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QUALITY EVALUATION OF SAGO AND ORANGE JUICE BASED SWEETENED YOGHURT AND THEIR COMPARISON WITH CARROT YOGHURT

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Summary

Cow milk was standardized for 4% fat and 14% SNF using cow cream and SMP (M_1) and cow cream along with admixture of SMP and sago powder in the ratio of 75:25 (M_2). The orange and carrot yoghurts were prepared from M_1 and M_2 milks separately with the addition of 0%, 2% and 5% orange and carrot juice and two levels of sugar – 4% (S_1) and 6% (S_2) in each sample. The acidity and total solids increased ($P<0.01$) and protein decreased ($P<0.01$) in all the yoghurt samples when it was prepared with increased levels of orange and carrot juice. The flavour, colour and appearance scores were also high ($P<0.01$) in the samples prepared with 2% orange and carrot juice than the other groups of yoghurt. The body and texture of yoghurt decreased ($P<0.01$) at increased levels of orange and carrot juice, except at 2% level of carrot juice (24.33%). The fat, protein and ash were the highest in both the yoghurt groups $M_1S_1O_0$ and $M_1S_1C_0$, sugar in $M_2S_2O_0$ and $M_2S_2C_0$ and acidity in $M_1S_1O_3$ and $M_1S_1C_3$, respectively.

सारांश

संतरा तथा गाजर योघर्ट तैयार करने हेतु 4% वसा तथा 14% वसा रहित दुग्ध चूर्ण व क्रीम मिलाकर (M_1) तथा क्रीम के साथ वसा रहित दुग्धचूर्ण व साबूदाना चूर्ण (75:25) मिलाकर (M_2) तैयार किया गया। इन दुग्धों (M_1, M_2) में संतरा व गाजर के रस को 0%, 2%, 5% के साथ 4% (S_1) o 6% (S_2) शक्कर मिलाकर योघर्ट तैयार किया गया। संतरा तथा गाजर दोनों की मात्रा बढ़ाने पर कुल ठोस पदार्थों मेंवृद्धि ($P<0.01$) तथा प्रोटीन में कमी ($P<0.01$) पायी गयी। 2% संतरे व गाजर के रस को मिलाने पर दोनों प्रकार के योघर्ट की सुरसता, रंग तथा आकार की मानकता बढ़ ($P<0.01$) जाती है। 2% गाजर वाले योघर्ट के अलावा सभी प्रकार के योघर्ट में संतरे तथा गाजर की मात्रा बढ़ाने पर योघर्ट के शरीर संरचना की मानकता घट ($P<0.01$) जाती है। दोनों प्रकार के योघर्ट में परस्पर सम्बन्धित समूह$M_1S_1O_2$ तथा $M_1S_2C_0$ में वसा, प्रोटीन व राख, $M_2S_2O_0$ तथा $M_2S_2C_0$ में चीनी और $M_2S_1O_3$ तथा $M_2S_1C_3$ में अम्लता की मात्रा अधिक पायी गयी।

Introduction

The fermented milk products has been used by man since down of civilization and be regarded safest perishable dairy product of all perishable food. It has always regards as one of the major architects of human diet. Among fermented dairy products, yoghurt is popular for flavour and healthful part of human diet. To enhance the nutritive value of yoghurt some vegetables have been added to milk (Bhadekar *et al*., 2008 and Patil *et al*., 2009). Keeping in view sago and carrot juice based sweetened yoghurt have been prepared from this station (Patel *et al*., 2009). In second phase of investigation, orange juice was tried for the preparation and quality evaluation of vegetable based yoghurt and their comparison with carrot yoghurt.

Orange (*Citrus sinesis*) juice is rich in Ascorbic acid (vitamin C), chemically ascorbic acid is a derivative of monosaccharide, L-glucose. The naturally occurring vitamin C is l-ascorbic acid. It D-forms are generally inactive as anti-scorbutic agents (Vieira *et al*., 2010). The sago (Sabudana) is produce in a sago palm (*Mutroxylon sagu*) stem in Indian sago. It is a cheaper source of starch and easily dissolved in hot water and milk. Carrot (*Dascus carota L*.) is rich in beta carotein, ascorbic acid, tocopherol and classified as vitaminized food.

