

Original Research Article

<https://doi.org/10.20546/ijcmas.2018.704.340>**Preparation of *Rabri* from Stored Concentrated Fig (*Ficus carica* L.) Pulp**C.Y. Dhumal^{1*}, J.K. Dhemre¹, R.J. Desale², M.B. Shete³ and S.N. Ambad⁴¹Department of Horticulture, Rahuri, Maharashtra, India²Department of Animal Husbandry and Dairy Science, Rahuri, Maharashtra, India³Floriculturist, NARP, Plain Zone, Ganeshkhind, Pune, Maharashtra, India⁴Horticulture Section, College of Agriculture, Kolhapur, Maharashtra, India

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The present investigation entitled “Preparation of *rabri* from stored concentrated fig (*Ficus carica* L.) pulp” was carried out during 2015–2016 at Post Harvest Technology Centre, Department of Horticulture, Mahatma Phule Krishi Vidyapeeth, Rahuri. The standardization of recipe i.e. quantity of concentrated fig pulp and sweetened condensed milk was finalised on the basis of sensory evaluation as 150 g and 1 L, respectively. The concentrated fig pulp which was packed in different packaging materials (glass bottles and standy pouches) and stored at two different storage conditions (ambient temperature and cold storage) for a period of 180 days were used for preparation of fresh *rabri* every month. On the basis of sensory evaluation, concentrated fig pulp packed in glass bottles and stored in cold storage was found to be best treatment combination for preparation of *rabri* during 180 days of storage. The cost of preparation of best treatment of *rabri* prepared from concentrated fig pulp was Rs. 237.81/kg.

Introduction

Fig (*Ficus carica* L.) belongs to the family Moraceae and native of Southern Arabia is widely cultivated throughout the tropical and subtropical regions of the world and to some extent in moderate climatic regions of temperate zone.

It is one of the most salt and drought tolerant fruit crops. It is grown commercially in areas bordering the Mediterranean sea, as well as U.S.A. In India, its commercial production is limited to a few centres in Maharashtra and South India. It is cultivated on commercial

scale in adjoining areas of Pune and Aurangabad. It is grown in small patches in Bengaluru, Sreerangapattanam and Bellary districts of Karnataka. It is also grown in and around Anantpur and Hyderabad in Telangana. In northern parts of India, its cultivation is scattered as a homestead crop in Punjab, Bihar, West Bengal and Uttar Pradesh. The production of fig in Maharashtra for the year 2013-14 was 2,705 MT from an area of 947 ha (Anon., 2014). Fig fruits cannot be stored for longer period and have to be sold in local market immediately after harvest. If the fruits are preserved in the form of concentrated pulp during seasonal glut, it may

help in better utilization of fig fruits for preparation of different types of products. Until recently, the surplus milk in flush season has been converted into skim milk powder and ghee by most of the dairies. The skim milk powder is largely used for recombination purpose during lean season. Now, we are fast moving from an area of scarcity to that of plenty. Thus the demand of skim milk powder and ghee is decreasing. Our dairy industry, therefore, may have to change the strategy that is, from skim milk powder to value added products like *khoa*, *rabri*, *burfi*, *kalakand*, etc. *Rabri* is indigenous milk product.

It is concentrated and sweetened whole milk product containing several layers of clotted cream. The basic methodology denotes to fresh cream milk heated in boiling pan to boil it. A thin layer of clotted cream formed on surface of milk clotted from time to time using a wooden stick. These layers of clotted cream are placed one over the other. This process is continued till 1/6th of original milk is left. Sugar 5 to 6% by weight of original milk volume is added. Fruits like grapes, apples, custard apple, etc. could be utilized for the preparation of fruit *rabri*. In addition, the colour and flavour of *rabri* is improved by incorporation of fruit pulp (Kerawala and Sidappa, 1963). Fig is a seasonal crop and its demand for utilization in various milk based products like *burfi*, ice cream, milkshake, etc. is rising. Therefore, the present investigation was carried out with an aim to utilize the stored concentrated fig pulp in *rabri* preparation with the following objectives

To standardize the recipe for making fig *rabri* from concentrated fig pulp.

