

ENHANCING OF MILK BEVERAGES

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ABSTRACT

The effect of adding mango, guava pulp, total milk protein powder, skim milk powder, storage period and fat ratio on Chemical composition was investigated. Results revealed that the addition of mango and guava pulp to skim milk increased the acidity, total solids (T.S), reducing sugars (R.S), non reducing sugars (N.R.S) and viscosity of the final product. However it had a negligible effect on the total protein (T.P) and non protein nitrogen (N.P.N) of the final product. The increase in fat ratio caused an increase in total solids, total protein, non protein nitrogen, pH and viscosity. However decreased the acidity and it had no effect on reducing sugars (R.S) and non reducing sugars (N.R.S). The fortification of mango and guava - flavoured cow's skim milk beverages with total milk protein powder (retentate) and skim milk powder increased T.S, T.P, N.P.N, acidity and viscosity. On the other hand that fortification decreased the reducing sugars (R.S) and pH. Pasteurized beverages had a marked increase on R.S, N.P.N, acidity and viscosity, and a decrease in N.R.S and pH after storage on refrigerator condition up to 2 weeks. However, the changes in T.S and T.P during storage were slight.

INTRODUCTION

Refreshing beverages have a very strong market all over the world, and even more important in Egypt. Flavoured milk offers the same great nutrient-rich package as white milk and can help improve overall diets. The use of skim milk in the preparation of beverages has been favoured by several studies as it improves the nutritional value of the product. Ibrahim. et al, (1993a,b) described the commercially available beverages based on skim milk and several beverages have been developed. Skim milk is a very important by-product in dairy manufacture. Skim milk resulted from separated milk using a cream separator. Mango and guava fruits are characterized by their high nutritive value and sweet taste. The objective of the present study was to investigate the effect of added mango and guava as flavouring materials, total milk protein powder (retentate), skim milk powder, storage period and fat ratio on the chemical composition of cow's skim milk.

MATERIALS AND METHODS

Materials :-

Milk sample Fresh bulk cow milks obtained from dairy unit of dairy department. Sugar was obtained from the local market. Stabilizers, Commercial carboxy methyl cellulose sodium salts (CMC) obtained from Amrety Company, Mansoura, Egypt. Fruits Selected mango varieties Alphonso and guava fruits were obtained from the local market. Skim milk powder obtained from Amrety Company, Mansoura, Egypt. Total milk protein powder (retentate) obtained from

Experimental :

Preparation of mango pulp

The fruits (mango) were washed with water, peeled off and destoned. The flesh was packed in poly-ethylene bags and stored in a deep freezer (-18 °C) until required.

Manufacture of Pasteurized mango-milk beverage:

Pasteurized mango milk beverage was prepared by using mango pulp 20 %, Sugar 2 % and CMC 0.02%. The mixture was then added to partially cow's skim milks (0, 1.5 and 3 % fat) and stirred for two minutes. The mixtures were pasteurized at 75 °C for five minutes and cooled, then filled in plastic package, covered and stored in a refrigerator at 5 ± 1 °C for 2 weeks. In agreement with Al-Haq, M. I. and Mohyuddin, G(1992).

Preparation of Guava pulp:

Guava fruits were thoroughly washed cut in to pieces then mixed in a blender and filtered through a cheese cloth. The resulting mixed pulp was heated in a stainless steel container at 87.5 °C for one minute to inactivate pectinase enzymes, cooled rapidly in an ice water bath at 20 °C then filled into poly-ethylene bags and stored in a deep freezer (-18 °C) until required.

Manufacture of the pasteurized guava milk beverage:

Pasteurized guava milk beverage was prepared by using guava pulp 10%, sugar 4 % and CMC 0.05%. The mixture was then added to cow's skim milks (0, 1.5 and 3% fat) and stirred for two minutes and filtered through cheese cloth. The mixtures were pasteurized in a water-bath at 75 °C for five minutes, cooled to room temperature, then filled in plastic package, covered and stored in refrigerator at 5 ± 1 °C for 2 weeks.