Materials and Methods

Cross breed cow milk samples were procured form Banaras Hindu University Dairy farm, Varanasi and the freeze dried pure culture of *Streptococcus salivarius* subsp. *thermophilus* and *Lactobacillus delbruechii* subsp. *bulgaricus* were procured from the National Dairy Research Institute, Karnal, Haryana (India). The *S. thermophilus* and *L. bulgaricus* were mixed in the ratio of 3:1 (volume basis). The fresh cow milk was standardized for 4% fat and 14% SNF (Solid- not fat)

using fresh cow cream and skim milk powder (M_1) and fresh cow cream along with admixture of skim milk powder (SMP) and sago powder in the ratio of 75:25 (M_2). Two levels of sugar - 4% (S_1) and 6% (S_2) and three levels of orange juice - 0% (O_0), 2% (O_1) and 5% (O_2) were added in milk samples M_1 and M_2. All the samples were heated at 90^{0}C for 10 minutes and cooled at inoculation temperature (41 $\pm$ 0.5^0 C). The samples were inoculated at 41 $\pm$ 0.5^{0}C using 1% mixed starter culture for 8 hours. The carrot yogurt was prepared in the same manner as orange juice yoghurt was prepared (Patel *et al.,* 2009). The yoghurt samples thus prepared were judged by five experienced panel of judges as per score card prescribed by Nelson and Trout (1981). The samples were statistically analysed as per technique given by Snedecor and Cochran (1998).Yoghurt samples were analysed for fat, protein, lactose, ash and acidity by the procedure given in AOAC (2000).

Results and Discussion

Physical Attributes : The flavour score of yoghurt (35.21) was very high ($P < 0.01$) when 2% orange juice was added in the sample (Table. 1) than the value obtained in sample prepared without orange juice (32.96) and with 5% orange juice (33.17).The interaction effect between sugar and orange juice (Table. 1) on the flavour score of yoghurt was very high ($P < 0.01$). Similar observations have also been reported by Richter *et al*. (1979), Drake *et al*. (2000) and Kale *et al*. (2007) when fruit juice was added in the samples. In carrot yoghurt (Table. 2) flavour score was also high when 2% carrot juice was added in the sample.

The body and texture score of yoghurt did not influenced by the levels of sugar and type of milk (Table. 1). The body and texture score (23.00) was very high ($P < 0.01$) in yoghurt prepared without orange juice than the values found at 2% and 5% levels of orange juice. The body and texture score of yoghurt increased ($P < 0.01$) when 4% sugar and 2% orange juice were added in the samples than the value found in sample S_2O_2 (Table. 1). These results were in close agreement by the observations recorded by Jogdand *et al*. (1991), Salwa *et al*. (2004) and Ahmet (2009) when starch, sugar, carrot juice and carob juice were added in the samples. In carrot yoghurt body and texture decreased when the level of carrot juice increased in the samples In carrot yoghurt body and texture decreased when the level of carrot juice increased in the samples (Table. 2).

The colour and appearance score of yoghurt (Table. 1) was significantly ($P < 0.01$) high in sample M_1 (10.97) as compared to M_2 (10.17). The effect of sugar on the colour and appearance of yoghurt was not significant. The colour and appearance score of yoghurt prepared from 2% orange juice was very high ($P < 0.01$) than the values obtained from other groups of samples. Similar results were also found when yoghurt was prepared with carrot juice. The interaction effect between sugar and orange juice on colour and appearance of yoghurt was significantly ($P < 0.01$) high. The score (13.33) was also high ($P < 0.01$) in sample $M_1S_2O_1$ (Table. 2) than the value found in sample $M_2S_1O_0$ (9.00). These results were at par with the observations reported by Mguven and Obkaraca (2002).

The score of yoghurt increased significantly ($P < 0.01$) when orange juice was added in the samples.

