in ambient temperature
PR = Instant RTU kachri chutney mix packed in PET bottle and stored in refrigerator

Effect of storability on vitamin-C (mg/100g) of stored instant RTU kachri chutney mix

The results of vitamin-C content of instant RTU kachri chutney mix stored in glass and PET bottles for up to 180 days in the refrigerator and ambient temperature are presented in [Table 6]. The results revealed

that there was a loss of vitamin-C content in the kachri chutney mix compared from the initial day to the final day (180th day) of storage. The maximum loss of vitamin-C was observed in products stored in PET bottles at ambient temperature of about 64.75 to 55.1 mg/100g. However, the lowest loss of vitamin-C was observed in products stored in glass in a refrigerator of about 65.43 to 57.24 mg/100g. The decrease in vitamin-C content it might be due to the reaction of trapped oxygen present bottle with ascorbic acid that further degraded to furfural compounds resulting in a decrease of vitamin-C content during the storage period. These results are in agreement as reported by Singhania *et al.*, (2020) for wood apple chutney and Mishra *et al.*, (2011) in ready to eat amla during storage.

Table 6: Effect of storability on the vitamin-C of stored instant RTU kachri chutney mix

Treatments	Storage in days			
	0 th days	60 th day	120 th day	180 th day
GA	65.26	62.31	58.52	56.9
GR	65.43	61.98	58.98	57.24
PA	64.75	59.43	56.6	55.1
PR	64.8	60.32	57.75	56.23
Total	260.24	244.04	231.85	225.47
F value	0.2013	0.1418	0.1462	0.1532
Sig.	0.000*	0.000*	0.000*	0.000*
SEM ±	1.5522	1.4631	1.3894	1.3502
C.D. at 5%	3.9353	3.7094	3.5227	3.4232
*Significant at 5% level of significance GA = Instant RTU kachri chutney mix packed in glass bottle and stored in ambient temperature GR = Instant RTU kachri chutney mix packed in glass bottle and stored in refrigerator PA = Instant RTU kachri chutney mix packed in PET bottle and stored in ambient temperature PR = Instant RTU kachri chutney mix packed in PET bottle and stored in refrigerator				

CONCLUSION

In general, preparation of instant RTU kachri chutney is a simple process. Instant RTU kachri chutney mix using kachri powder, coriander powder and other spice ingredients had a greater advantage to utilize the raw material during glut season. The kachri powder and coriander powder in the ratio of 90:10 was found best formulation compared to others based on sensory evaluation. The product packed in glass bottles and stored in refrigerator was found shelf stable for six months without the addition of chemical preservatives.

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COMPETING INTEREST

The authors have declared that no competing interest exists.

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