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Preparation and Evaluation of Fruit Flavored Soymilk

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Abstract: Soymilk was prepared by soaking soybeans fortnight with sodium bicarbonate (baking soda), drained, and then blanched to inactivate lipoxygenase enzyme. Beans were passed through blender and extract was squeezed through muslin cloth, adjusted TSS of the remaining milk to 12% with distilled water, and homogenized. The milk was sweetened with 5% cane sugar and divided to four equal lots. Three lots were flavoured separately with most acceptable quantity (10%) of mango, banana and guava fruit pulp and one lot was kept as control. All the samples were pasteurized at 161°F for 16 minutes, cooled packed in 250ml sterilized glass bottles and stored in refrigerator (40-45°F). All the samples were analyzed for pH, acidity, TSS, protein and fat and organoleptically evaluated at an interval of one week till coagulation. It was observed that pH decreased while acidity and TSS significantly ($P<0.05$) increased in all samples. There was no effect of storage on protein content of all samples. The fat content remained almost the same. The score for color and flavour significantly ($P<0.05$) decreased during storage. All the samples coagulated after four week storage.

Key words: Soymilk, Fruit flavoured soymilk, flavoured milk, Physicochemical analyses

Introduction

Soybean is a universal food, feed fodder and industrial crop. It is used to prepare more than 400 different products. It's by products are also used in manufacturing of soap, varnishes, paints, lubricants and plastics.

It is used in the food industry in the manufacturing of flour, oil, margarine, biscuits, candy, milk, meat, cheese, lecithin and many other food products. Nutritionally it is much superior to all conventional pulses like gram, lentil, mong, mash, pigeon pea, cowpea and various beans.

Soybean is low in carbohydrates, thus useful for diabetic patients as well as for weight reducing purposes. It is far superior in the supply of essential amino acids and essential fatty acids. It also contains almost all

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vitamins and more minerals as compared to other pulses. Soybean contains 37.54 to 45.60% protein, 19.40 to 27.00% crude fat, 0.17 to 0.21% Ca (Ahmed et al.,, 1983). Soybean is reported to have a high nutritive value, being rich in both lysine and tryptophane, which are generally deficient in diets based on cereals. Soybean protein may give good blend with the protein of cereals.

In the United Sates, China and other far east countries, soymilk is used by individuals who are allergic to the protein of cow's milk, or who are lactose intolerant. Soymilk is popular among vegetarians who wish to totally avoid animal products. Further processing of soymilk in many of the same ways as cow's milk produces products similar to yoghurt or cheese. Soymilk may be used in place of cow's milk in a number of recipes. Soymilk is sold around the world and in many cases, it is flavored or sweetened to suit local preferences. Added ingredients change the nutrient content depending on the flavoring or sweetener used.

A 100 gm portion (about ½ cup) of soymilk provides 3.20g of protein, comparing favorably with cow's milk, which contains 3.29g. On the other hand soymilk contains less calcium, phosphorus, and sodium. Soymilk, however contains more iron, magnesium and potassium than whole cow's milk. Soymilk is getting more popularity and acceptability in developing countries due to its high nutritive value (Ruth, 1989).

Soymilk has a particular beany flavour which is not liked by most consumers. To overcome this problem, the milk was sweetened with sugar and flavoured with various fruit flavours. It is hoped that this project will help in overcoming the deficiency of milk and will also help the people interested in preparation of milk beverages.

Materials and Methods

Soybean seed

The research work was conducted in the Department of Food Science and Technology, NWFP Agricultural University, Peshawar. Certified seeds of soybean variety Swat-84, obtained from Agronomy Department of NWFP Agricultural University Peshawar, were used for the preparation of soymilk.

Cleaning of soybean

Soybean was cleaned to remove all extraneous materials. Then, it was washed twice with clean water.

Preparation of soymilk

Soaking of soybean

One kg of soybean was soaked in 3 kg of water (1:3) containing 50 gm of sodium bicarbonate (baking soda) for eight hours. After soaking soybean seeds were blanched for 25 minutes in boiled water containing baking soda in order to destroy lipoxygenase enzyme. The blanched seeds were drained and ground in a blender with small amount of warm water to form a paste. The paste was diluted to 10-12% total solids with water. The soymilk so prepared was heated to 180°F for 12 minutes. After heating the soymilk was homogenized (Escueta and Banzon, 1979).

Preparation of flavored soymilk

Soymilk was sweetened with 5% cane sugar. Different amount of fruit flavor, such as mango, guava and banana were added to soymilk samples @ 7, 9 and 10%. One of the soymilk samples was kept as control i.e. unflavored.

Preservation

The flavored soymilk samples in case of each flavour were subjectively analysed by a panel of 10 judges to find out the most acceptable flavoured soymilk drink sample. After finding out the most acceptable drink sample in case of each flavour, the samples were prepared, homogenized, filled in glass bottles, pasteurized at 161°F for 16 minutes, and cooled.

