

Changes in rabri during storage

K.P.SINGH AND BIRPAL SINGH¹

Deptt. of A.H. & Dairying, R.B.S. College, Bichpuri, Agra.

Abstract

Rabri samples type A (5% fat and 8.5% SNF in milk) and type B (6% fat and 9% SNF in milk) were prepared in the laboratory and examined for physico-chemical changes during storage at room temperature and refrigeration temperature. The changes were faster in sensory quality (physical) and chemical quality at room temperature than refrigeration temperature. In type B samples the changes in physico-chemical quality were more than that in type A samples.

key words: SNF, physico-chemical changes, refrigeration, chemical quality, sensory quality

Introduction

There are different types of concentrated Indian indigenous milk products, such as Khoa, rabri malai, khurchan etc. These products are highly localized in our country. There is no doubt that the idea of making milk products in ancient times was to store in times of plenty against the periods of scarcity but at present time milk products from regular part of the human diet and are the basis of prosperity and of source of income of the agriculture nations of the world.

Rabri is an important indigenous milk product quite popular in Northern India. It is a sweetened concentrated product made by skimming of successive layers of clotted cream from the simmering milk, adding sugar to the liquid residue in the pan when it has been concentrated to about one eighth of the original volume, and blending into it the skimmed off clots. It is highly nutritious as it contains about 70% total solids which consist of 20% milk fat, 17% lactose, 10% protein and 3% mineral matter besides 20-30% cane Sugar (Davies, 1958).

Materials and Methods

1. Preparation of control samples

The control samples (type A and type B) of rabri were prepared according to the method described by Sukumar, De (1988).

2. Physical/Sensory examination

The samples of rabri were examined by a panel of judges drawn from the deptt. of AH & Dairying, RBS College, Bichpuri, Agra for colour, flavour and body and texture using 100 point scale. 20 marks were allotted to colour 45 marks for flavour and 35 marks were allotted to body and texture.

3. Chemical analysis

The titratable acidity of samples was

determined according to IS:1165-1967. The pH of rabri was determined electrometrically with the help of Beckman pH meter. The total solids were determined gravimetrically using the method of IS:4079-1967. The fat content of rabri was determined by the Roesse Gottlieb method (IS:4079-1967). The free fat content of rabri was determined according to the method of Pruthi et al. (1973). The protein content was determined according to the kjeldahl method (A.O.A.C.1970). Lactose content was determined by the method described by Knowles and Watkin (1947). The well known Lane Eynon volumetric method was used for the determination of sucrose (IS: 4079-1967). The total ash, insoluble ash and soluble ash content of rabri were determined according to the method of AOAC (1970).

Results and Discussion

The score (Table 1) of colour of rabri decreased at both the temperature during storage. At room temperature on 6th days of storage was 14.080 ± 0.40 , respectively, for type A and type B samples. While at refrigeration temperature on 12th day of storage it was 13.20 ± 0.86 and 12.60 ± 0.74 in type A and type B samples. The score flavour on 6th day of storage at room temperature reduced to 34.00 ± 0.44 and 32.00 ± 0.70 points and at refrigeration temperature on 12 day of storage it decreased to 26.00 ± 0.44 and 25.00 ± 0.44 points in type A and type B samples from initial score of 43.20 ± 0.32 and 42.00 ± 0.63 points, respectively. The score for body and texture on 0 day as 33.80 ± 0.20 and 32.60 ± 0.51 points in type A and type B samples, respectively, decreased to 27.7 ± 0.80 and 25.8 ± 0.86 points on 6th day of storage at room temperature and 23.40 ± 0.51 and 31.60 ± 0.51 points on 12th day of storage at refrigeration and temperature, respectively. The total score of 95.80 ± 0.58 and 92.80 ± 0.91 points of type A and type B samples decreased to 76.00 ± 1.18 and 71.40 ± 1.67 points on 6th