To evaluate the sensory parameters of *rabri* prepared from concentrated fig pulp.

To study the cost of production of *rabri* from stored concentrated fig pulp.

Materials and Methods

Fig fruits and other ingredients

Fig fruits of Cv. Poona fig were obtained from All India Coordinated Research Project on Arid Zone Fruit Project, Department of Horticulture, MPKV, Rahuri. Well matured fruits of uniform and medium size were harvested, and brought to the Post Harvest Technology Centre for pulp extraction. Sodium benzoate was used as a preservative obtained from manufactures M/s. Thermo Fisher Scientific India Pvt. Ltd., Mumbai and the sweetened condensed milk (TSS: 60⁰B) of popular co-operative brand AMUL (Anand Milk Union Limited, Anand; Gujarat) was used for *rabri* preparation. It was procured from Ahmednagar city.

Pulp extraction, packaging and storage

The pulp after extraction from screw type pulper was heated till the TSS of the product became 35⁰B. The preservative i.e. sodium benzoate was added before TSS reached to end point. The hot concentrated fig pulp was filled in pre-sterilized 500 g glass bottles and 200 mL capacity standy pouches and sealed. All the packed samples were sterilized. The concentrated fig pulp was stored at ambient conditions and cold storage for a period of 180 days. The treatment details are given in Table 1. The flowchart for extraction and storage of concentrated fig pulp is given in Figure 1.

Observation recorded

Sensory evaluation of *rabri*

The sensory evaluation of freshly prepared *rabri* from stored concentrated fig pulp was done at 30 days interval for a period of 180 days for colour, flavour, texture, taste and overall acceptability by using a 9-point hedonic scale given by Amerine *et al.*, (1979).

Statistical analysis

The experiment was planned and carried out using Factorial Completely Randomised Design with five replications. The data obtained in the present investigation for sensory evaluation of *rabri* prepared from stored concentrated fig pulp was analysed for statistical significance according to the standard procedure given by Panse and Sukatme (1985).

Cost of production

The cost of production of fig *rabri* was worked according to the standard procedure given by Lal *et al.*, (1980).

Results and Discussion

Standardization of recipe for making *rabri* from concentrated fig pulp

Preliminary trials were conducted for preparation of *rabri* from concentrated fig pulp. The details of various treatment combinations for the preparation of *rabri* from different concentrated fig pulp levels are given in Table 2.

From the given treatment combinations, the best treatment was selected using sensory evaluation and used for further research. The flow chart for preparation of fig *rabri* from concentrated fig pulp is given in Figure 2.

Results of standardized treatments for preparation of *rabri* from concentrated fig pulp

The results in the table mentioned hereunder contain the sensory scores of preliminary trials for standardization of recipe for preparation of *rabri* using different combinations of concentrated fig pulp. The sensory scores of *rabri* prepared from different combinations of

concentrated fig pulp are mentioned in Table 3. On the basis of sensory evaluation, Treatment T5 i.e. 150 g of concentrated fig pulp and 1 litre of sweetened condensed milk was found to be better having overall acceptability of 8.65. Hence, the treatment T5 from Table 3 was selected and finalized for further research.

Preparation of *rabri* from concentrated fig pulp

The *rabri* was prepared from concentrated fig pulp packed in glass bottles and standy pouches stored in ambient temperature and cold storage. The *rabri* from concentrated fig pulp was prepared using standardized treatment i.e., concentrated fig pulp 150 g + 1.0 litre sweetened condensed milk. The freshly prepared fig *rabri* every month was evaluated for sensory parameters *viz.*, colour, flavour, texture, taste and overall acceptability.

Sensory parameters of freshly prepared *rabri* from concentrated fig pulp

The freshly prepared *rabri* from concentrated fig pulp had score for colour, flavour, texture, taste and overall acceptability as 8.74, 8.50, 8.52, 8.65 and 8.60, respectively.

