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QUALITY EVALUATION OF THE FRUIT PULP ADDED YOGHURT

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ABSTRACT

Yoghurt is a coagulated milk product that results from the fermentation of lactose in milk by *lactobacillus bulgaricus* and *streptococusthermophilus*. It is nutritionally beneficial product generally considered as safe with taste and is like by many people. Fruit yoghurt, a popular type of yoghurt is like by masses and is known as fruit stirred yoghurt. Yoghurt prepared by adding seasonal fruits are very attractive. Addition of fruit makes the yoghurt more delicious. Thus, the present study was designed to prepare different levels of sapota and grape pulp yoghurt and to assess the nutritional, physiological, microbiological and organoleptic characteristics of yoghurt. The yoghurt was manufactured according to international standards of yoghurt manufacture (IDF 1987 standards). The milk is homogenized and heated at 90°C for 3 minutes for pasteurization, then cooled to 45°C. It is then inoculated with 5% of *lactobacillus bulgaricus*. Yoghurt was prepared using various fruit pulp. Yoghurt were cooled at 6°C and stored at the same temperature during all period of post-acidification. Owing to the various nutritive advantages the two different types of fruits were used in the preparation of yoghurt using various combinations with buffalo milk. All the developed products (total=7 variations) were analyzed organoleptically, the best variations (2 variations) will be selected and analysed for nutrients, microbial load and physicochemical properties. The result obtained was compared with the selected variable, control sample and also with commercial products. From this study it was concluded that fruit pulp added yoghurt BS3 (Buffalo milk + Sapota pulp) 3rd variation has got 1st rank followed by BG3 (Buffalo milk + Grape pulp) 3rd variation. On comparing all criteria for all developed yoghurts, buffalo milk with incorporation of sapota pulp yoghurt have high acceptability.

KEY WORDS

Sapota, Grape, Yoghurt, *Lactobacillus bulgaricus*, Microbial and Acidification.

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INTRODUCTION

Yoghurt is a coagulated milk product that results from the fermentation of lactose in milk by *lactobacillus bulgaricus* and *streptococcus thermophilus*¹. Other lactic acid bacteria (LAB) are also frequently used to produce yoghurt with unique

characteristics². Yoghurt is a sour milk product and is one of the oldest and popular foods in Africa, Asia, Europe and USA because of its nutritive and therapeutic value (Deeth, 1984). It is nutritionally beneficial product generally considered as safe with taste and is like by many people. Yoghurt or yogurt is a dairy product by bacterial fermentation of milk. Fermentation of lactose produces lactic acid, which falls on milk protein to give yoghurt its texture and its characteristics tang³. Yoghurt ranks as a popular food in many parts of the world. People in turkey and some other countries of the Middle East have eaten yoghurt for thousands of years. Yoghurt is part of the diet in south Eastern Europe and Middle East for millennia and is now part of the dairy counters even in smallest grocery stores in many countries⁴.

Yoghurt is more nutritious than many other fermented milk products because it contains a high level of milk solids in addition to nutriment developed during the fermentation process⁵ yoghurt is nutritionally rich in protein, calcium, riboflavin, vitamin B6 and vitamin B12⁶. It has nutritional benefits beyond those of milk. Yoghurt also has medical use, in particular for a variety of gastro intestinal conditions and in preventing antibiotic associated diarrhea³.

Yoghurt can be good sources of essential nutrients as minerals in the human diet. It could contribute significantly to the recommended daily requirements for calcium and magnesium to maintain the physiological process⁷. Fruit yoghurt, a popular type of yoghurt is like by masses and is known as fruit stirred yoghurt. Yoghurt prepared by adding seasonal fruits are very attractive. Fruit stirred yoghurt is popular among masses and particularly children who dislike the flavour of plain yoghurt. This modification has made the yoghurt flavour attractive for them. Addition of fruit makes the yoghurt more delicious⁸. Sapodilla is a long-lived evergreen tree native to southern Mexico, central America, and the West Indies. It is grown in high quantities in India. Sapota is high in tanning. So, it is believed that when sapota is boiled with water, the decoction is good for curing diarrhea⁹. Coronation grapes are a virtually

seedless hybrid variety of table grape developed in Canada. Grapes are rich in energy, vitamin and minerals. The grapes can be eaten fresh or incorporated into fruit preserves, sauces and desserts¹⁰. Thus, the present study was designed to develop different levels of sapota and grape pulp yoghurt and to assess the nutritional, physiological, microbiological and organoleptic characteristics of yoghurt.

MATERIALS AND METHODS

The raw materials like ripe sapota and grape fruits were purchased from the local market. The foreign material present in the fruits were cleaned and gently washed with tap water were subjected to pulp extraction. Preparation of fruit pulp was structured in Figure No.1.

