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Study on Microbiological Quality of Safflower and Groundnut Milk, Paneer and Halwa: A Value-Added Dairy Products

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Abstract: ***The safflower oil is rich in polyunsaturated fatty acids, which helps in lowering the blood cholesterol and in preventing heart disease. Hence the present investigation was conducted to know the microbiological quality of laboratory-made safflower and groundnut plain milk, flavoured milk, safflower and groundnut milk incorporated paneer and halwa. The microbial population was estimated by analyzing microbial load in paneer, milk & halwa by using Nutrient Agar (NA) for bacteria and Martins Rose Bengal Agar (MRBA) for mold count and fat media for lipolytic bacteria, following the standard plate count method. As the storage period increased microbial population was also found to increase in all the products.***

Keywords: Safflower, groundnut, dairy products, microbial

1. Introduction

Safflower (*Carthamus tinctorius*) is a member of Compositae, family Asteraceae. Worldwide, safflower is a comparatively minor oilseed crop, being limited in its distribution by constraints of environment and its spiny nature. The plant has been cultivated for centuries in India either for its orange red dye (carthamin) extracted from its brilliantly coloured florets and/or for its much valued oil. With the advent of synthetic dyes and food colourants, the crop is now grown mainly for edible oil obtained from the seed. Utilization of safflower milk in different products will not only bring down its cost but will makes to improve their nutritional security. Such milk will be useful for those people who are allergic to cow or buffalo milk or people suffering from heart ailments, as safflower milk contains polyunsaturated fatty acids which help in lowering blood cholesterol. Safflower petals are used for treatment of coronary heart disease, hypertension, renal thrombosis, gyanaecological diseases, etc. It is also used as substitute for saffron imparts a golden colour to the milk.

Groundnut (*Arachis hypogaea* L.) occupies an important position in the economy of developing nations. The major groundnut producing countries are India, China and the United States. Groundnut is nutrient dense agricultural produce, which is very high in energy due to its high fat and protein content. The carbohydrate content of groundnut is relatively low, being under 30% of the whole nut. The nut has relatively high content of fiber. It is an industrial crop whose major utilization is a source of oil. As a result of improper processing and storage conditions of groundnuts and safflower milk and its products may be contaminated with microorganisms. Hence the present investigation was conducted with the objective to know the microbiological quality of laboratory-made safflower and groundnut plain milk, flavoured milk, safflower and groundnut milk incorporated paneer and halwa.

2. Materials and Methods

2.1 Milk and milk products preparation:

a) Materials

Materials required for the study was procured from local market *viz.*, groundnut, safflower seeds, cheese cloth and milk.

b) Methods

2.2 Shelf life studies of safflower seeds & groundnut products

Developed products were packed in different packaging materials and stored at refrigerated temperature (4 ± 2° C). Storage study was carried out for milk & halwa 7 days period and 15 days for paneer from the sensory evaluation. Packaging materials used were glass jar for milk, glass bottle for halwa and good life milk pouch for paneer. The products were evaluated for sensory evaluation.