Table 1 Changes in Physical (sensory) quality of rabri

Storage day Room Refri. temp	37°C						Storage at						Total score			
	Colour		Flavour		Body & texture		Total score		Colour		Flavour		Refrigeration (5°C) Body & texture		Total score	
	Type A	Type B	Type A	Type B	Type A	Type B	Type A	Type B	Type A	Type B	Type A	Type B	Type A	Type B	Type A	Type B
0	18.80±0.20	18.20±0.37	43.20±0.37	42.00±0.63	33.80±0.20	32.6070.51	95.80±0.58	92.80±0.91	18.80±0.20	18.20±0.37	43.20±0.37	42.00±0.63	33.80±0.20	32.60±0.51	95.80±0.58	92.80±0.91
2	17.80±0.20	17.40±0.24	41.40±0.40	40.00±0.70	31.40±0.51	30.40±0.40	90.60±0.92	87.80±0.91	18.00±0.24	18.00±0.44	42.40±0.24	41.40±0.60	32.60±0.24	32.60±0.51	93.40±0.67	92.00±1.04
4	17.40±0.24	16.80±0.37	40.20±0.37	38.20±0.66	30.00±0.70	29.00±0.89	87.60±1.03	84.00±1.58	17.60±0.24	17.80±0.37	41.60±0.51	41.20±0.49	31.60±0.24	31.20±0.49	90.80±0.58	90.40±0.81
6	14.80±0.20	13.60±0.40	34.00±0.44	32.00±0.70	27.23±0.80	25.80±0.86	76.00±1.18	71.40±1.69	17.40±0.24	17.60±0.40	40.40±0.40	40.40±0.40	30.80±0.37	29.80±0.37	96.60±0.92	87.08±1.06
8									16.20±0.24	16.20±0.20	38.40±0.24	33.20±0.37	29.40±0.40	28.80±0.37	84.40±0.51	83.20±0.66
10									15.40±0.40	14.40±0.40	37.60±0.40	36.20±0.58	27.00±0.70	26.80±0.70	80.00±1.37	77.40±1.03
12									13.20±0.86	12.60±0.74	26.00±0.44	25.00±0.44	23.40±0.51	21.60±0.51	62.60±1.28	54.70±1.59
Overall mean	17.20±0.35	16.50±0.43	37.40±0.81	38.05±0.67	30.50±0.67	29.40±0.6587	5001771.7284	00±1.91	16.77±0.33	16.40±0.37	38.51±0.94	37.77±0.96	29.80±0.58	20.05±0.63	85.08±1.81	83.25±1.92

Table 2 Analysis of variance for changes in Physical (sensory) quality of rabri

Source of variance	D.F.	M.S.S.						F- value								
		Room Refri.	Colour	Flavour	Body & texture	Total score	Colour	Flavour	Body & texture	Total score	Room Refri.	Room Refri.	Room Refri.	Room Refri.	Room Refri.	
Replication	4	4	1.21	4.9	9.62	3.82	11.33	2.82	40.81	26.23						
Bet sample	1	1	4.89	2.41	27.22	9.65	13.27	9.66	122.5	58.5	15.67**	4.18*	68.66**	11.86**	16.35**	11.38**
Bet period	3	6	34.56	41.34	172.75	351.82	78.49	139.05	767.36	1340.85	110.61**	71.73**	45.72**	423.37**	97.03**	172.52**
Sample x period	3	6	0.3	0.48	0.42	0.72	0.091	0.98	1.63	3.37	0.96	0.83	1.07	0.89	0.11	1.22*
Error	28	52	0.31	0.57	0.39	0.81	0.8	0.8	1.81	3.21						

NS= non significant

*= significant at (pd*0.05)