Formulation of different combination of buffalo milk based fruit yoghurt

Owing to the various nutritive advantages the two different types of fruits were used in the preparation of yoghurt using various combinations with buffalo milk.

Table No.1 pictured different combinations of Sapota Pulp Based Yoghurt (SPBY) and Grape Pulp Based Yoghurt (GPBY) with its percentage of incorporations.

Development of yoghurt using buffalo milk with incorporation of various fruit yoghurt

The yoghurt was manufactured according to international standards of yoghurt manufacture (IDF 1987 standards). The milk is homogenized and heated at 90°C for 3 minutes for pasteurization, then cooled to 45°C. It is then inoculated with 5% of *Lactobacillus bulgaricus*. Prepared yoghurt using various fruit pulp. Yoghurt were cooled at 6°C and stored at the same temperature during all period of post-acidification (for 21 days) (Figure No.2).

Using the above standard procedure, development of yoghurt using various fruit pulp with buffalo milk is prepared at different combinations given in Table No.1.

Analysis performed in developed yoghurt

The developed seven yoghurts were analyzed for chemical, physical, microbiological and sensory properties.

Chemical analysis of developed yoghurt

The nutrients like carbohydrate, protein, fat, calcium, and vitamin-c content of the seven treatments were analyzed by proximate composition analysis as described in the AOAC protocols¹¹.

Physico properties of developed yoghurt

The physical properties of yoghurt like pH, moisture, acidity, syneresis were analysed using standard techniques.

Sensory evaluation of developed yoghurt

Organoleptic quality is a combination of different sense of perception coming to play in choosing and eating a food. The entire products developed were evaluated thrice for their acceptability and a panel of judges selected at random from Department of Food Science and Nutrition, Periyar University, Salem. All judges were asked to score the product for appearance, colour, flavor, taste and overall acceptability using a 9 point hedonic scale card, with score ranging from 9 to 11 where score represented like extremely and dislike extremely respectively was used for evaluating developed products.

Microbial analysis of developed yoghurt

Yoghurt is produced by fermentation of milk with two bacteria, *L.bylgaricus* and *S.thermophilus*, which act together. Bulgaricus was performed as described by the international dairy federation (IDF standard 306, 1995). The following media were selected as suitable for enumeration: M17 agar and aerobic incubation at 42⁰C for 24h for the selective enumeration of *S. thermophilus* while for the enumeration of *L. delbrueckii ssp.* Bulgaricus, MRS agar incubated at 42⁰C for 24 h was applied. Microbiological count data are expressed as Colony Forming Units (CFU) per gram of yoghurt. Four dilutions were carried out to determine the number of bacteria during storage.

Statistical analysis

The data obtained for different parameters was analysed statistically using "T" test and analysis of variance (ANOVA). Duncan's multiple range tests were used for comparing the means to find the

significance of acceptability of developed yoghurt product.

RESULTS AND DISCUSSION

Table No.2 indicates the total yield of yoghurt in (ml) at combination of buffalo milk with different levels of fruit pulp added yoghurt. When compared to control, the different fruit pulp based yoghurt has got good amount of yield.

Duncan's test reveals that there was no significant difference between the variation control and commercial and that there was no significant difference between the variations BS₁, BS₂ and BS₃ for appearance attribute. Regarding colour attribute that there was no significant difference between the variation control and commercial and that there was no significant difference between the variation BS₁, BS₂ and BS₂. Regarding favour attribute that there was significant difference exists for variations control, commercial and BS₃ and that there was no significant difference between the variations BS₁ and BS₂. Regarding taste attribute that there was no significant difference between the variations control and BS₂ and that there was significant difference exists for variations control and commercial and that there was no significant difference between the variation BS₁ and BS₂. Regarding texture attributes that there was no significant difference between the variations BS₁, BS₂ and BS₃ and the significant difference exists for variation control and commercial. Regarding over all acceptability that there was no significant difference between the variation BS₁ and BS₃ and there was significant difference exists for variations control, commercial and BS₂ (Table No.3). Duncan's test reveals that there was no significant difference between the variations control and commercial and that there was no significant difference between the variations BG₁, BG₂ and BG₃ for appearance attributes. Regarding colour attributes that there was no significant difference between the variation control and commercial and that there, was no significant difference between the variation BG₁, BG₂ and BG₃. Regarding flavour attribute that there was no significant difference between the variations control, commercial and there was significant difference exist for variation BG₂ and BG₃. Regarding taste attribute that there was significant