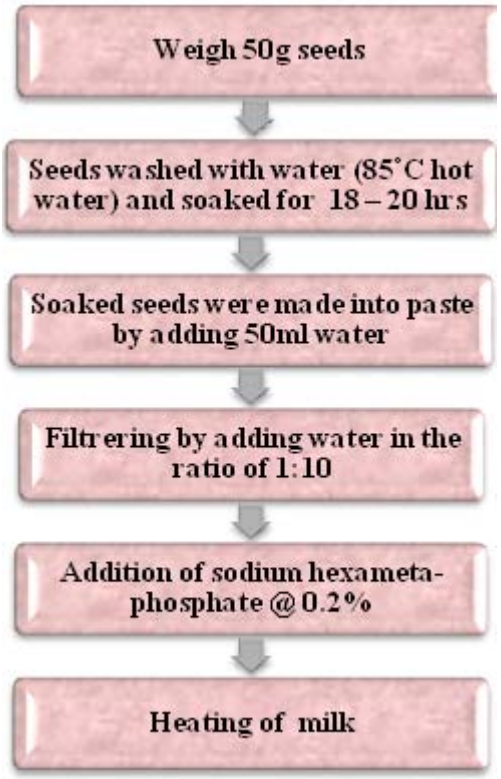

Figure 1: Preparation of safflower milk

Figure 2: Preparation of groundnut milk

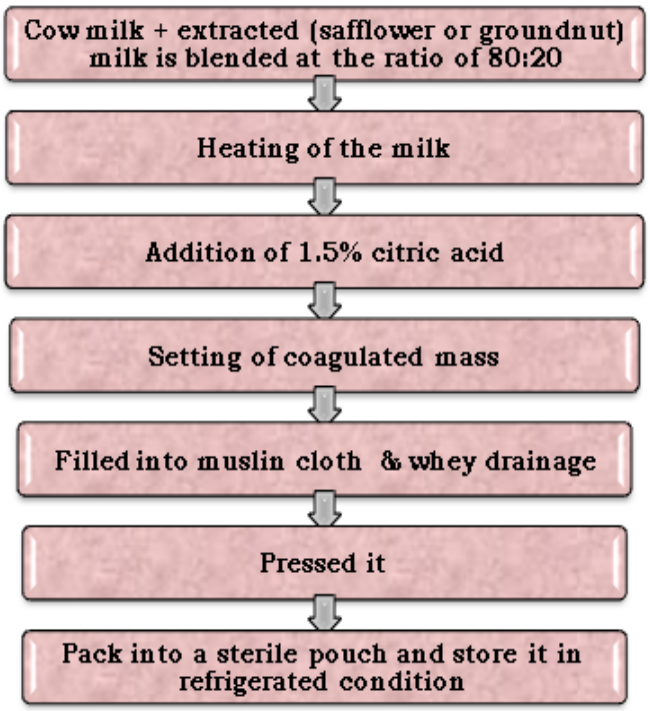

Figure 4: Preparation of paneer

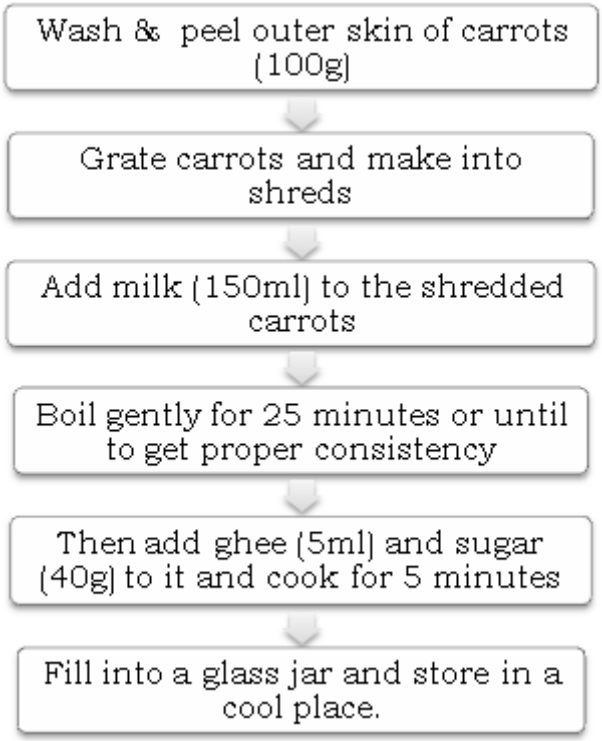

Figure 7: Preparation of carrot halwa

2.3 Microbial studies of safflower seeds & groundnut products (Anon, 1957)

Storage studies were conducted according to products in different packaging material and were kept at refrigerator temperature and every week the respective set of the packs were tested for its microbial load (Bacteria, lipolytic bacteria and mold). Initial and final microbial counts were carried out. The microbial population was estimated by analyzing microbial load in paneer, milk & halwa by using Nutrient Agar (NA) for bacteria and Martins Rose Bengal Agar

(MRBA) for mold count and fat media for lipolytic bacteria, following the standard plate count method. Samples were diluted to 103 for plating. The following media were used for enumeration of different microorganisms.