Sensory parameters of freshly prepared *rabri* from stored concentrated fig pulp during 180 days

Colour

The treatment combination of packaging materials and storage conditions indicated that the colour of *rabri* prepared from concentrated fig pulp was found to be statistically significant upto 180 days. The highest sensory score for colour was observed in P1S2 from 8.70 to 8.12 followed by P2S2 from 8.65 to 8.02 during 180 days of storage (Table 4).

Fig.1 Preparation of concentrated fig pulp

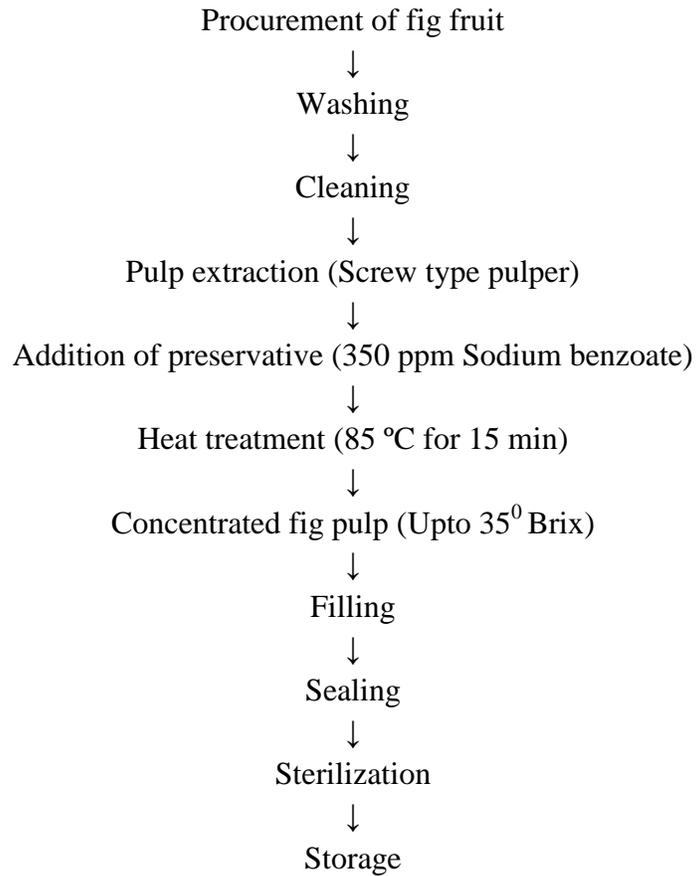


Fig.2 Preparation of fig *rabri* from concentrated fig pulp

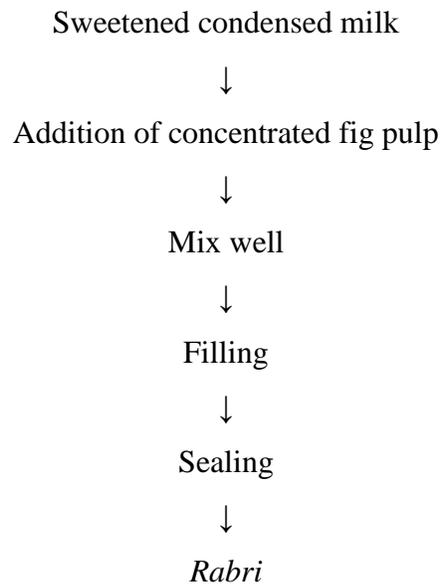


Table.1 Treatment details for concentrated fig pulp storage

Treatment No.	Interaction	Treatment details
T1	P1S1	Concentrated fig pulp + Glass bottles + Ambient conditions.
T2	P2S1	Concentrated fig pulp + Standy pouch + Ambient conditions
T3	P1S2	Concentrated fig pulp + Glass bottles + Cold storage
T4	P2S2	Concentrated fig pulp + Standy pouch + Cold storage

Table.2 Treatment details for *rabri* prepared from concentrated fig pulp

Treatments	Concentrated Fig pulp 35 ⁰ B (g)	Sweetened Condensed milk (litres)
T1	125	0.750
T2	125	1.000
T3	125	1.250
T4	150	0.750
T5	150	1.000
T6	150	1.250
T7	175	0.750
T8	175	1.000
T9	175	1.250

