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RESEARCH PAPER

Physico-chemical, Sensory and Microbial Quality of Yoghurt Drink Fortified with Pineapple Pulp

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Abstract

Yoghurt drink was prepared from different proportions of yoghurt and pineapple pulp viz. 100:0 (T_0), 97:3 (T_1), 94:6 (T_2), 91:9 (T_3) with sugar and water level maintained at 10 % (by weight) and was evaluated for physicochemical, sensory and microbial quality. Statistical analysis showed significant difference in physico chemical and sensory evaluation for different treatments. The fat and protein content decreased with addition of pineapple fruit pulp to yoghurt drink while total solids, acidity and solid not fat increased. Microbial quality for total viable count, coliform count and yeast and mold count was analyzed at 0, 5, 7 and 9 days and which were found more in the experimental sample than the control. The coliform and yeast/molds count was zero up to 5 days. Highest sensory score and overall acceptability of 8.58 was awarded to in treatment T_2. and was the best product

Keywords: Pineapple pulp, yoghurt drink, physicochemical quality, sensory quality, microbial quality

Yoghurt is a semi-solid, custard like acidified fermented milk product made by fermenting the high solid fortified milk using symbiotic mixture of *Streptococcus salaivarius subsp. thermophilus* and *Lactobacillus delbruekii subsp. bulgaricus* as a starter (Munzur *et al.*, 2004). It is well-known and widely acceptable product in the world amongst other fermented milk products (Coisson *et al.*, 2005), due to its nutritive and therapeutic values viz., controlling the growth of pathogenic bacteria, curing intestinal diseases like constipation, diarrhea and dysentery, anti-carcinogenic effect, protection from osteoporosis, hypertension and lowering of blood cholesterol (Kamruzzaman *et al.,* 2002). One hundred gram of yoghurt provides about 4.9 g carbohydrate, 3.4 g fat, 3.9g protein, 0.14 mg calcium, 0.11 mg phosphorus, 0.18 mg potassium, and 0.14 mg sodium (Tomar, 1988). It is categorized as stirred yoghurt with low viscosity obtained through high agitation, which breaks the coagulum after the fermentation but before the product is bottled and refrigerated, and is usually sweetened with fruit flavor or sugar (Tamime and Robinson, 1985; Chandan *et al.,* 1993). Yoghurt fortification by addition of fruit juices is forming a new trend worldwide (Shukla *et al.,* 1987). Pineapple is available in India all-round the year therefore its availability for production is not a matter of concern. Even though fortification of yoghurt with different seasonal fruits is highly growing in India (Desia *et al.,*

1994) but few study have been conducted on manufacturing and evaluation of pineapple pulp fortified yoghurt drink. Edible portion of 100pineapple contain 47-52 calories, 85.3-87.0 g water, 0.4 g protein, 0.2 g fat, 11.6-13.7 g total carbohydrate, 0.5 g fibre, 0.3 g ash, 17-18 mg calcium, 8-12 mg phosphorus, 0.5 mg iron, 1-2 mg sodium and 125-146 mg potassium (Khare, 2004). Thus blending of yoghurt with pineapple pulp has polential to produce high nutritious food. The present investigation was conducted to develop new type of fruity yoghurt drink by its fortification with pineapple and purchased evaluate its physiochemical, sensory and microbial qualities.

Materials and Methods

Cow milk was obtained from dairy farm of Animal Husbandry and Dairying Section, College of Agriculture, Nagpur, Maharashtra, India. The culture of *Streptococcus thermophilus* and *Lactobacillus bulgaricus* was ordered from NDRI, Karnal, Haryana, India. Fresh clean, fully ripened pineapple fruits and sugar were purchased from the local market in Nagpur. Yoghurt for experiment was made in laboratory of Department of Animal Husbandry and Dairying, College of Agriculture, Nagpur, Maharashtra, India.

Yoghurt drink production

Cow's milk was standardized at 3.5% fat level and 8.5% SNF level. It was pasteurized at 80^{O}C for 5 min and immediately cooled to 4^{O}C and stored in a refrigerator until use. The cool milk was heated at 95^{O}C for 30 min with constant stirring to obtaine thick yoghurt after incubation and rapidly cooled to 40^{O}C. The milk was then inoculated and by adding 1% starter culture consisting of *Streptococcus thermophilus* and *Lactobacillus bulgaricus* in the ratio of 1:1. The inoculated milk was incubated at 30^{O}C for 12-15 hrs in an incubator until the pH reached 4.6. The set yoghurt was broken by slow agitation using domestic mixer to obtain semi-solid consistency. Pineapple was first cleaned and then chopped by peeling the outer layer with peeling instrument. The unwanted parts were removed from the pineapple with the help of knife. The homogenous pulp was obtained by subjecting chopped pineapple pieces to electrically operated fruit processor and filled into a sterile jar.