Organisms Medium
Bacteria : Nutrient agar (NA) (Anon, 1957)
Fungi : Martin's Rose Bengal Agar (MRBA) (Martin, 1950)
Lipolytic bacteria : Fat media (Collins *et al*., 1995)

Plates were incubated at room temperature for 2, 4 and 2 days for bacteria, mold and lipolytic bacteria respectively and colony counts were recorded.

2.4 Statistical analysis of the data (Snedecor and Cochran, 1968)

The data was tabulated keeping in view the objectives of the study. Analysis of variance technique (F-test) was employed for the nutrient composition and sensory characteristics to test the significant difference between groundnut & safflower seed products in the study. One-way analysis of variance was employed for the storage study.

3. Results and Discussion

3.1 Mean sensory scores for shelf-life studies of paneer

Results pertaining to impact of storage on sensory attributes of paneer are presented in Table 21. Groundnut milk paneer (CMP3) has obtained low score on 4th and 7th day storage compared to cow milk paneer (CMP1) and safflower milk paneer (CMP2). On initial day before storage, score for overall acceptability was found to be 8.40 for CMP1, 7.70 for CMP2 and 7.50 for CMP3, but it was decrease to 4.40, 3.60 and 3.00 respectively for all the three samples. Results reveal that there was significant difference in the sensory characteristics among all three products. It indicates that as the number of days increased, the score for all sensory characteristic decreased in all the three paneer products.

3.2 Mean sensory scores for shelf-life studies of carrot halwa

Results pertaining to impact of storage on sensory attributes of carrot halwa are presented in Table 22. Incorporated safflower paste (CH2) and groundnut paste (CH3) carrot halwa control (CH1) were kept for storage study. Among all three products as the day increased the sensory score for all sensory attributes were found to be decreased. From the result, it was found that appearance, texture, colour, flavour, taste and overall acceptability scores significantly deceased among all the products. Overall acceptability had low scores on 7th day of storage *i.e*., the scores decreased from 7.80 to 3.90, 8.20 to 3.30 and 6.40 to 2.80 in CH1, CH2 and CH3 respectively. Results reveal that there was significant difference in the sensory characteristics among all the three products at 5 per cent level.

3.3 Microbial study of milk on storage

Total bacterial, lipolytic bacteria and fungal population in milk of cow, safflower and groundnut at 1st, 4th and 7th days of storage are presented in Table-23. It was found that, the bacterial populations in all the samples were not found to be not significantly different from each other on 1st day of storage, whereas on 4th and 7th day significant difference was found. The lipolytic bacterial population from all the samples found were not significantly different from each other on 1st and 7th day of storage, but on 4th day the lipolytic bacterial population was significantly higher in G2 sample (29.00 ×103 cfu/g) compared to control and S2 samples (20.66 and 22.66 ×103 cfu/g respectively). The mold population on initial day was significant in S2 and G2 samples (6.66 and 4.00 ×103 cfu/g) compared to control.

On 4th day of storage, S2 and G2 samples showed significant lipolytic bacterial population (15.66 and 13.33 ×103 cfu/g respectively) compared to control (6.00 ×103 cfu/g). Similar trend was observed on 7th day, sample S2 and G2 showed higher mold population (32.66 and 31.66 ×103 cfu/g respectively) compared to control (16.66 ×103 cfu/g).

3.4 Microbial study of paneer on storage

Total bacterial, lipolytic bacteria and fungal population in safflower and groundnut milk incorporated paneer at 1st, 7th and 15th days of storage presented in Table-25. The bacterial population on initial, 7th and 15th day was not significantly different from all the samples. The lipolytic bacterial population on initial and 7th day storage was not significant among all the samples. Whereas on 15th day, the lipolytic bacterial population recorded higher in CMP2 and CMP3 (72.00 and 70.00 ×103 cfu/g) than CMP1 (63.66 ×103 cfu/g). On 1st day, the mold population was not recorded in any of the samples. Whereas on 7th and 15th day, the mold population was recorded non-significant. Sachdeva and Singh (1990) reported that fresh paneer had a total plate count of 101 to l03 cfu g-1 whereas for spoiled samples counts ranged from 158 × l04 cf/g-1 to 45 ×106 cfu/g-1 Paneer.