difference exist for variations control and BG₃ and that there was no significant difference between the variations BG₁, BG₂, BG₃. Regarding texture attributes that there was no significant difference between the variation control, BG₁ and BG₃ and that there was significant difference exist for variations control, commercial and BG₂. Regarding texture attribute the variations BG₁ and BG₃ and that of the commercial BG₂. Regarding overall acceptability attribute that there was no significant difference between the variation BG₁, BG₂ and BG₃ and that there was significant difference between the variation control and commercial (Table No.4). Among the 7 variations, the best 2 variations based on the organoleptic evaluation were selected and analysed for nutrient, physicochemical properties and microbial analysis. The results were compared with control and commercially prepared yoghurt. On comparing, there was no significant difference

between the variation BG₁, BG₂ and BG₃. Regarding nutrient analysis, grape pulp added yoghurt (BG₃) were found to have high amount of calcium and Vitamin C. Protein content is high and fat content is low in commercially prepared yoghurt. Energy and carbohydrate is high in BS₃ when compared to control, commercial and BG₃. Upon physicochemical properties, the pH, moisture and acidity are higher in developed product when compared to control and commercial. But the syneresis content of the developed product is lower when compared to control and commercial. Upon microbial analysis, the normal desirable range of microbial load in the yoghurt is 7.28×10^7 . But the range of microbial load at all the different levels of developed yoghurts contains lesser range when compared to the normal desirable range (Table No.5)

Table No.1: Basic formulation of different combination of buffalo milk based fruit yoghurt

S.No	Items	Control	SPBY			GPBY		
			V ₁	V ₂	V ₃	V ₁	V ₂	V ₃
1	Cow 's milk	100	-	-	-	-	-	-
2	Buffalo milk	-	92	84	76	92	84	76
3	Respective fruit pulp	-	8	16	24	8	16	24
4	Skim milk powder %	1	1	1	1	1	1	1
5	Sugar %	2	2	2	2	2	2	2
6	Culture	<i>Lacto bacillus bulgaricus</i> 5%						

Note: SPBY – Sapota pulp based yoghurt, GPBY – Grape pulp based yoghurt, V- Variations

Table No.2: Total product yield of yoghurt from buffalo milk with incorporation of different fruit pulp at various combinations

S.No	Parameters	Control	SPBY			GPBY		
			BS ₁	BS ₂	BS ₃	BG ₁	BG ₂	BG ₃
1	Cow 's milk	100	-	-	-	-	-	-
2	Buffalo milk	-	92	84	76	92	84	76
3	Respective fruit pulp	-	8	16	24	8	16	24
4	Yield of yoghurt (ml)	83	89	86	85	85	89	90

Note: B – Buffalo milk; S – Sapota pulp; G – Grape pulp,
BS₁, BS₂, BS₃ (Buffalo milk + Sapota pulp) variations,
BG₁, BG₂, BG₃ (Buffalo milk + Grape pulp) variations.

Table No.3: Mean organoleptic evaluation of developed yoghurt from buffalo milk with sapota pulp

S.No	Product	Appearance	Colour	Flavour	Taste	Texture	Over all acceptability
1	Control	7.70 ± 0.82 ^b	7.60 ± 0.51 ^{bc}	7.40 ± 1.17 ^{ab}	7.30 ± 0.82 ^{ab}	7.70 ± 0.82 ^{ab}	7.30 ± 0.67 ^{bc}
2	Commercial	8.20 ± 0.63 ^b	8.40 ± 0.51 ^c	8.20 ± 0.42 ^b	8.10 ± 0.56 ^b	8.10 ± 0.56 ^b	8.00 ± 0.47 ^c
3	BS ₁	6.50 ± 1.080 ^a	6.20 ± 1.22 ^a	6.30 ± 1.25 ^{ab}	6.00 ± 1.41 ^a	6.90 ± 0.99 ^a	6.50 ± 0.84 ^{ab}
4	BS ₂	6.40 ± 1.07 ^a	6.40 ± 0.96 ^a	6.40 ± 1.26 ^{ab}	6.40 ± 1.17 ^{bc}	6.90 ± 0.87 ^a	6.30 ± 1.05 ^a
5	BS ₃	6.20 ± 1.31 ^a	6.30 ± 1.25 ^a	6.00 ± 1.56 ^a	6.10 ± 1.72 ^a	6.90 ± 0.99 ^a	6.60 ± 1.07 ^{ab}
6	F ratio	7.744	10.474	5.847	6.058	4.273	6.702
7	P value	0.000 ^{**}	0.000 ^{**}	0.001 ^{**}	0.001 ^{**}	0.005 ^{**}	0.000 ^{**}

Note: *values with difference superscripts difference with each other an application of Duncan multiple range test. ** - significant at 0.01% level, * - significant at 0.05% level, ^{NS} – No significant.