Table.3 Sensory scores of preliminary trials for *rabri* prepared from various treatment combinations of concentrated fig pulp

Sr. No.	Treatments	Colour	Flavour	Texture	Taste	Overall Acceptability
1	T1	8.05	7.95	7.90	8.34	8.06
2	T2	8.11	8.08	7.84	8.41	8.11
3	T3	8.17	8.10	7.96	8.27	8.13
4	T4	8.62	8.41	8.38	8.56	8.49
5	T5	8.78	8.52	8.56	8.72	8.65
6	T6	8.59	8.33	8.41	8.66	8.50
7	T7	8.23	8.09	8.00	8.16	8.12
8	T8	8.10	8.02	8.12	8.28	8.13
9	T9	8.23	7.96	8.09	8.31	8.15

Table.4 Effect of packaging materials and storage conditions on sensory parameters of fresh *rabri* prepared from stored concentrated fig pulp

Particulars	Storage period (days)	P1S1	P2S1	P1S2	P2S2	SE. m (+)	CD @ 5 %	CD @ 1 %
Colour								
	30 days	8.59	8.35	8.70	8.65	0.0367	0.1132	0.1587
	60 days	8.45	8.25	8.61	8.55	0.0265	0.0818	0.1146
	90 days	8.30	8.12	8.52	8.43	0.0163	0.0503	0.0705
	120 days	8.16	7.98	8.40	8.31	0.0155	0.0478	0.0670
	150 days	8.07	7.85	8.25	8.18	0.0176	0.0541	0.0758
	180 days	7.95	7.70	8.12	8.02	0.0118	0.0365	0.0511
Flavour								
	30 days	8.30	8.09	8.44	8.38	0.0327	0.1006	0.1411
	60 days	8.19	7.95	8.38	8.30	0.0306	0.0943	0.1323
	90 days	8.06	7.85	8.22	8.15	0.0163	0.0503	0.0705
	120 days	7.90	7.70	8.10	8.03	0.0176	0.0541	0.0758
	150 days	7.78	7.60	8.00	7.90	0.0135	0.0415	0.0582
	180 days	7.65	7.54	7.85	7.80	0.0114	0.0352	0.0494
Texture								
	30 days	8.31	8.13	8.48	8.43	0.0282	0.0868	0.1217
	60 days	8.20	8.01	8.41	8.35	0.0257	0.0793	0.1111
	90 days	8.05	7.85	8.30	8.22	0.0204	0.0629	0.0882
	120 days	7.88	7.70	8.18	8.08	0.0167	0.0516	0.0723
	150 days	7.72	7.52	8.02	7.90	0.0143	0.044	0.0617
	180 days	7.58	7.35	7.91	7.77	0.0122	0.0377	0.0529
Taste								
	30 days	8.51	8.29	8.61	8.57	0.0408	0.1258	0.1764
	60 days	8.40	8.18	8.55	8.50	0.0367	0.1132	0.1587
	90 days	8.28	8.10	8.45	8.38	0.0245	0.0755	0.1058
	120 days	8.14	7.95	8.36	8.26	0.0204	0.0629	0.0882
	150 days	7.98	7.75	8.27	8.14	0.0184	0.0566	0.0794
	180 days	7.81	7.62	8.13	8.00	0.0149	0.0459	0.0644
Overall acceptability								
	30 days	8.43	8.22	8.56	8.51	0.0245	0.0755	0.1058
	60 days	8.31	8.10	8.49	8.43	0.0327	0.1006	0.1411
	90 days	8.17	7.98	8.37	8.30	0.0147	0.0453	0.0635
	120 days	8.02	7.83	8.26	8.17	0.0171	0.0528	0.0741
	150 days	7.89	7.68	8.14	8.03	0.0163	0.0503	0.0705
	180 days	7.75	7.55	8.00	7.90	0.0114	0.0352	0.0494