Fortified mango and guava - milk beverages by:

a. Total milk protein powder (retentate)

The total milk protein powder was added at the rate of 1.5 and 3% to partially skimmed cow's milk (1.5 % fat) and (0 % fat) , stirred to dissolve the protein at 60 °C for 10 minutes then 20% mango and 10% guava pulps with 2 and 4% sugar were added. The mixture was filtered through cheese cloth. The mixture was pasteurized at 75 °C for 30 sec and cooled, Put into plastic package, covered and stored in a refrigerator at 5 ± 1 °C. In agreement with Visser, F.M.W. (1981).

b. Skim milk powder

Skim milk powder was added at the rate of 1.5 % to skimmed cow's milk (1.5 % fat) and 3% to skimmed cow's milk (0 % fat) , stirred to dissolve the protein at 45 °C for 10 minutes then 20% mango and 10% guava pulps with 2 and 4% sugar were added. The mixture was filtered through cheese cloth. The mixture was pasteurized at 75 °C for 30 sec and cooled, put into plastic package, covered and stored in a refrigerator at 5 ± 1 °C.

Samples from each treatment were analyzed for acidity, pH, total solids(T.S), total protein(T.P) and non protein nitrogen(N.P.N) (Ling, 1963). Viscosity was determined by Ostwald tube (Arbuckle, 1986). Reducing sugars(R.S) and non reducing sugars N.R.S were determined by (Shaffer and Smogyi, 1945) during storage period (15 day).

RESULTS AND DISCUSSION

The data in table (1) illustrated the effect of adding guava and mango pulp and fat ratio on the composition of skim milk.

Addition of mango and guava pulp caused a decrease in pH value ranged between 0.15 and 0.25 pH values and an developing on acid content from 0.15 % at zero time to (0.21- 0. 25%) when 20% mango pulp and 10% guava pulp were added. These results are in agreement with Gudnason et al, (1960).who reported that the addition of fruit flavour into milk caused an increase on its acid content.

Table(1): Chemical composition of guava and mango cow's skim milk beverages with different ratio of fat (A 0%, B 1.5%, C 3%).

Kind of treatment	T.S (A)	T.P (B)	N.P.N (C)	R.S (D)	N.R.S (E)	PH	Acidity	Viscosity	
Skim milk control	7.5	3.25	0.13	4.7	—	6.5	0.15	1.35	
guava	1	12.11	2.98	0.033	4.130	4.080	6.35	0.26	1.740
	2	13.61	3.01	0.035	4.130	4.080	6.43	0.24	1.843
	3	15.10	3.04	0.038	4.130	4.080	6.55	0.21	2.182
mango	4	11.23	2.71	0.034	3.616	4.425	6.40	0.25	1.681
	5	12.73	2.72	0.035	3.616	4.425	6.50	0.23	1.784
	6	14.25	2.74	0.038	3.616	4.425	6.55	0.21	2.123

A- Total solids

B- Total protein

C- Non protein nitrogen

D- Reducing sugars

E- Non reducing sugars

1- Cow's skim milk 0% fat+10% guava pulp+4% sugar+0.05% CMC.

2- Cow's skim milk 1.5% fat +10% guava pulps+4% sugar+0.05% CMC.

3- Cow's skim milk 3% fat+ 10% guava pulp+4% sugar+0.05% CMC.

4- Cow's skim milk 0% fat+20% mango pulp+2% sugar+0.02% CMC.

5- Cow's skim milk 1.5% fat +20% mango pulps+2% sugar+0.02% CMC.

6- Cow's skim milk 3% fat+20% mango pulp+2% sugar+0.02% CMC.