Table No.4: Mean organoleptic evaluation of developed yoghurt from buffalo milk with grape pulp

S.No	Product	Appearance	Colour	Flavour	Taste	Texture	Over all acceptability
1	Control	7.70 ± 0.82 ^b	7.60 ± 0.51 ^{bc}	7.40 ± 1.17 ^{ab}	7.30 ± 0.82 ^{ab}	7.70 ± 0.82 ^{ab}	7.30 ± 0.67 ^{bc}
2	Commercial	8.20 ± 0.63 ^b	8.40 ± 0.51 ^c	8.20 ± 0.42 ^b	8.10 ± 0.56 ^b	8.10 ± 0.56 ^b	8.00 ± 0.47 ^c
3	BG ₁	6.10 ± 0.73 ^a	6.40 ± 1.26 ^a	6.20 ± 1.54 ^{ab}	6.20 ± 1.03 ^a	6.20 ± 1.03 ^a	6.50 ± 1.17 ^a
4	BG ₂	6.20 ± 1.13 ^a	6.20 ± 1.81 ^a	6.60 ± 1.30 ^{ab}	6.20 ± 1.13 ^a	6.90 ± 1.10 ^{ab}	6.40 ± 1.17 ^a
5	BG ₃	6.20 ± 1.39 ^a	6.10 ± 1.79 ^a	6.00 ± 1.94 ^a	6.30 ± 1.41 ^a	6.80 ± 1.13 ^a	6.40 ± 1.34 ^a
6	F ratio	10.140	5.954	4.457	7.593	4.641	4.513
7	P value	0.000 ^{**}	0.001 ^{**}	0.004 ^{**}	0.000 ^{**}	0.003 ^{**}	0.003 ^{**}

Note: * values with difference superscripts difference with each other an application of Duncan multiple range test. ** - significant at 0.01% level, * - significant at 0.05% level and ^{NS} – No significant.

Table No.5: Nutrients, physicochemical and microbial analysis of yoghurt prepared at various combinations

S.No	Criteria	Control	Commercial	BS ₃	BG ₃	
1	Nutrients	Carbohydrates (g)	4.9	5.6	8.52	7.1
		Protein (g)	3.5	3.8	3.53	3.60
		Calcium (mg)	121	120	116.19	145
		Vitamin C (mg)	0.7	0.8	1.47	1.54
		Fat (g)	3.3	3.0	3.2	3.70
		Energy (kcal)	63.3	64.6	77	76
2	Physico Chemical Properties	pH	4.5	4.9	6.3	6.8
		Moisture %	80.97	82.46	83.92	82.49
		Acidity %	0.97	0.14	1.14	1.13
		Syneresis %	60.16	57.36	55.34	56.83
3	Microbial analysis	Microbial count CFU/ml	7.14 × 10 ⁷	7.01 × 10 ⁷	7.20 × 10 ⁷	7.15 × 10 ⁷

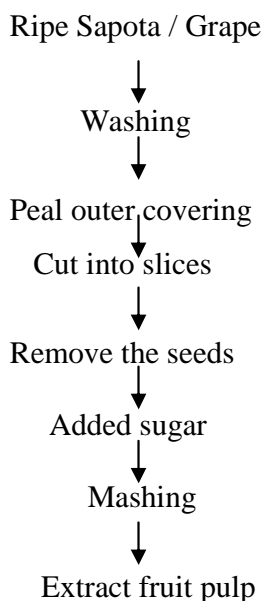


Figure No.1: Preparation of fruit pulp

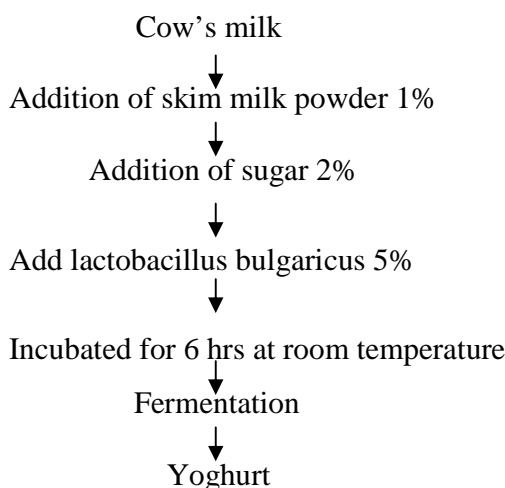


Figure No.2: Standard Yoghurt

CONCLUSION

The results acquire in this study showed that, yoghurt developed from fruit pulp, BS3 variation has got 1st rank followed by BG3. By comparing all the criteria's of developed yoghurts, buffalo milk with incorporation of sapota pulp yoghurt having high acceptability value than grape pulp developed yoghurts. From this research it was showed that fruit yoghurt samples produced from purely fruit pulp and in combination with milk will compete favourably with yoghurt produced form pure buffalo milk. Nutritionally, the yoghurt samples from the buffalo

milk-fruit pulp combination met the dietary requirements of pure yoghurt without significant difference. The choice of appropriate flavour or other additive with low side effects would surely enhance greater acceptability rates in yoghurts.

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