Trials were conducted to standardize the pineapple yoghurt drink. Pineapple pulp 3, 6, 9% with 10% of sugar and 10% of chilled water were added to the smoothened yoghurt. The samples were mixed with electric stirrer and packed in 150 ml sterilized cups and stored in refrigerator at 4^{O}C. Along with pineapple yoghurt drink, one control yoghurt drink was also prepared without addition of pineapple pulp. So there were 4 treatments i.e. T_0 (100:0), T_1 (97:3), T_2 (94:6), T_3 (91:9), where T = Part of yoghurt drink: Part of pineapple pulp.

Analysis

The samples were analyzed in quintuplicate i.e. 5 replications for physic-chemical parameters (Fat, total solids, acidity, protein, solid not fat) and sensory evaluation parameters (flavor, body and texture, appearance, color, overall acceptability). Fat percent in yoghurt drink samples was determined by Gerber's method, total solids content was determined by standard gravimetric method, acidity was estimated by titration method and protein contentwas determined by Kjeldahl method as described in Handbook of Food Analyses-Dairy products in SP 18 : Part XI (1981).

Solids not fat (SNF) percentage of yoghurt drink samples was determined by the formula as per IS: 1183 (1965) revised edition.

Sensory Quality, Flavor, Body and texture, Appearance, Color was judged by a panel of 5 judges in each trial, as per the score card method suggested by Pal and Gupta (1985) and Overall acceptability was judged by a 9 point hedonic scale as discribet by Nelson and Trout (1964).

The microbial quality parameters (Total Viable Count, Coliform Count, Yeast and Molds Count) were determined of yogurt drink samples according to the Standard Methods for Examination of Dairy Products by American Public Health Association (APHA, 1989).

Media used for enumeration of total viable count was Plate Count Agar (PCA), for coliform count it was Violet Bile Red Agar (VBRA) and for yeast and molds count it was Potato Dextrose Agar (PDA). Total viable count was determined by multiplying the number of colony forming units (CFU) with respective dilution factor and then converting it into logarithmic form. Coliform count was counted by Most Probable Number (MPN) method.

Yeast and molds count was obtained by counting colonies formed on the respective media. Experiments were conducted in triplicate.

For statistical analysis, experiment was laid out in

completely randomized design (CRD) with 4 treatments and 5 replications. The data obtained were statistically according to the method described by Snedecor and Cochran (1994). The significance was evaluated on basis of critical difference.

Results and Discussion

Physico-chemical Characteristic

The addition of pineapple pulp resulted in no significant difference between the control and pineapple yoghurt drink samples for fat percentage (Table 1). It was the highest in the control sample i.e. 3.35%, while it decreased with increase in level of pineapple pulp (3.11, 3.04, 2.91% for level 3, 6, 9% of pineapple pulp respectively) as the pineapple pulp contains lower fat than milk the decrease is very apparent and understandable . These results were in accordance with findings of Sengupta *et al.,* (2014). The total solids values were found significantly different. The yoghurt drink blended with 9% pineapple pulp contained the highest total solids while it decreased with decreased with the decreased level of pineapple pulp as the total solids contents in the pineapple pulp are higher than milk (Table 1) the increase took place. Blending of yoghurt drink with increased level of pineapple pulp increased titratable acidity, similar to the total solidsthe reason behined the increase of acidity was the acidic nature of pineapple. Similar results have been reported by Chougrani *et al.* (2009), Khan *et al.* 2008 wherein the acidity of the yoghurt was increased with addition of fruit pulp as the activity of micro-organisms to produce lactic acid continued in post-acidification period up to the availability of nutrients present in the yoghurt. Similar results have found in our study also. There were significant difference in values of protein content in all yoghurt drink samples. The highest protein content was observed in control yoghurt drink i.e. 3.21%, while protein percentage decreased to 2.95, 2.70 and 2.49% in yoghurt drink blended with different proportion of pineapple pulp respectively As the protein content in pineapple pulp is lowest than milk. its addition has evidently decreased the protein content of yoghurt The result are in accordance with findings of Hossain *et al.*, (2012). The values for solid not fat vary significantly between the control and pineapple yoghurt drink samples. Addition of pineapple pulp into yoghurt drink increased the solid not fat (SNF) content of yoghurt drink