The addition of mango and guava pulp caused an increase in the concentration of reducing sugar , non reducing sugar , total solids and viscosity in the final product. No important difference could be detected in total protein and non protein nitrogen for the control sample when it was compared with 20% mango pulp and 10% guava pulp were incorporated because mango and guava pulp not contains non-protein nitrogen fractions (Askar, 1966). The increasing of Fat ratio had no effect on reducing sugar and non reducing sugar content and decreased the acidity to 0. 21% in the final product compared to 0.26% as compared with fresh skim milk beverage. on the other hand this increase caused an increase in total protein , non protein nitrogen, total solids, viscosity and pH value ranged from 0.1 to 0.2 in the final product as compared with fresh skim milk beverage.

The data in table (2) illustrated the effect of adding total milk protein powder (TMPP) and skim milk powder on the composition of skim milk.

No important difference could be detected in reducing and non-reducing sugar with increasing the total milk protein powder (retentate) and skim milk powder concentration in fresh mango and guava skim milk beverages were observed. Addition of total milk protein powder (retentate) caused a decrease in pH value amounting to 0.1 pH values, while the

addition of skim milk powder caused a decrease in pH value amounting to 0.2 pH values.

Table (2): Effect of adding total milk protein powder (retentate) and skim milk powder on chemical composition of guava and mango cow's skim milk beverages

Kinds of juice	Additives	treatments	T.S (A)	T.P (B)	N.P.N (C)	R.S (D)	N.R.S (E)	pH	Acidity	Viscosity
Guava	Retentate	1	15.10	3.04	0.038	4.130	4.080	6.55	0.21	2.182
		2	14.81	4.06	0.038	4.207	4.237	6.35	0.26	1.92
		3	14.51	5.08	0.036	4.285	4.395	6.25	0.29	1.895
	Skim milk powder	4	15.10	3.04	0.038	4.130	4.080	6.55	0.21	2.182
		5	15.76	3.88	0.034	4.685	4.362	6.30	0.27	1.935
		6	15.12	3.995	0.046	4.249	4.418	6.10	0.35	2.156
Mango	Retentate	7	14.25	2.74	0.038	3.616	4.425	6.55	0.21	2.123
		8	13.93	3.77	0.039	3.693	4.582	6.35	0.26	2.034
		9	13.63	4.81	0.035	3.815	4.740	6.30	0.275	2.191
	Skim milk powder	10	14.25	2.74	0.038	3.616	4.425	6.55	0.21	2.123
		11	14.89	3.79	0.039	4.126	4.365	6.30	0.275	2.183
		12	14.26	3.92	0.041	3.986	4.492	6.20	0.30	2.075

A- Total solids

B- Total protein

C- Non protein nitrogen

D- Reducing sugars

E- Non reducing sugars

- 1- Cow's skim milk 3% fat+10% guava pulp+4% sugar+0.05% CMC.
- 2- Cow's skim milk 1.5% fat +1.5% retentate+10% guava pulp+4% sugar+0.05% CMC.
- 3- Cow's skim milk +3% retentate+ 10% guava pulp+4% sugar+0.05% CMC.
- 4- Cow's skim milk 3% fat+10% guava pulp+4% sugar+0.05% CMC.
- 5- Cow's skim milk 1.5% fat +1.5% skim milk powders+10% guava pulp+4% sugar+0.05% CMC.
- 6- Cow's skim milk+3% skim milk powder+10% guava pulp+4% sugar+0.05% CMC.
- 7- Cow's skim milk 3% fat+20% mango pulp+2% sugar+0.02% CMC.
- 8- Cow's skim milk 1.5% fat +1.5% retentate+20% mango pulp+2% sugar+0.02% CMC.
- 9- Cow's skim milk +3% retentate+ 20% mango pulp+2% sugar+0.02% CMC.
- 10- Cow's skim milk 3% fat+20% mango pulp+2% sugar+0.02% CMC.
- 11- Cow's skim milk 1.5% fat +1.5% skim milk powders+20% mango pulp+2% sugar+0.02% CMC.
- 12- Cow's skim milk+3% skim milk powder+20% mango pulp+2% sugar+0.02% CMC.