Storage

The most acceptable fruit flavored soymilk drinks were stored in refrigerator at (40-45^{0}F) for further studies to determine the shelf life and to see the effect of storage on the physicochemical characteristics of each sample.

Physicochemical Analysis

Samples pH was determined with a Microprocessor Bench-top pH meter, Model H1817, Italy according to the instruction manual of the apparatus. Titratable acidity, total soluble solids (TSS), crude protein and crude fats were determined by the standard method of A.O.A.C. (1990).

Organoleptic evaluation:

For organoleptic evaluation colour and flavour a 9 point Hedonic scale was used as described by Larmond (1977) starting from extremely disliked to extremely liked.

Statistical Analysis:

All the data regarding chemical analysis and organoleptic evaluation were statistically analyzed by using randomized complete block design (RCBD) as described by Steel and Torrie (1980

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Results and Discussion

Soymilk was prepared by traditional or conventional method by soaking soybean seeds for overnight in water containing sodium bicarbonate. Then inactivated the lipoxygenase enzyme by keeping the soaked seeds in warm water. Lipoxygenase is responsible for beany or chalky flavour of soymilk. Soybeans seeds were then blended in blender, extracted the soymilk by squeezing the extract through muslin cloth, adjusted its TSS to 12% with water. The milk was then sweetened with 5% sucrose and homogenized. The milk was divided into four lots. Among which three lots were flavoured with 10% guava, banana and mango pulp separately, since the biggest hurdle is the acceptance of soymilk by the consumers. One lot was kept as control. The soymilk drinks were subjectively analysed by a panel of 10 judges, in order to determine the most acceptable drink.

Soymilk samples were analyzed for various constituents such as pH, titratable acidity, TSS, protein, fats and colour and flavour at 0 storage and at an interval of one week upto 4 week storage period. The mean values of pH in case of guava, mango and banana flavoured milk drink samples and control were 5.4, 5.38, 6.38 and 6.6 respectively. The pH significantly ($P<0.05$) decreased to 5.1, 5.2, 5.9, 6.3 in case of guava, mango, banana and control soymilk samples respectively (Table 1). These results are in agreement with Gould et al. (1946) who observed that titratable acidity increases and pH decreases in milk during storage. The findings regarding pH are also in agreement with the findings of Nelson et al. (1978) who found out that the average pH of whole soymilk was 7.2.

The mean values of percent titratable acidity in case of guava, mango, banana and unflavoured soymilk were 0.392, 0.406, 0.286, 0.235 respectively (Table 2). Significant increase in percent titratable acidity was observed in all samples during storage. The mean values of TSS in case of guava, mango, banana and unflavoured were 12.4, 11.8, 12.0, 11.0 respectively (Table 2). These results are in agreement with Gould et al. (1946) who investigated that titratable acidity increases in milk during storage. These results are in agreement with the findings of Munir et al. (1985) who found that titratable acidity increases during storage. In another study Webb et al. (1974) reported that the acidity of milk increases with temperature, partially as a result of changes in the buffer capacity of the milk salts and the expulsion of carbon-dioxide on heating. This increase in acidity might be due to the thermal decomposition of the lactose to organic acids. Significant increase in TSS was observed in all samples during storage (Table 3).

Table 1. Effect of Storage period on the pH of soymilk.

Samples	Storage interval days					Means
	0 week	1st Week	2nd week	3rd week	4th week	
Guava flavored Soymilk	5.8	5.4	5.3	5.3	5.1	5.38 C
Mango flavored Soymilk	5.8	5.5.	5.3	5.2	5.2	5.4 C
Banana flavored Soymilk	6.8	6.6.	6.5	6.1	5.9	6.3 B
Controlled Soymilk	7	6.9	6.5	6.3	6.3	6.6. A
Means	6.35 A	6.1 E	5.9 C	5.7 D	5.62 E	

Figures bearing the same letters are statistically not different from one another (P<0.05).

Table 2. Effect of Storage period on the titratable acidity of soymilk.

Samples	Storage interval days					Means
	0 week	One Week	Two week	Three week	Four week	
Guava flavored soymilk	0.386	0.386	0.39	0.39	0.41	0.392 B
Mango flavored soymilk	0.404	0.405	0.405	0.406	0.41	0.406 A
Banana flavored soymilk	0.27	0.28	0.28	0.29	0.31	0.286 C
Controlled soymilk	0.229	0.229	0.23	0.24	0.25	0.235 D
Means	0.322 E	0.325 D	0.326 C	0.331 B	0.345 A	

Figures bearing the same letters are statistically not different from one another (P<0.05).