Table 1: Chemical Composition of pineapple yoghurt drink

	Fat (%)	Total Solids (%)	Acidity (%)	Protein (%)	Solids Not Fat (%)
$T_{o\ (100\%\ Yoghurt)}$	3.35	21.05	0.79	3.21	17.70
T_1(97% Yoghurt+3.0% Pineapple Pulp)	3.11	21.87	0.82	2.98	18.77
T_2(94% Yoghurt+ 6% Pineapple Pulp)	3.04	22.93	0.88	2.70	19.89
T_3 (91% Yoghurt+ 9% Pineapple Pulp)	2.91	23.10	0.99	2.69	20.20
SE±	0.024	0.066	0.006	0.008	0.079
CD at p ≥ 0 5%	0.072	0.198	0.020	0.026	0.0239

Mean values of 5 replications are given in the table.

Values with different superscripts differ significantly (P<0.05).

Table 2: Sensory evaluation of pineapple yoghurt drink

	Flavor (out of 45)	Body and Texture (out of 30)	Appearance (out of 15)	Color (out of 10)	Overall acceptability (out of 9)
T_o (Contrast) 100% yoghurt	34.85	20.13	7.89	6.64	7.53
T_1 (97% yoghurt)	37.80	22.22	9.10	7.32	7.80
T_2 (94% yoghurt)	38.41	22.91	11.54	8.23	8.58
T_3 (91% yoghurt)	34.58	20.24	6.96	6.05	6.55
SE±	0.211	0.236	0.109	0.129	0.097
CD at 5%	0.634	0.709	0.327	0.389	0.291

Mean values of 5 replications are given in the table.

Values with different superscripts differ significantly (P<0.05).

Table 3: Microbial Analysis of pineapple yoghurt drink during storage

Parameter	Different types of pineapple yoghurt drink															
	Control				Pineapple pulp 3 %				Pineapple pulp 6 %				Pineapple pulp 9 %			
Days	0	5	7	9	0	5	7	9	0	5	7	9	0	5	7	9
TVC, log (CFU g^{-1})	1.3	5.3	05.37	05.60	1.6	5.2	05.42	05.65	1.8	5.1	5.46	05.68	2	4.9	5.41	05.74
Coliform (MPN g^{-1})	0.0	0.0	10.00	24.00	0.0	0.0	07.00	21.00	0.0	0.0	5.00	16.00	0	0.0	5.00	18.00
Yeast and Mold (CFU g^{-1})	0.0	0.0	12.00	24.00	0.0	0.0	11.00	31.00	0.0	0.0	9.00	27.00	0	0.0	9.00	22.00

due to higher solid not fat content in pineapple pulp than milk. The result for solids not fat are similar to finding reported by Manjula *et al.*, (2012).

Sensory analysis result

The results for sensory evaluation given for various sample are presented in Table 2. The sensory quality of pineapple yoghurt drink was higher than that of the control yoghurt drink due its higher overall acceptability. The pineapple yoghurt drink was preferred to the control yoghurt drink by the panelists. Score for flavor, body and texture, appearance and color enhanced as the level of pineapple pulp contents were increased in the yoghurt drink and was the highest at 6% pineapple pulp after that there was a gradual decrease in score i.e. at 9% pineapple pulp. Overall acceptability for yoghurt drink with 6% pineapple pulp was the highest. Overall acceptability score was also raised with increase in level of pineapple pulp in yoghurt drink up to certain level i.e. up to 6% pineapple pulp, further addition of pineapple pulp however , reduced the score.

Microbial analysis result

The values for total viable count (TVC), coliform count and Yeast and molds count of control yoghurt drink and pineapple yoghurt drink samples at 0 day, 5 days, 7 days and 9 days at storage temperature of 4^{O}C were presented in Table 2. Highest number of total viable count was seen in experimental sample containing 9% pineapple pulp. The microbial load in experimental sample was more than the control sample. The coliform count was zero at zero time i.e. 0 day and 5 days, in later days its presence was doucomeed in both the control and experiment of samples same was observed in case yeast and molds count. The results are similar to these reported by Hossain *et al.* (2012).

Conclusion

The consumer acceptance for the pineapple yoghurt drink was more than control yoghurt drink. In case of physico-chemical composition of yoghurt drink samples, fat and protein content decreased with addition of pineapple fruit pulp to yoghurt drink while total solids, acidity and solid not fat increased. Thus, acceptable quality of yoghurt drink can be produced by blending yoghurt drink with 6% pineapple pulp. However, the microbial quality needs to be improved from safety consideration of consumer.

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