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MANUFACTURE OF EXOTIC FRUIT-FLAVOURED MILK BEVERAGE BY EMPLOYING UHT TECHNIQUE

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Milk-shakes especially containing apple are popular beverage of the summer season in Pakistan. Pineapple-flavoured apple milk-based beverages were prepared by using different doses of four stabilizers and varying SMP contents. After one day's cold storage, 16 formulations thus prepared were organoleptically evaluated by a trained panel of judges to select the best beverage. Recodan and Supercol applied @ 0.2-0.3% gave inferior-quality beverages, while Grindsted's Gelodan and Givaudan's stabilizer No. 76084-72 gave acceptable beverages. The best formulation was prepared by using 13% cane-sugar, 3% apple pulp, 2% SMP, 0.3% Givaudan's stabilizer, 0.2% citric acid, 0.02% sodium citrate, 0.01% potassium sorbate, 0.07% pineapple flavour, colour as desired and made volume to 100% with water. This was manufactured on a UHT plant by direct steam-injection technique at 144°C and packed in 250 ml brick packs. The results of the triangular taste test showed that the product was admired by the panelists and it remained good up to 75 days' storage in ambient and 90 days' refrigerated storage.

Key words: Milk-based fruit beverages, Apple milk shakes, UHT technique.

Introduction

Milk drinks containing fruit are gaining popularity all over the world. These drinks have been recognized as genuine thirst quenchers, light and refreshing. Several workers have prepared milk drinks by using different kinds of fruits [1-5]. In Pakistan, some research work [3,4,6] has also been carried out in the Department of Food Technology, University of Agriculture, Faisalabad, by utilizing mango and banana fruits with some stabilizers and employing pasteurized techniques [3-5]. The present study was aimed at manufacturing a product flavoured with a fruit which is not available in Pakistan, i.e. pineapple and making it nutritious by adding the pulp of some other fruit. For this purpose it was decided to use apple pulp, as it was expected to mingle well with the exotic flavour of pineapple. Hedrick *et al.* [1] manufactured cherry flavoured milk drinks and reported that consumer acceptance increased when 4% apple pulp was added to the drink. Apple pulp was also expected to give richness of mouth feel to the beverages and increase its nutritive value. Moreover, the low acid content of the fruit used was expected to reduce the risk of milk coagulation and, when consumed, would suppress excessive formation of gastric acid. Shih [2] stated that pineapple flavoured milks could be prepared by using pineapple essence, sugar and pineapple juice in varying proportions. He observed that casein slowly precipitated.

In the present study, different formulations were manufactured by using four different stabilizers and by varying their doses. Powder milk offers more convenience than fluid milk because it directly gives standardized milk [4], therefore it was decided to use skimmed milk powder (SMP).

A formulation was manufactured industrially by employing direct-steam injection Ultra High Temperature (UHT) technique. UHT-treated products are sterile and easily digestible, besides having long-life, even if not refrigerated. Blanc *et al.* [7] reported that direct UHT milk was preferred in all organoleptic assessments to the indirect UHT milk and it was generally indistinguishable in flavour from pasteurized milk when stored for upto 8 weeks at 5°C, but after longer storage its flavour deteriorated.

In the present study, an attempt has been made to study whether fruit-milk drinks have acceptability or not, because the general observation is that milk-shakes are popular beverages of the summer season in Pakistan and that the people of Pakistan relish such beverages. If this observation is confirmed then one of the 25 dairy plants of Pakistan could be persuaded to take initiative in marketing the fruit-milk beverages.

Materials and Methods

The study was divided into two phases. In the first phase, 16 formulations (Table 1) were manufactured by varying levels of apple pulp, stabilizers and their doses. This exercise was conducted in the laboratories of the Department of Food Technology, University of Agriculture, Faisalabad, in the sum-

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mer of 1988. For manufacturing pineapple-flavoured fruit-milk-base beverages it was decided to use the last year preserved pulp by the Department by adding 700 ppm of potassium meta-bisulphite and 1% citric acid. The other ingredients used in this study (SMP, cane sugar, preservatives, stabilizer) were locally purchased.

First part of the study. In the first part of the study, the four stabilizers viz. Supercol (Guar gum), Grindsted's Recodan R.S., Grindsted's Gelodan M.S. and Givaudan's No. 76084-72 were tested. Except Gelodan, the other three stabilizers were not used in the earlier series of studies [3-6] and were employed for the first time in this study. In addition to the stabilizers and SMP levels mentioned in Table 1, the other ingredients used in manufacturing all the formulations were cane-sugar (13%), sodium citrate (0.02%), potassium sorbate (0.01%), citric acid (0.2%), pineapple flavour (0.07%) and water (81.42%). The method of manufacture was followed as given by Al-Haq and Mohyuddin [4]. After preparation the products were packed in pre-sterilized bottles, immediately cooled and stored in a refrigerator. The next day the performance of 16 milk beverages so obtained were judged on the basis of colour, taste and flavour by a seven-member trained panel of judges on 9-point hedonic scale as described by Larmond [8]. The numerical values were equivalent to:

(1) = Dislike extremely, (2) = Dislike very much, (3) = Dislike moderately, (4) = Dislike slightly, (5) = Neither dislike no like, (6) = Like slightly, (7) = Like moderately, (8) = Like very much and (9) = Like extremely.