Table. 1. Physico- chemical Quality of yoghurt prepared from orange juice, sago and sugar

Treatment Quality	Group I						Group II						
	$M_1S_1O_0$	$M_1S_1O_2$	$M_1S_1O_3$	$M_1S_2O_0$	$M_1S_2O_2$	$M_1S_2O_3$	$M_2S_1O_0$	$M_2S_1O_2$	$M_2S_1O_3$	$M_2S_2O_0$	$M_2S_2O_2$	$M_2S_2O_3$	CD at P? 0.01
A. Chemical composition													
Fat%	3.64	3.58	3.55	3.46	3.46	3.45	3.44	3.61	3.58	3.54	3.51	3.45	NS
Protein %	5.93	5.78	5.67	5.80	5.71	5.59	5.25	5.23	5.17	5.23	5.15	5.03	0.060
Sugar %	11.19	10.98	10.79	13.15	13.00	12.87	11.97	11.94	11.76	14.09	13.91	13.72	0.057
Ash %	0.87	1.12	1.37	0.86	1.15	1.34	0.87	1.12	1.36	0.87	1.16	1.36	0.060
Acidity %	1.48	1.43	1.40	1.46	1.42	1.40	1.46	1.43	1.39	1.46	1.42	1.39	0.033
B. Sensory Score													
Flavour (45)	33.33	35.00	33.33	32.67	36.17	33.50	33.50	35.00	32.33	33.33	34.67	33.50	3.507
Body & texture (30)	24.33	23.33	21.33	23.00	22.00	20.00	22.33	22.00	20.33	22.33	22.00	19.67	3.468
Colour & appearance (15)	9.17	12.50	10.83	9.17	13.33	10.83	9.00	12.08	10.33	8.17	11.67	9.83	1.743
Acidity score (10)	6.20	5.30	4.23	6.03	5.47	4.83	5.83	5.17	4.80	6.03	5.30	4.47	1.072
Overall acceptability	73.03	76.13	69.72	70.87	76.97	69.16	70.66	74.17	67.79	69.86	73.64	67.47	NS

Similarly, score was also increased ($P<0.01$) when carrot juice (Table. 2) was added in the sample. The interaction effects between milk, sugar and orange juice on acidity score were very high ($P<0.01$). The increase in acidity score have also been reported by Kale *et al*. (2007).

Chemical Attributes : The level of fat decreased ($P<0.01$) in the yoghurt as the levels of sugar increased in the samples (Table. 1). The orange juice had not significantly impact on the quantity of fat in the yoghurt. In case of carrot juice yoghurt the difference in the values obtained from 4% and 6% sugar. The defference in the sugar was not significant, but the difference in the mean values between the levels of sugar in the samples was significant (Table. 2).The interaction effect between milk and orange juice on fat was significant ($P<0.05$). The fat content of yoghurt prepared with 4% sugar without orange juice decreased ($P<0.01$) than the value found in sample S_2O_2 (3.44%). The present findings are in conformity with the results of Shukla *et al*. (1986), McGlinchey (1996), Ahmet and Adem (2003) and Farinde *et al*. (2009).

The protein content of yoghurt (Table. 1) prepared from sample M_1 (5.75%) was significantly ($P<0.01$) high than the value found in M_2 (5.18%). Irrespective of milks, the protein content was high (5.51%) when 4% sugar was added in the sample than the value obtained at 6% sugar (5.42%). The yoghurt prepared without orange juice at 4% and 6% levels of sugar contained 5.55% protein, which was significantly ($P<0.01$) higher than the values obtained from the groups O_1 (5.46%) and O_2 (5.37%). Similar results were also found when carrot juice added in the samples (Table. 2). The interaction effect on protein content of yoghurt between M_1 and S_1 samples (5.80%) was the highest ($P<0.01$) than the value found in M_2S_2 (5.14%). The fat content decreased by interaction effect between increased levels of SMP, sago, orange juice. The interaction effect found in the present study was similar to the finds reported by Park (1994) and Drake *et al*. (2001), but dissimilar to the findings of Farinde *et al*. (2009) and Estevez *et al*. (2010).