The addition of total milk protein powder (retentate) and skim milk powder caused an increase in acidity ranged from 0.26 to 0.27% compared to 0.23 - 0.25% in fresh mango and guava skim milk beverage, total protein , non protein nitrogen, total solids and viscosity of the final product . The increase in non protein nitrogen was higher at the addition of skim milk powder than total milk protein powder (retentate), on the other hand the increase in total protein was higher at the addition of total milk protein powder (retentate) than skim milk powder. The increase in total solids was higher in the addition of skim milk powder than total milk protein powder (retentate), on the other hand the increase in viscosity was higher in the addition of total milk protein powder (retentate) than skim milk powder. These results are in agreement with Ibrahim, M. K. E.; et al,(1993b).

The data in table (3, 4) illustrated the effect of storage on the composition of mango and guava flavoured skim milk and fortified mango and guava flavoured skim milk.

Table (3): Effect of storage at 5 ± 1 °C for 15 days on the chemical composition of guava and mango cow's skim milk beverages.

Chemical composition	Storage periods	T.S (A)	T.P (B)	N.P.N (C)	R.S (D)	N.R.S (E)	PH	Acidity	Viscosity
1	Zero	12.11	2.98	0.033	4.130	4.080	6.35	0.26	1.740
	3 days	12.13	2.98	0.041	4.202	4.153	6.35	0.26	1.754
	7days	12.06	2.98	0.045	4.152	4.235	6.35	0.26	1.779
	10 days	11.96	2.97	0.055	4.089	3.710	6.30	0.275	1.832
2	Zero	13.61	3.01	0.035	4.130	4.080	6.43	0.24	1.843
	3 days	13.63	3.01	0.040	4.202	4.153	6.43	0.24	1.858
	7days	13.56	3.01	0.046	4.152	4.235	6.40	0.25	1.893
	10 days	13.49	2.99	0.057	4.089	3.710	6.40	0.25	1.972
3	Zero	15.10	3.04	0.038	4.130	4.080	6.55	0.21	2.182
	3 days	15.128	3.04	0.043	4.202	4.153	6.55	0.21	2.200
	7days	15.03	3.04	0.049	4.152	4.235	6.55	0.21	2.225
	10 days	15.95	3.02	0.056	4.089	3.710	6.50	0.23	2.278
4	Zero	11.23	2.71	0.034	3.616	4.425	6.40	0.25	1.681
	3 days	11.27	2.70	0.041	3.788	4.498	6.40	0.25	1.685
	7days	11.19	2.70	0.047	3.738	4.580	6.40	0.25	1.720
	10 days	11.14	2.69	0.051	3.515	4.213	6.30	0.275	1.773
5	Zero	12.73	2.72	0.035	3.616	4.425	6.50	0.23	1.784
	3 days	12.75	2.72	0.038	3.788	4.498	6.50	0.23	1.799
	7days	12.70	2.72	0.046	3.738	4.580	6.50	0.23	1.834
	10 days	12.66	2.70	0.051	3.515	4.213	6.45	0.24	1.862
6	Zero	14.25	2.74	0.038	3.616	4.425	6.55	0.21	2.123
	3 days	14.26	2.74	0.044	3.788	4.498	6.55	0.21	2.141
	7days	14.23	2.73	0.049	3.738	4.580	6.55	0.21	2.194
	10 days	14.19	2.72	0.054	3.515	4.213	6.50	0.23	2.229

A- Total solids

B- Total protein

C- Non protein nitrogen

D- Reducing sugars

E- Non reducing sugars

- 1- Cow's skim milk 0% fat+10% guava pulp+4% sugar+0.05% CMC.
- 2- Cow's skim milk 1.5% fat +10% guava pulps+4% sugar+0.05% CMC.
- 3- Cow's skim milk 3% fat+ 10% guava pulp+4% sugar+0.05% CMC.
- 4- Cow's skim milk 0% fat+20% mango pulp+2% sugar+0.02% CMC.
- 5- Cow's skim milk 1.5% fat +20% mango pulps+2% sugar+0.02% CMC.
- 6- Cow's skim milk 3% fat+20% mango pulp+2% sugar+0.02% CMC.