**= significant at (pd*0.01)

Table3: Changes in chemical composition of rabri during storage

Constituent	Storage temp. %	Storage period (days)												Overall				
		0		2		4		6		8		10		12		Type A	Type B	
		Type A	Type B	Type A	Type B	Type A	Type B	Type A	Type B	Type A	Type B	Type A	Type B	Type A	Type B	Type A	Type B	
Acidity	RT	0.176±0.002	0.176±0.002	0.276±0.002	0.302±0.004	0.34±0.012	0.368±0.004	0.432±0.11	0.464±0.005	0.364±0.002	0.364±0.002	0.364±0.002	0.414±0.009	0.456±0.004	0.502±0.004	0.518±0.005	0.309±0.02	0.321±0.021
	RFT	0.176±0.002	0.176±0.002	0.176±0.002	0.176±0.002	0.256±0.002	0.266±0.004	0.278±0.004	0.294±0.002	0.294±0.002	0.364±0.002	0.364±0.002	0.414±0.009	0.456±0.004	0.502±0.004	0.518±0.005	0.309±0.02	0.321±0.021
pH	RT	6.62±0.037	6.68±0.037	6.34±0.025	6.18±0.037	5.82±0.037	5.64±0.025	5.30±0.032	5.10±0.055	6.30±0.032	6.18±0.020	6.30±0.032	5.80±0.032	5.18±0.020	5.32±0.037	5.06±0.040	6.02±0.117	5.900±0.137
	RFT	6.62±0.037	6.68±0.037	6.62±0.037	6.66±0.037	6.54±0.024	6.35±0.039	6.32±0.020	6.12±0.020	6.12±0.020	6.30±0.032	6.18±0.020	5.80±0.032	5.18±0.020	5.32±0.037	5.06±0.040	6.217±0.078	6.033±0.105
TS	RT	73.65±0.60	74.81±0.33	71.47±0.60	72.12±0.31	70.09±0.61	70.62±0.32	6.48±0.67	68.88±0.27	67.74±0.36	71.86±0.37	62.31±0.66	62.31±0.66	6.82±0.45	57.92±0.43	64.77±0.70	70.43±0.66	71.61±0.52
	RFT	73.65±0.60	74.81±0.33	73.65±0.59	74.79±0.33	72.11±0.59	74.01±0.46	70.48±0.49	72.88±0.33	68.88±0.27	67.74±0.36	71.86±0.37	62.31±0.66	6.82±0.45	57.92±0.43	64.77±0.70	68.25±0.98	71.63±0.62
Total Fat	RT	20.58±0.49	21.56±0.28	20.15±0.49	20.86±0.19	19.888±0.53	20.46±0.19	19.22±0.69	20.42±0.18	18.69±0.45	21.04±0.29	17.13±0.36	20.00±0.11	15.11±0.38	19.00±0.11	18.80±0.35	19.95±0.28	20.83±0.14
	RFT	20.58±0.49	21.56±0.28	20.60±0.49	21.54±0.27	20.17±0.46	21.049±0.28	19.37±0.46	21.25±0.22	18.69±0.45	21.04±0.29	17.13±0.36	20.00±0.11	15.11±0.38	19.00±0.11	18.80±0.35	19.95±0.28	20.83±0.14
Free Fat	RT	10.82±1.26	8.88±0.63	11.83±1.25	9.83±0.64	11.93±1.01	10.39±0.65	13.07±0.73	11.59±0.65	11.79±1.15	10.76±0.46	11.94±0.96	11.28±0.47	13.41±0.91	11.92±0.47	11.46±0.40	11.79±0.53	10.17±0.37
	RFT	10.82±1.26	8.88±0.63	10.82±1.26	8.90±0.63	11.08±1.20	9.54±0.62	11.39±1.19	10.00±0.59	11.79±1.15	10.76±0.46	11.94±0.96	11.28±0.47	13.41±0.91	11.92±0.47	11.46±0.40	11.79±0.53	10.17±0.37