Table.5 Economics of the cost of production of fig *rabri* from concentrated fig pulp

Sr. No.	Particulars	Rate (Rs.)	P1S1		P2S1		P1S2		P2S2	
			Qty.	Cost (Rs.)						
A.	Fixed cost									
1.	Interest @12 per cent on fixed assets.	-----	-----	0.015	-----	0.015	-----	0.015	-----	0.015
2.	Depreciation @10 per cent on fixed assets.	-----	-----	0.013	-----	0.013	-----	0.013	-----	0.013
	Total fixed cost (Rs.)			0.028		0.028	-----	0.028	-----	0.028
B.	Variable cost									
1.	Fig fruits	40/kg.	260 g.	10.4						
2.	Recovery of concentrated pulp		150 g.	-----	150 g.	----	150 g.	----	150 g.	-----
3.	Preservative (Sodium Benzoate)	1000/kg	0.91 g.	0.91						
4.	Packaging	Rs. 12/ glass jar. Rs 1.60/ Standee pouch	1	12	1	1.60	1	12	1	1.60
5.	Storage (Cold storage)	Rs. 2/kg	-----	-----	-----	-----	150 g.	0.30	150 g.	0.30
6.	Milk (sweetened condensed)	90/can (400 ml.)	1l	225/1	1 l.	225/1	1 l.	225/1	1 l.	225/1
7.	Overhead charges (@ 10 %)	-----	-----	24.81	-----	23.79	-----	24.86	-----	23.82
	Total variable cost (Rs.)			273.12		261.70		273.47		262.03
C.	Total cost (A+B) (Rs.)			273.14		261.72		273.49		262.05
D.	Total expenditure (Rs.)			273.14		261.72		273.49		262.05
E.	Total <i>rabri</i> prepared (kg.)		1.150		1.150		1.150		1.150	
F.	Cost of production of <i>rabri</i> per kg.			237.51		227.58		237.81		227.86
G.	Selling Price (Taking into consideration profit @ 20 %)		1 kg.	285.01	1 kg.	273.09	1 kg.	285.40	1 kg.	273.43

The lowest sensory score for colour was observed in P2S1 from 8.35 to 7.70 followed by P1S1 from 8.59 to 7.95 during 180 days. The data indicates that the scores for colour decreased continuously during 180 days. This might be due to non-enzymatic reaction of organic acids with sugars or oxidation of phenols, which leads to formation of brown pigments in the concentrated fig pulp during storage.

Similar results were reported by Kamble (2010) and Sutar (2014) on fig *burfi*; Kolape (2009) on papaya pulp *shrikhand*; Kamble *et al.*, (2010) on pineapple *burfi*; Hinwar (2013) on guava pulp *shrikhand* and Deshmukh (2014) on custard apple pulp utilisation in ice-cream and milkshake.

Flavour

The treatment combination of packaging materials and storage conditions indicated that the flavour of *rabri* prepared from concentrated fig pulp was found to be statistically significant upto 180 days. The highest sensory score for flavour was observed in P1S2 from 8.44 to 7.85 followed by P2S2 from 8.38 to 7.80 during 180 days of storage. The lowest sensory score for flavour was observed in P2S1 from 8.09 to 7.54 followed by P1S1 from 7.30 to 7.65 during 180 days.

With the increase in storage period there was decrease in the scores for flavour of *rabri* which might be due to loss of flavouring compounds at a higher rate at higher storage temperature in the concentrated fig pulp during storage. Similar results were reported by Kamble (2010) and Sutar (2014) on fig *burfi*; Kolape (2009) on papaya pulp *shrikhand*; Kamble *et al.*, (2010) on pineapple *burfi*; Hinwar (2013) on guava pulp *shrikhand* and Deshmukh (2014) on custard apple pulp utilisation in ice-cream and milkshake.