Storage caused a slight decrease in the pH value in all samples at the end of storage period. This ranged from 0.05 to 0.1 pH values, which is in agreement with the finding of Hassan, F. A. M.; et al,(1996).On the other hand Storage caused a slight increase in acidity , viscosity and non protein nitrogen in all samples at the end of storage period which is in agreement with Ibrahim, M. K. E.; et al,(1993b).

This increase in viscosity may be caused by the increase in acidity and sugar decomposition to organic acids (Webb and Hufnagel . 1948) and the increase in N.P.N content of stored milk can be attributed to residual thermo resistant enzymes activity of psychrotrophic bacteria Mottar (1981). Also, a slight increase in the reducing and non-reducing sugar was observed up to 10 days of storage ,followed by slight decrease later on, which is in agreement with Ibrahim, M. K. E.; et al,(1993a). The decrease in reducing

and non-reducing sugars after 15 days of storage might be due to decomposition of lactose and sucrose to organic acid (Patton. 1952). A little change in the concentration of total solids and total protein during storage period was observed, which is in agreement with Ibrahim, M. K. E.; et al, (1993b).

Table (4): Effect of storage at 5 ± 1 °C for 15 days on the chemical composition of fortified guava and mango cow's skim milk beverages with total milk protein powder (retentate) and skim milk powder.

Chemical composition	Storage periods	T.S (A)	T.P (B)	N.P.N (C)	R.S (D)	N.R.S (E)	PH	Acidity	Viscosity
1	Zero	14.51	5.08	0.036	4.285	4.395	6.25	0.29	1.895
	3 days	14.52	5.08	0.041	4.315	4.422	6.25	0.29	1.906
	7days	14.51	5.07	0.045	4.280	4.475	6.25	0.29	1.918
	10 days	14.49	5.07	0.051	4.192	4.221	6.20	0.30	1.962
2	Zero	14.81	4.06	0.038	4.207	4.237	6.35	0.26	1.92
	3 days	14.84	4.06	0.041	4.261	4.287	6.35	0.26	1.97
	7days	14.82	4.05	0.046	4.191	4.322	6.35	0.26	2.12
	10 days	14.80	4.04	0.049	4.322	4.196	6.31	0.275	2.36
3	Zero	13.63	4.81	0.035	3.815	4.740	6.30	0.275	2.191
	3 days	13.64	4.82	0.037	3.875	4.765	6.30	0.275	2.196
	7days	13.62	4.81	0.041	3.805	4.796	6.25	0.29	2.209
	10 days	13.60	4.80	0.044	3.722	4.650	6.20	0.30	2.228
4	Zero	13.93	3.77	0.039	3.693	4.582	6.35	0.26	2.034
	3 days	13.93	3.77	0.042	3.712	4.559	6.35	0.26	2.084
	7days	13.92	3.76	0.045	3.686	4.662	6.35	0.26	2.112
	10 days	13.89	3.76	0.047	3.575	4.473	6.30	0.275	2.165
5	Zero	15.12	3.995	0.046	4.249	4.418	6.10	0.35	2.156
	3 days	15.13	3.995	0.048	4.912	4.462	6.10	0.35	2.163
	7days	15.09	3.990	0.053	4.803	4.499	6.10	0.35	2.163
	10 days	5.06	3.980	0.057	4.784	4.286	6.00	0.37	2.218
6	Zero	15.76	3.88	0.034	4.685	4.362	6.30	0.27	1.935
	3 days	15.67	3.88	0.039	4.689	4.017	6.30	0.27	1.969
	7days	15.22	3.87	0.045	4.578	4.178	6.30	0.27	1.995
	10 days	15.08	3.85	0.049	4.492	3.643	6.10	0.35	2.068
7	Zero	14.26	3.92	0.041	3.986	4.492	6.20	0.30	2.075
	3 days	14.26	3.92	0.045	34.04	4.513	6.20	0.30	2.088
	7days	14.25	3.91	0.049	4.004	4.587	6.10	0.35	2.118
	10 days	14.21	3.89	0.056	3.836	4.263	6.10	0.35	2.183
8	Zero	14.89	3.79	0.039	4.126	4.365	6.30	0.275	2.183
	3 days	14.89	3.79	0.043	4.178	4.408	6.30	0.275	2.195
	7days	14.87	3.79	0.045	4.122	4.477	6.20	0.30	2.234
	10 days	14.84	3.78	0.051	3.997	4.158	6.10	0.35	2.276