Protein	RT	10.58±0.43	10.47±0.28	10.40±0.48	10.38±0.27	10.36±0.49	10.31±0.27	10.14±0.49	0.22±0.24	9.84±0.32	9.84±0.18	9.11±0.13	9.57±0.19	8.50±0.14	9.13±0.19	9.84±0.16	10.37±0.22	10.34±0.12
	RFT	10.58±0.43	10.47±0.28	10.57±0.43	10.47±0.28	10.28±0.39	10.37±0.27	10.006±0.30	10.20±0.23	9.84±0.32	9.84±0.18	9.11±0.13	9.57±0.19	8.50±0.14	9.13±0.19	9.84±0.16	10.37±0.22	10.34±0.12
Lactose	RT	16.74±0.11	17.21±0.18	16.43±0.09	16.88±0.18	16.26±0.08	16.57±0.17	14.44±0.16	15.96±0.22	15.37±0.13	16.27±0.15	13.5±0.21	14.71±0.27	12.44±0.15	13.86±0.49	15.32±0.27	15.97±0.21	16.65±0.13
	RFT	16.74±0.11	17.21±0.18	16.74±0.11	17.14±0.14	16.37±0.14	16.92±0.14	16.09±0.13	16.61±0.15	15.37±0.13	16.27±0.15	13.5±0.21	14.71±0.27	12.44±0.15	13.86±0.49	15.32±0.27	15.97±0.21	16.65±0.13
Sucrose	RT	22.72±0.45	23.04±0.23	21.42±0.39	21.44±0.24	20.54±0.32	20.64±0.23	19.58±0.19	19.73±0.23	20.29±0.67	22.11±0.27	19.41±0.75	21.09±0.26	18.90±0.70	19.59±0.26	21.06±0.31	21.21±0.29	21.97±0.21
	RFT	22.72±0.45	23.04±0.23	22.72±0.45	23.04±0.23	22.23±0.45	22.68±0.31	22.00±0.47	22.26±0.26	20.29±0.67	22.11±0.27	19.41±0.75	21.09±0.26	18.90±0.70	19.59±0.26	21.06±0.31	21.21±0.29	21.97±0.21
Total Ash	RT	3.08±0.07	2.53±0.05	3.06±0.05	2.53±0.05	3.02±0.03	2.53±0.05	3.00±0.03	2.54±0.05	2.95±0.02	2.51±0.05	2.94±0.02	2.51±0.05	2.96±0.03	2.52±0.40	3.04±0.02	2.53±0.018	2.49±0.023
	RFT	3.08±0.07	2.53±0.05	3.06±0.05	2.53±0.05	3.05±0.06	2.52±0.05	3.01±0.04	2.52±0.05	2.95±0.02	2.51±0.05	2.94±0.02	2.51±0.05	2.96±0.03	2.52±0.40	3.04±0.02	2.53±0.018	2.49±0.023
Soluble Ash	RT	3.03±0.06	2.49±0.05	3.03±0.05	2.49±0.05	2.98±0.03	2.49±0.05	2.97±0.82	2.49±0.05	2.92±0.02	2.49±0.05	2.90±0.18	2.49±0.05	2.92±0.02	2.49±0.05	3.005±0.022	2.49±0.018	2.49±0.018
	RFT	3.03±0.06	2.49±0.05	3.02±0.05	2.49±0.05	2.99±0.05	2.49±0.05	2.98±0.05	2.50±0.05	2.92±0.02	2.49±0.05	2.90±0.18	2.49±0.05	2.92±0.02	2.49±0.05	3.005±0.022	2.49±0.018	2.49±0.018
Insoluble Ash	RT	0.046±0.004	0.03±0.01	0.032±0.007	0.036±0.01	0.038±0.007	0.032±0.006	0.026±0.006	0.046±0.01	0.032±0.007	0.018±0.005	0.034±0.007	0.018±0.005	0.038±0.007	0.034±0.005	0.035±0.003	0.025±0.003	0.025±0.003
	RFT	0.046±0.004	0.03±0.01	0.044±0.006	0.032±0.01	0.054±0.004	0.022±0.01	0.028±0.01	0.028±0.01	0.032±0.007	0.018±0.005	0.034±0.007	0.018±0.005	0.038±0.007	0.034±0.005	0.035±0.003	0.025±0.003	0.025±0.003