3.5 Microbial study of halwa on storage

Total bacterial, lipolytic bacteria and fungal population in safflower and groundnut incorporated halwa at 1st, 4th and 7th days of storage are presented in Table-26. With respect to bacterial population, all the samples were found to be not significantly different from each other on 1st, 4th and 7th day. Whereas similar results were found in lipolytic bacterial population. Mold population was also non-significant on 7th day, but no growth was found on initial and 4th day of storage period.

4. Conclusion

Hence, it can be concluded from the study that formulated safflower seed and groundnut products were nutrient dense with good acceptability, fairly good storage stability which can be promoted for regular consumption. Such products will be particularly useful for those people who are allergic to cow or buffalo milk or people suffering from heart ailments, as it contains mono and poly unsaturated fatty acids. Keeping in view the importance of indigenous dairy products and the limitations associated with the existing

methods of manufacture, the National Commission on Agriculture recommends to take up the production of various indigenous milk products by the organized plants. The Commission has suggested rationalizing the technique of production of various indigenous milk products and exploring the possibility by improving their keeping quality and packaging with minimum expense.

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Table 1: Mean sensory score for shelf life studies of paneer

Product	*Duration*	*Appearance*	*Texture*	*Colour*	*Flavor*	*Taste*	*Overall acceptability*
CMP1	Initial	8.10	8.10	8.40	8.60	8.60	8.40
	15 days	7.70	7.50	6.60	6.70	7.00	6.60
	30 days	7.20	5.40	4.20	4.70	4.70	4.40
	F value	*	*	*	*	*	*
	SEm ±	0.23	0.34	0.26	0.23	0.17	0.22
	CD at 5%	0.67	0.99	0.75	0.67	0.51	0.64
CMP2	Initial	8.20	8.30	7.70	7.70	7.80	7.70
	15 days	7.80	7.80	6.90	5.30	5.90	6.30
	30 days	6.70	5.80	5.30	3.40	3.30	3.60
	F value	*	*	*	*	*	*
	SEm ±	0.20	0.30	0.39	0.30	0.19	0.32
	CD at 5%	0.59	0.88	1.13	0.87	0.57	0.94
CMP3	Initial	7.70	7.20	7.50	7.30	7.20	7.50
	15 days	7.40	5.20	6.20	5.50	5.60	5.50
	30 days	6.70	4.20	4.50	2.60	2.90	3.00
	F value	*	*	*	*	*	*
	SEm ±	0.21	0.27	0.27	0.31	0.33	0.27
	CD at 5%	0.62	0.80	0.80	0.91	0.98	0.80

CMP1- cow milk paneer, CMP2- safflower milk paneer and CMP3- groundnut milk paneer

Table 2: Mean sensory score for shelf life studies of carrot halwa

Product	*Duration*	*Appearance*	*Texture*	*Colour*	*Flavor*	*Taste*	*Overall acceptability*
CH1	Initial	7.30	7.60	7.30	7.40	7.70	7.80
	4th day	6.50	6.40	6.00	6.50	6.50	6.70
	7th day	3.40	2.40	4.00	4.00	3.70	3.90
	F value	*	*	*	*	*	*
	SEm ±	0.27	0.35	0.31	0.27	0.30	0.27
	CD at 5%	0.80	1.01	0.90	0.80	0.87	0.80
CH2	Initial	8.40	8.00	8.40	8.20	8.30	8.20
	4th day	7.00	6.70	6.60	6.60	6.30	6.40
	7th day	3.00	3.80	4.10	3.20	4.00	3.30
	F value	*	*	*	*	*	*
	SEm ±	0.28	0.24	0.20	0.22	0.24	0.25
	CD at 5%	0.83	0.69	0.60	0.65	0.71	0.75
CH3	Initial	6.80	6.70	6.60	6.40	6.10	6.40
	4th day	5.70	5.90	4.90	5.00	4.70	5.00
	7th day	2.80	3.10	2.60	2.50	2.90	2.80
	F value	*	*	*	*	*	*
	SEm ±	0.32	0.27	0.29	0.33	0.42	0.41
	CD at 5%	0.95	0.78	0.85	0.98	1.22	1.19