The scores were then statistically analyzed by using analysis of variance technique as described by Steel and Torrie [9] and out of the 16 preparations, the most-liked formulation was picked up.

Second part of the study. The most-liked formulation screened out through the first part of the study was industrially manufactured at Kabirwala Dairies Ltd., Kabirwala, Khanewal, where it was given direct steam injection UHT treatment at 144°C for 3-4 sec. After cooling to 77°C by evaporation, homogenization at 188 bar pressure at 50°C and chilling at 25°C, the product was packed in 250 ml tetra packs and stored under ambient and refrigerated conditions. Later on these were transferred, in a refrigerated tank car, from Khanewal to the Fruits and Vegetables Laboratory, Department of Food Technology, University of Agriculture, Faisalabad, where further studies were undertaken. To study shelf-life, triangular test as described by Larmond [8] was used. At each testing three samples were presented to every member of the taste panel. Two samples of these were identical, i.e. refrigerated, while the third, which was kept under ambient conditions, was refrigerated only one hour before evaluation, to make the serving temperature of the three

samples similar. These three samples were presented to the judges in randomized order along with the evaluation proforma, asking them the following four questions:

1. Can you detect a difference in these samples? (Yes/No)
2. Please indicate the degree of difference: (Slight/Moderate/Much/Extreme)
3. Which one is the odd (Please tick) ? (Coded Sample: 1/2/3)
4. Which is the best (please give the code)? Code No: _____

The judges were instructed that they should rinse mouth, sniff each sample deeply, put approximately 5-10 ml sample in 50 ml beaker, swish around so that it reaches all parts of the tongue and score the sample. Rinse mouth again, taste another sample and continue through series with the same drill. They were also directed not to disturb the order of the samples. Sensory evaluations were carried out after an interval of 15 days. The data obtained were statistically analyzed as described by Larmond [8] by employing the statistical charts prepared by Roessier *et al.* [10].

Results and Discussion

First part of the study. The aggregate scores on the 9-point Hedonic scale (9+9+9 i.e. colour + taste + flavour) for the sensory evaluation of the 16 formulations given by the panel of seven expert judges are shown in Table 2. The results showed highly significant differences for the various treatments employed. The average scores revealed that (a) four treatments fell in the "dislike moderately" group, which

TABLE 1. TREATMENT CODES WITH THE LEVELS OF DIFFERENT STABILIZERS AND SKIMMED MILK POWDER.

Codes	Stabilizer	Stabilizer Dose (%)	SMP (%)
A-1	Supercol (guar gum)	0.2	2
A-2	Supercol (guar gum)	0.3	2
A-3	Supercol (guar gum)	0.2	3
A-4	Supercol (guar gum)	0.3	3
B-1	Recodan R.S.	0.2	2
B-2	Recodan R.S.	0.3	2
B-3	Recodan R.S.	0.2	3
B-4	Recodan R.S.	0.3	3
C-1	Gelodan S.M.	0.2	2
C-2	Gelodan S.M.	0.3	2
C-3	Gelodan S.M.	0.2	3
C-4	Gelodan S.M.	0.3	3
D-1	Givaudan S-76084-72	0.2	2
D-2	Givaudan S-76084-72	0.3	2
D-3	Givaudan S-76084-72	0.2	3
D-4	Givaudan S-76084-72	0.3	3

were B-1, B-2, B-3 and B-4; (b) four (A-1, A-2, A-3 and A-4) in "dislike slightly" group; (c) two (D-1 and D-3) in the "neither dislike nor like"; (d) five (C-2, C-4, C-1, C-3 and D-4) in "like slightly" group; and (e) one treatment (D-2) fell in "like moderately" group.

It is interesting to note that the four treatments prepared by using Recodan stabilizer fell in "dislike moderately" group. Although Recodan is one of the mostly used stabilizers in the industrially processed fluid milks but in the current case it was completely eliminated when used up to 0.3%. The possible reason could be the fact that pineapple-flavoured apple-milk-beverages were manufactured by utilizing SMP, hence due to less fat contents Recodan could not give successful results. Similarly, all the four treatments of the "dislike slightly" class were manufactured by employing Supercol stabilizer. Guar gum is now-a-days utilized in the fruit-drink industry of Pakistan, as it is cheaper than the other stabilizers because it is locally manufactured. But in fruit-milk beverages it did not yield good results when used up to 0.3%.

The two treatments D-3 and C-2 were rated by the judges in the "neither dislike nor like" group, while the remaining six treatments fell in the "like" groups. These six were either prepared by using Grindsted's Gelodan or Givaudan's Stabilizer No. S-76084-72. Hence it was concluded that these two stabilizers could be used successfully for manufacturing fruit-milk beverages. Rehman *et al.* [3] stated that 0.15 and 0.20% Mexpectin RS-450 and Gelodan both tended to check coagulation of casein and separation of constituents, thereby giving a better-quality banana milk-based beverages prepared by using fresh milk of cow and buffalo.