RT= Room Temperature

RFT= Refrigeration Temperature

Table 4: Analysis of variance for changes in chemical composition of rabri

S. No.	Source of variance	Rrplication		Bet. Sample		Bet. period		Sample X Period		Error	
		RT	RFT	RT	RFT	RT	RFT	RT	RFT	RT	RFT
1	DF	4	4	1	1	3	6	3	6	28	52
2	MSS										
	Acidity	0.00019	0.00002	0.046	0.0025	0.1306	0.162	0.00053	0.00057	0.00022	0.00008
	pH	0.0057	0.0048	0.1431	0.5886	3.988	3.24	0.0369	0.1294	0.0068	0.0048
	TS	1.777	3.062	14.14	199.093	75.135	242.22	1.807	13.395	1.135	1.0907
	Total fat	3.83	4.83	7.62	72.42	2.82	22.69	0.189	2.94	0.48	0.33
	Free fat	9.52	17.2	26.16	28.65	10.97	7.98	0.1117	0.83	3.22	3.06
	Protein	4.03	3.65	0.009	0.622	0.202	3.84	0.015	0.28	0.289	0.167
	Lactose	0.354	0.626	4.7	10.65	6.03	22.55	0.77	0.4	0.094	0.183
	Sucrose	1.44	3.18	0.212	13.95	18.7	22.62	0.04	1.24	0.31	0.85
	Ash (Total)	0.08	0.13	2.58	4.14	0.002	0.009	0.004	0.006	0.0032	0.0035
	Soluble	0.07	0.11	2.58	3.89	0.002	0.007	0.002	0.005	0.0032	0.0039
	Insoluble	0.001	0.002	0.0000025	0.003	0.00003	0.00045	0.00059	0.0002	0.00025	0.00019
3	F-Value										
	Acidity			20.04**	30.51**	594.52**	1966.67**	2.4	6.92**		
	pH			20.77**	121.95**	578.65**	671.31**	5.36**	26.81**		
	TS			12.45**	182.53**	66.19**	222.07**	1.59	12.28**		
	Total fat			15.69**	217.87**	5.81**	68.28**	0.39	8.84**		
	Free fat			8.12**	9.34**	3.40*	2.60*	0.036	0.27		
	Protein			0.033	3.72	0.69	23.03**	0.05	1.68		
	Lactose			49.77**	58.12**	63.82**	123.04**	8.22**	2.9		
	Sucrose			0.68	16.25**	60.26**	26.36**	0.3	1.45		
	Ash (Total)			805.39**	1154.61**	0.76	2.69*	1.41	1.89		
	Soluble		808.89**	983.03**	0.7	1.78	0.78	1.5			
	Insoluble		0.0103	19.94**	0.11	2.44*	2.34	1.05			

NS= non significacnt

* = significant at (pd^{0.05})** = significant at (pd^{0.01})

day of storage at room temperature and 62.60 ± 1.28 and 59.70 ± 1.5 points on 12 day of storage at refrigeration temperature, respectively. Analysis of variance (Table 2) for sensory quality revealed that the type of sample, period of storage at both the temperature had significant (pd^{0.01}) effect on score of colour, flavour and body and texture and total score of the product. However, interaction between type of samples and period of storage had non significant effect.