A- Total solids

B- Total protein

C- Non protein nitrogen

D- Reducing sugars

E- Non reducing sugars

- 1- Cow's skim milk +3% retentate+ 10% guava pulp+4% sugar+0.05% CMC.
- 2- Cow's skim milk 1.5% fat +1.5% retentate+10% guava pulp+4% sugar+0.05% CMC.
- 3- Cow's skim milk +3% retentate+ 20% mango pulp+2% sugar+0.02% CMC.
- 4- Cow's skim milk 1.5% fat +1.5% retentate+20% mango pulp+2% sugar+0.02% CMC.
- 5- Cow's skim milk+3% skim milk powder+10% guava pulp+4% sugar+0.05% CMC.
- 6- Cow's skim milk 1.5% fat +1.5% skim milk powder 10% guava pulp+4% sugar+0.05% CMC.
- 7- Cow's skim milk+ 3% skim milk powder+20% mango pulp+2% sugar+0.02% CMC.
- 8- Cow's skim milk 1.5% fat +1.5% skim milk powder+20% mango pulp+2% sugar+0.02% CMC.

A little change in the concentration of total protein throughout the storage period was observed. This may be due to decomposition of protein causing transformation of small fraction of it to non protein nitrogen.

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تحسين المشروبات اللبنية

الطاهرة محمد احمد عمار ، عبد الوهاب الشاذلي خليل و محمد صبري مصطفى
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يهدف هذا البحث إلى إنتاج مشروب اللبن الفرز البقرى المطعم بالمانجو أو الجوافة و أثر اضافة لب الفاكهة وبروتين اللبن المركز واللبن الفرز المجفف وفترة التخزين واختلاف نسبة الدهن على التركيب الكيمائي له.

تشير النتائج إلى أن إضافة لب المانجو و الجوافة إلى اللبن الفرز أدت إلى زيادة نسبة الحموضة والمواد الصلبة الكلية والسكريات المختزلة و الغير مختزلة واللزوجة في الناتج النهائي. ولكن لها تأثير بسيط للغاية على نسبة البروتين الكلى والنيتروجين الغير بروتيني.

كذلك أدت زيادة نسبة الدهن إلى زيادة نسبة المواد الصلبة الكلية و البروتين الكلى والنيتروجين الغير بروتيني واللزوجة و درجة ال pH بينما قلت نسبة الحموضة في الناتج النهائي. ولكن وجد أن ليس لها تأثير على نسبة السكريات المختزلة و الغير مختزلة.

وعند تدعيم هذه المشروبات ببروتين اللبن المركز واللبن الفرز المجفف أدى ذلك إلى زيادة نسبة المواد الصلبة الكلية و البروتين الكلى والنيتروجين الغير بروتيني واللزوجة و الحموضة بينما قلت درجة ال pH و. السكريات المختزلة في الناتج النهائي.

وعند تخزين هذه المشروبات لمدة 15 يوم على درجة حرارة الثلاجة 5 ± 1 أدى ذلك إلى زيادة نسبة السكريات المختزلة والنيتروجين الغير بروتيني و الحموضة و اللزوجة. بينما قلت درجة ال pH و السكريات الغير مختزلة في الناتج النهائي. بينما وجد تغير بسيط في نسبة المواد الصلبة الكلية و البروتين الكلى .