The two treatments which fell in the "like" group were D-1 and D-2, while the codes for the five treatments which fell in "like moderately" were C-3, C-1, C-4, C-2 and D-3. The treatment D-2 was adjudged as the best by the panelists. It contained Givaudan's Stabilizer No. S-76084-72 @ 0.3% and SMP @ 2%.

Second part of the study. The best formulation contained 13% sucrose, 3% apple pulp, 2% SMP, 0.3% Givaudan's Stabilizer No. 76084-72, 0.2% citric acid, 0.02% sodium citrate, 0.01% potassium sorbate, 0.07% Givaudan's Pineapple flavour and 81.42% water and was industrially manufactured at a UHT plant and was presented to the taste panel for evaluation.

To judge the quality triangular taste test was employed. Its results are shown in Table 3, which showed that on the first and the 15th day evaluation five out of seven judges correctly matched the refrigerated samples. These, when compared with the statistical charts prepared by Roessler *et al.* [10] indicated a detectable difference between the two samples. On 30th to 60th day evaluation six out of seven judges

correctly identified the odd sample. It is evident from Table 3 that on 75th and 90th day every judge correctly identified the ambient sample. According to Roessler *et al.* [10], six correct judgements out of seven in a triangular test indicate a significant difference at 1% level.

The degree of difference indicated by six judges, who correctly identified the odd sample revealed to be slight (1.66) (Table 4).

The next part of the triangular test was to choose the more acceptable sample. Of the six judges who correctly identified the odd sample, five reported the sample kept under refrigerated conditions as more acceptable. According to Roessler's statistical chart, these results were significant at 5% level.

On 75th day evaluation, the judges reported change in drinking quality for the samples stored under ambient conditions and on 90th day evaluation they declared ambient sample as deteriorated, while no significant change was

TABLE 2. SCORES FOR THE PINEAPPLE FLAVOURED APPLE-MILK-BASED BEVERAGES.

Treatment Codes	Total score obtained on 9-point hedonic scale from 7 judges (Total = 189)	Average of seven judges (Total = 27)	Rank
A-1	89	12.7 h	10
A-2	88	12.5 h	11
A-3	96	13.7 g	9
A-4	85	12.1 h	12
B-1	75	10.1 i	14
B-2	67	9.6 j	15
B-3	72	10.3 i	13
B-4	65	9.3 j	16
C-1	139	19.8 c	4
C-2	129	18.2 d	6
C-3	143	20.4 b	3
C-4	132	18.8 d	5
D-1	105	15.0 f	8
D-2	164	23.4 a	1
D-3	108	15.4 e	7
D-4	164	20.8 b	2

Note: Means followed by the same letter do not differ at P = 0.05 percent probability level by DMR test. F Value (Judges = 2.70* and Treatments = 554.90**). Coefficient of variation = 3.34%. * = significant. ** = highly significant.

TABLE 3. RESULTS OF TRIANGULAR TEST.

Identified	Storage time (Days)						
	1	15	30	45	60	75	90
Correctly	5	5	6	6	6	7	7
Incorrectly	2	2	1	1	1	0	0
Total	7	7	7	7	7	7	7

TABLE 4. DEGREE OF DIFFERENCE INDICATED BY THE JUDGES WHO CORRECTLY IDENTIFIED THE ODD SAMPLE.

Degree of difference	(Scores × No. of Judges)	Value
Slight	(1 × 3)	1
Moderate	(2 × 2)	6
Much	(3 × 1)	3
Extreme	(4 × 0)	0
Total	6	10

Average difference = 1.66 (Slight).

reported in case of refrigerated samples even on 90th day evaluation. The results are also in conformity with the results obtained by the physico-chemical analysis of the same product [7]. The increased shelf-life was due to the fact that in this study, the milk-based beverages were prepared on industrial scale by UHT technique and were packed aseptically, hence it gave 75 days shelf-life in ambient and 90 days life in refrigerated storage conditions. While in case of pasteurized mango fruit-flavoured milk-based beverages the shelf life was estimated as 3 days in ambient and 49 days in refrigerated conditions [4,5], while in case of bottled banana fruit milk it was one month in cold storage [3].

Conclusion

Apple milk-beverages can be successfully flavoured with pineapple essence as it gave refreshing, thirst quenching beverages, when served chilled. Hence, increased milk consumption accompanied by a reduction in soft drink intake is strongly recommended on nutritional grounds.

Recodan and Supercol applied up to 0.3% in fruit-milk

beverages prepared by using SMP gave inferior-quality beverages, while the same proportion of Gelodan and Givaudan's stabilizer No. 76084-72 proved effective in controlling the sedimentation, stabilizing the dispersed phase and in checking coagulation of milk.

By using UHT technique 75 days shelf-life of such beverages can easily be obtained in ambient conditions. Further research may increase this shelf-life period.

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