The result in Table 3 shows that the acidity of type A and type B samples ($0.176 \pm 0.002\%$) increased to 0.432 ± 0.011 and $0.464 \pm 0.005\%$ on 6th day of storage at room temperature and 0.502 ± 0.004 and $0.518 \pm 0.005\%$ on 12th day of storage at refrigeration temperature, respectively. These results are in fair agreement of Gayan and Pal (1991), who reported 0.52 and 0.35% acidity in rabri after 24 hrs at 30°C and for 20 days at 5°C storage temperature. The pH of type A and type B samples 6.62 ± 0.037 and 6.68 ± 0.037 , respectively, decreased to 5.30 ± 0.032 and

5.10 ± 0.055 on 6 day of storage at room temperature and 5.32 ± 0.037 and 5.06 ± 0.040 on 12th day of storage at refrigeration temperature. Published data are not available on this aspect compare the present findings. Total solids content $73.65 \pm 0.601\%$ in type A samples and $74.81 \pm 0.33\%$ in type B samples decreased to 66.48 ± 0.67 and $68.88 \pm 0.27\%$, respectively, after storage for 6 days storage at room temperature and 57.92 ± 0.43 and $64.76 \pm 0.70\%$ after 12 days of storage at refrigeration temperature. These data are in fair agreement of Narang et al. (1969), who reported the decrease in total solids content of khoa during storage. The fat content of product decreased from $20.58 \pm 0.49\%$ in type A samples and $21.56 \pm 0.27\%$ in type B samples, to 19.22 ± 0.69 , $20.42 \pm 0.18\%$ and 15.11 ± 0.38 , $19.00 \pm 0.11\%$, respectively, after storage for 6 days at room temperature and 12 days storage at refrigeration temperature. Published data are not available to affirm the present results. The free fat content of rabri increased from 10.82 ± 1.26 and $8.88 \pm 0.63\%$, respectively, in type A and type B samples

to 13.07 ± 0.73 , 11.59 ± 0.65 and 12.40 ± 0.91 , $11.92 \pm 0.47\%$, after storage for 6 days at room temperature and 12 days storage at refrigeration temperature. Published data are not available on this aspect to compare present findings. There were light changes in protein content of the product on storage for 6 days at both the temperature but after 6 days it decreased from $10.58 \pm 0.43\%$ in type A and $10.47 \pm 0.28\%$ in type B sample, to 8.50 ± 0.14 and $9.30 \pm 0.19\%$ on storage at refrigeration temperature for 12 days, respectively. Published literature is scarce on this aspect to compare present findings. The lactose content in type A sample ($16.74 \pm 0.11\%$) and in type B sample ($17.21 \pm 0.18\%$) decreased to 14.44 ± 0.16 , $15.96 \pm 0.22\%$ and 12.44 ± 0.15 , $13.86 \pm 0.49\%$, respectively, after 6th day of storage at room temperature and 12th day of storage at refrigeration temperature. These results are in fair tune of Dubey and Gupta (1986), who reported decrease in lactose content during storage. The sucrose content in type A samples ($22.72 \pm 0.45\%$) and in type B sample ($23.04 \pm 0.23\%$) decreased to 19.58 ± 0.19 , $19.7 \pm 0.23\%$ and 18.19 ± 0.070 , $19.59 \pm 0.26\%$, respectively, after 6 days of storage at room temperature and 12 days of storage at refrigeration temperature. These results are in fair tune of Dubey and Gupta (1986), who reported decrease in sucrose content of rabri during storage. The total ash, insoluble ash and soluble ash content did not change substantially during storage at 37°C and under refrigeration condition.

Analysis of variance Table 4 revealed that the type of sample, period of storage and temperature of storage had significant ($p < 0.01$) effect on changes in sensory quality and chemical constituents of rabri. The interaction between sample x period also had significant

effect ($p < 0.01$) on changes in Acidity, pH, T.S. and total fat.

During storage it was found that the changes in physico-chemical quality were at faster pace at room temperature than that at under refrigeration conditions. The changes in type B samples were more than type A samples. The product could be stored successfully under refrigeration condition for 12 days while for 6 days at room temperature.

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