Table 3. Effect of storage period on the total soluble solids of soymilk samples

Samples	Storage interval days					Means	%gain
	0 week	1st Week	2nd week	3rd week	4th week		
Guava flavored soymilk	11	12	13	13	13	12.4 A	18
Mango flavored soymilk	11	11	12	12	13	11.8 C	18
Banana flavored soymilk	11	12	12	13	13	12.2 B	18
Controlled soymilk	10	11	11	11	12	11 D	20
Means	10.7 E	11.5 D	11.7 C	12.5 B	12.7 A		

Figures bearing the same letters are statistically not different from one another (P<0.05)

These results are in agreement with Rehman (1989) finding out that the initial mean values for the banana based milk drinks ranged from 14.97 to 15.20°Brix. Al-Haq (1988) inferred that the rise in the total soluble solids of the pasteurized mango fruit-flavoured milk-based drink could be due to the formation of pectic substances from the stabilizer Mexpectin R.S-450. In another study Kanujoso and Luh (1967) reported that the increase in T.S.S. of samples may be attributed to the formation of water soluble pectin from protopectin during storage as well as hydrolysis of sucrose.

The mean values of protein of fat in case of guava, mango, banana and unflavoured were 4.068, 4.018, 4.032, 4.02 respectively. Storage had no significant effect on protein content. The mean values in case of guava, mango, banana and unflavoured were 2.4, 2.2, 2.6, 2.0 respectively. Results showed that the protein content decreased in all samples during storage. The protein content on initial stage ranged between 4.08 to 4.02% (Table 4). These results are in agreement with Ward (1995) who found that soymilk contains 4.4% protein. The findings of protein content of controlled soymilk is in agreement with the findings of Khaleques et al. (1970) who found out that soymilk contained 3.62 percent proteins. The fat content of the soymilk is in agreement with the findings of Altschul (1965) who found that soymilk contained 2% fat. These results are also in agreement with Ward (1995) who found that soymilk contained 2.5% fat. Storage had no significant effect on fat (Table 5).

The flavoured soymilk samples were also organoleptically evaluated for colour and flavour during storage. The mean scores in case of colour for soymilk flavoured with guava, mango, banana and unflavoured soymilk were 5.78, 4.42, 5.4 and 4.7 respectively (Table 6). The mean scores for flavour in case of soymilk flavoured with guava, mango, banana and unflavoured soymilk were 5.18, 5.48, 4.94, 3.8 respectively (Table 7). It was concluded that soymilk flavoured with guava, mango, banana were more physicochemical and organoleptic value.

Table 4. Effect of Storage period on the protein content of soymilk.

Samples	Storage interval (Weeks)					Means	% Loss
	0	Ist	2nd	3rd	4th		
Guava flavored soymilk	4.08	4.08	4.08	4.05	4.05	4.068 A	0.73
Mango flavored soymilk	4.02	4.02	4.02	4.02	4.01	4.018 B	0.24
Banana flavored soymilk	4.04	4.04	4.03	4.03	4.02	4.032 B	0.49
Controlled soymilk	4.02	4	4.02	4.05	4.01	4.02 B	0.24
Means	4.04.7 A	4.035 A	4.037 A	4.022 A	4.022 A		

Figures bearing the same letters are statistically not different from one another (P<0.05).

Table 5. Effect of Storage period on the fat content of soymilk.

Samples	Storage Interval (Weeks)					Means	% Loss
	0	Ist	2nd	3rd	4th		
Guava flavored soymilk	2.4	2.4	2.3	2.1	2.2	2.280	8.3
Mango flavored soymilk	2.3	2.3	2.3	2.1	2.2	2.240	4.3
Banana flavored soymilk	2.6	2.6	2.6	2.6	2.5	2.580	3.8
Controlled soymilk	2.1	2.0	2.1	2.0	2.0	2.040	4.7
Means	2.350	2.325	2.325	2.200	2.225		

Figures bearing the same letters are statistically not different from one another (P<0.05).

Table 6. Effect of Storage on Color of Soymilk Samples

Samples	Storage Interval (Weeks)					Means	% Loss
	0	Ist	2nd	3rd	4th		
Guava flavoured soymilk	7.1	6.1	5.8	5.2	4.7	5.78 A	33
Mango flavoured soymilk	6.4	5.1	4.4	3.5	2.7	4.42 B	57
Banana flavoured soymilk	7.7	5.7	5.4	4.7	3.5	5.4 A	54
Controlled soymilk	6.8	5.5	4.8	3.0	3.4	4.7 B	50
Mean	7.0 A	5.6 B	5.1 B	4.1 C	3.57 C		

Figures bearing the same letters are statistically not different from one another (P<0.05).

Table 7. Effect of Storage on Flavour of Soymilk Samples

Samples	Storage interval (Weeks)					Means	% Loss
	0	Ist	2nd	3rd	4th		
Guava flavoured soymilk	7.0	6.1	5.3	4.1	3.4	5.18 B	51
Mango flavoured soymilk	7.4	6.5	5.6	4.4	3.5	5.48 A	52
Banana flavoured soymilk	7.1	6.1	4.7	3.6	3.2	4.94 B	54
Controlled soymilk	5.5	4.9	4.0	2.4	2.2	3.8 C	60
Mean	6.75 A	5.9 B	4.9 C	3.6 D	3.07 E		

Figures bearing the same letters are statistically not different from one another (P<0.05).

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