Texture

The treatment combination of packaging materials and storage conditions indicated that the texture of *rabri* prepared from concentrated fig pulp was found to be statistically significant upto 180 days. The highest sensory score for texture was observed in P1S2 from 8.48 to 7.91 followed by P2S2 from 8.43 to 7.77 during 180 days of storage. The lowest sensory score for texture was observed in P2S1 from 8.13 to 7.35 followed by P1S1 from 8.31 to 7.58 during 180 days. Similar results were reported by Kamble (2010) and Sutar (2014) on fig *burfi*; Kolape (2009) on papaya pulp *shrikhand*; Kamble *et al.*, (2010) on pineapple *burfi*; Hinwar (2013) on guava pulp *shrikhand* and Deshmukh (2014) on custard apple pulp utilisation in ice-cream and milkshake.

Taste

The treatment combination of packaging materials and storage conditions indicated that the taste of *rabri* prepared from concentrated fig pulp was found to be statistically significant upto 180 days of storage. The highest sensory score for taste was observed in P1S2 from 8.61 to 8.13 followed by P2S2 from 8.57 to 8.00 during 180 days. The lowest sensory score for taste was observed in P2S1 from 8.29 to 7.62 followed by P1S1 from 8.51 to 7.81 during 180 days. From the data it was observed that the taste scores of *rabri* decreased gradually during 180 days of storage which might be due to the gradual loss in taste scores might be due to changes in the volatile compounds in the concentrated fig pulp during storage. Similar results were reported by Kamble (2010) and Sutar (2014) on fig *burfi*; Kolape (2009) on papaya pulp *shrikhand*; Kamble *et al.*, (2010) on pineapple *burfi*; Hinwar (2013) on guava pulp *shrikhand* and Deshmukh (2014) on custard apple pulp utilisation in ice-cream and milkshake.

Overall acceptability

The treatment combination of packaging materials and storage conditions indicated that the overall acceptability of *rabri* prepared from concentrated fig pulp was found to be statistically significant upto 180 days.

The highest sensory score for overall acceptability was observed in P1S2 from 8.56 to 8.00 followed by P2S2 from 8.51 to 7.90 during 180 days of storage. The lowest sensory score for overall acceptability was observed in P2S1 from 8.22 to 7.55 followed by P1S1 from 8.43 to 7.75 during 180 days. From the data it is observed that the overall acceptability scores of *rabri* decreased due to oxidation, storage time, temperature, light exposure, packaging materials sorption or chemical composition and changes in volatile compounds in the concentrated fig pulp during storage. Similar results were reported by Kamble (2010) and Sutar (2014) on fig *burfi*; Kolape (2009) on papaya pulp *shrikhand*; Kamble *et al.*, (2010) on pineapple *burfi*; Hinwar (2013) on guava pulp *shrikhand* and Deshmukh (2014) on custard apple pulp utilisation in ice-cream and milkshake.

Economics of preparation of *rabri* from concentrated fig pulp

The cost of production of *rabri* from concentrated fig pulp which had maximum overall acceptability was from treatment P1S2 which is Rs. 237.81/kg (Table 5). Similar results are reported by Kamble (2010) on fig *burfi*; Sakate (2000) on wood apple *burfi*; Yadav *et al.*, (2010) on custard apple ice-cream; Bankar *et al.*, (2012) on pineapple *burfi*; Khore (2013) on strawberry *lassi*; Hinwar (2013) on guava pulp based *shrikhand*; Deshmukh (2014) on custard apple ice-cream and milkshake; Patil *et al.*, (2014) on papaya ice-cream; Navale *et al.*, (2015) on wood apple *burfi*.

The standardization of recipe i.e. quantity of concentrated fig pulp (150 g) and sweetened condensed milk (1 L) was finalised on the basis of sensory evaluation. The concentrated fig pulp packed in different packaging materials (glass bottles and standy pouches) and stored at two different storage conditions (ambient temperature and cold storage) for a period of 180 days were used for preparation of fresh *rabri* every month. On the basis of sensory evaluation, concentrated fig pulp packed in glass bottles and stored in cold storage was found to be best treatment combination for preparation of *rabri* during 180 days of storage. The cost of preparation of best treatment of *rabri* prepared from concentrated fig pulp was Rs. 237.81/kg.

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