The sugar content of yoghurt (Table. 1) prepared from sample M_1 (12.00%) was significantly ($P<0.01$) low than the value recorded in sample M_2 (12.90%). The level of sugar decreased as the levels of orange juice increased ($P<0.01$) in the samples. The interaction effect between milk, sugar and orange juice in the samples prepared from M_2 and 6% sugar without orange juice ($M_2S_2O_0$) was significantly ($P<0.01$) high than the value obtained in sample M_1containing 4% sugar and 5% orange juice (Table. 1). In case of carrot juice yoghurt, the levels of sugar increased as the levels of carrot juice increased in the samples. These results were in close conformity with the findings of Drake *et al*. (2000), Salwa *et al*. (2004) and Patil *et al*. (2009).

The ash content decreased significantly ($P<0.01$) when the levels of orange juice and carrot juice increased in the samples. The interaction effect between sugar and orange juice on ash content of yoghurt was significant ($P<0.01$). Park (1994) and Farinde *et al*. (2009) reported that ash content decreased by increasing the levels of soy milk and fruit juice in the yoghurt. This finding is in close conformity with the present investigation.

The acidity of yoghurt increased ($P<0.01$) when the levels of orange juice increased in the samples (Table. 1). The increase in the acidity from O_0 to O_1, O_0 to O_2

Table. 2. Physico- chemical Quality of yoghurt prepared from carrot juice, sago and sugar

Treatment Quality	Group I						Group II						
	$M_1S_1C_0$	$M_1S_1C_2$	$M_1S_1C_3$	$M_1S_2C_0$	$M_1S_2C_2$	$M_1S_2C_3$	$M_2S_1C_0$	$M_2S_1C_2$	$M_2S_1C_3$	$M_2S_2C_0$	$M_2S_2C_2$	$M_2S_2C_3$	CD at P? 0.01
A. Chemical composition													
Fat%	3.67	3.63	3.60	3.51	3.49	3.47	3.63	3.59	3.59	3.45	3.46	3.46	0.073
Protein %	5.87	5.67	5.62	5.71	5.62	5.52	5.26	5.24	5.10	5.29	5.16	5.05	0.087
Sugar %	10.78	10.87	11.02	12.90	12.95	13.13	11.75	11.87	11.99	13.79	13.89	13.95	0.145
Ash %	1.50	1.46	1.42	1.43	1.40	1.38	1.46	1.42	1.39	1.40	1.40	1.38	0.035
Acidity %	0.88	0.92	0.96	0.88	0.93	0.96	0.88	0.94	0.97	0.88	0.93	0.96	0.037
B. Sensory Score													
Flavour (45)	32.33	34.50	32.83	33.83	35.00	33.00	30.83	33.33	32.33	31.33	34.00	32.50	2.809
Body & texture (30)	22.33	24.33	21.00	23.00	24.67	21.83	21.67	22.67	19.50	22.33	22.50	21.00	2.899
Colour & appearance (15)	8.83	11.67	10.17	10.17	12.67	10.83	9.17	11.17	9.83	9.17	11.50	10.17	1.884
Acidity score (10)	5.83	5.50	5.40	6.60	5.20	5.17	6.33	5.57	4.83	6.27	5.24	4.97	0.977
Overall acceptability	69.37	76.00	69.40	73.60	77.53	70.90	68.00	72.73	66.10	69.10	73.23	68.97	3.983

and O_1 to O_2 were 31.03, 56.32 and 19.30 per cent, respectively. The acidity was also high when carrot juice increased in the samples. The interaction effect between sugar and orange juice on the acidity of yoghurt (Table. 1) was significant ($P<0.01$). According to Ahmet and Adem (2003), Kale *et al*. (2007), Ghadge *et al*. (2008) Patil *et al*. (2009) and Patel *et al*. (2009) acidity increased when fruit juice was added in the samples.

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