CH1- control, CH2- safflower paste and CH3- groundnut paste

Table 3: Enumeration of total bacterial, lipolytic bacteria and fungal population in safflower and groundnut milk on 1st, 4th and 7th days of storage (cfu/10^3.g^{-1})

Sample	Bacteria			Lipolytic bacteria			Mold		
	1st day	**4th day**	**7th day**	**1st day**	**4th day**	**7th day**	**1st day**	**4th day**	**7th day**
Control	17.66	50.00[a]	59.00[a]	10.33[a]	20.66[b]	35.33[a]	0.00[b]	6.33[b]	16.66[b]
S2	20.66	57.35[a]	69.00[a]	14.33[a]	22.66[b]	45.66[a]	6.66[a]	15.66[a]	32.66[a]
G2	20.33	60.33[a]	68.00[a]	16.00[a]	29.00[a]	46.00[a]	4.00[a]	13.33[a]	31.66[a]
F value	NS	*	*	NS	*	*	*	*	*
SEm ±	1.37	3.40	3.39	2.25	1.58	3.22	1.12	2.51	3.03
CD at 5%	4.75	11.78	11.76	7.79	5.49	11.16	3.88	8.70	10.50

Control - Cow milk, S2 - safflower milk and G2 - groundnut milk

Table 4: Enumeration of total bacterial, lipolytic bacteria and fungal population in safflower and groundnut milk incorporated paneer on 1st, 7th and 15th days of storage (cfu/10^3.g^{-1})

Sample	Bacteria			Lipolytic bacteria			Mold		
	1st day	7th day	15th day	1st day	7th day	15th day	1st day	7th day	15th day
CMP1	18.00	30.66	42.33	21.00	41.00	63.66[b]	Nil	18.00	47.00
CMP2	18.66	32.00	47.33	23.33	46.66	72.00[a]	Nil	23.00	46.66
CMP3	18.33	31.00	46.66	29.00	43.66	70.00[a]	Nil	22.66	44.00
F value	NS	NS	NS	NS	NS	*	-	NS	NS
SEm ±	1.08	1.98	6.04	3.83	2.59	1.74	-	1.95	2.00
CD at 5%	3.76	6.85	20.92	13.26	8.98	6.03	-	6.75	6.95

CMP1- cow milk paneer, CMP2- safflower milk paneer and CMP3- groundnut milk paneer

Table 5: Enumeration of total bacterial, lipolytic bacteria and fungal population in safflower and groundnut incorporated halwa on 1st, 4th and 7th days of storage (cfu/10^3.g^{-1})

Sample	*Bacteria*			*Lipolytic bacteria*			*Mold*		
	1st day	*4th day*	*7th day*	*1st day*	*4th day*	*7th day*	*1st day*	*4th day*	*7th day*
CH1	14.66	23.00[a]	57.66	13.66	21.00	51.33	Nil	Nil	35.66
CH2	15.00	25.33[a]	60.33	14.33	23.00	55.66	Nil	Nil	37.66
CH3	14.66	21.30[a]	57.33	16.33	24.66	57.00	Nil	Nil	36.33
F value	NS	*	NS	NS	NS	NS	-	-	NS
SEm ±	1.74	1.38	1.56	1.73	1.30	2.15	-	-	1.00
CD at 5%	6.17	4.80	5.41	5.99	4.51	7.44	-	-	3.46

CH1- control, CH2- safflower paste and CH3- groundnut paste