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Acceptability trials of fructooligosaccharides (FOS) added soup and beverages

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ABSTRACT

Fructooligosaccharides are prebiotics which beneficially affect the host by selectively stimulating the growth and activity of one or limited number of bacteria in the colon that can improve host health. The present study focuses on acceptability trials of FOS added soup and beverages namely, butter milk, lemon juice, milk and tomato soup at 2.5 per cent, 4 per cent, 5 per cent, 6 per cent, 7.5 per cent levels. The organoleptic attributes were determined by 25 semi trained panel members using 10 point numerical scoring test and difference test in triplicates. The organoleptic parameters included colour and appearance, taste, after taste, consistency and overall acceptability. Results revealed that all the FOS added products were well accepted up to 7.5 per cent level of addition and there were no significant changes observed in the overall acceptability of the products. Results obtained from the difference test revealed that consistency and overall acceptability of buttermilk significantly improved upon the addition of FOS at 7.5 per cent level. Also the colour and appearance of tomato soup improved significantly when FOS was added at 7.5 per cent level. Therefore, it can be concluded that FOS (7.5%) can be added in beverages and soup without affecting their organoleptic attributes and can form part of daily diets of human beings.

KEY WORDS : Fructooligosaccharides, Organoleptic, Addition, Soup, Beverages

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The consumption of foods and beverages containing prebiotics and probiotics is the current consumer global trend (Mark-Herbert, 2004). Consequently the global, functional food market is thriving with recent estimates indicating upto a $ 50 billion annual share (Stanton *et al.*, 2005)

The supplementation of neutraceutical components and traditional nutritional ingredients improve the nutritional quality of beverages (Breithaupt, 2001). Fortification with novel functional ingredient such as prebiotic like FOS is a recent development in this direction (Luckow *et al.,* 2006). Prebiotics promote the growth or activity of a limited number of bacterial species especially probiotics in the gut. They selectively nourish beneficial intestinal flora, stimulate their proliferation and reinforce their action and imparts beneficial health effects in humans (Ziemer and Gibson, 1998).

FOS has attracted special attention because of its prebiotic properties and also due to its sweet taste being very similar to that of sucrose (Yun, 1996). It acts as functional food ingredient that exhibits specific physiological effect such as growth stimulating beneficial bifidobacteria in the digestive tract, decrease in total cholesterol and lipid in serum, relief of constipation and general improvement of human health (Tomomatsu, 1994).

In addition, FOS being slightly sweet in taste is likely to blend well with many products. In pure form, it has sweetness of about 30-35 per cent in comparison to sucrose. Its sweetening profile closely approaches that of sugar. The taste is very clean without any lingering effect. It mingles very well with delicate aromas and even enhances fruit flavours (Franck, 2002; 2008). FOS was used for partial substitution of sucrose in fruit juices without significantly affecting the overall quality (Prapulla *et al.,* 2009). However, the acceptability of FOS added in variety of food products need to be tested. Therefore, the present study focuses on acceptability trials of FOS addition in the beverages and soup on their organoleptic attribute.

RESEARCH METHODS

Procurement of raw materials:

Food grade fructooligosaccharide (Frutafit HD, 250880119) was procured from S.A Pharmachem. Pvt. Ltd. Other materials required to develop FOS incorporated food products including sugar, lemon procured from the local market; milk and buttermilk were procured from Sugam parlor supplied by Amul dairy.

Selection of the products:

Four products were selected on the basis of their popularity and consumption on daily basis which included butter milk, lemon juice, milk and soup.

Procurement and standardization of FOS added products:

FOS was added in all the food products namely, butter milk, lemon juice, milk and tomato soup at 2.5 per cent, 4 per cent, 5 per cent, 6 per cent and 7.5 per cent.

Procurement of butter milk:

Standard Amul salted Jeera butter milk was procured freshly from the dairy and was refrigerated at 7^0C until use. FOS was added at varying levels.

Standardisation of lemon juice:

Standard lemon juice was prepared by adding 90 ml of fresh lime juice and 120 g of sugar to 1050 ml of water and then FOS was added at varying levels.

Procurement of milk:

Pasteurized Amul skimmed milk was procured freshly from the dairy and was refrigerated at 7^oC until use, sugar was added at 15 per cent and then FOS was added at varying levels.

Standardization of soup:

Standard soup was prepared using 600 g of tomato, 600 ml water, 125g onion, 100 g potato, 4 cloves of garlic, 10 g ginger, 1 green chilli, 5 g sugar and salt to taste. All the ingredients were together pressure cooked for10 min at 95^oC and then cooled, blended and sieved. The soup thus obtained was then boiled up to 3 min. followed by addition of FOS at varying levels.

Sensory evaluation:

Three successive trials were conducted for screening the panelist through threshold test (Rangana, 1995). Sensory evaluation was carried out by hedonic scale of 10 point numerical scale test and difference test for all the four products. An internal panel of 25 semi-trained panel members evaluated the products for colour and appearance, taste, after taste, consistency and overall acceptability.

For difference test, score cards were given where the panelists were asked to rate FOS added products as compared with the standard products for colour and appearance, taste, after taste, consistency and overall acceptability in term of equal, superior or inferior.

Statistical analysis:

To determine the effect of adding varying levels FOS on organoleptic attributes, ANOVA- one way variance was used. Chi square was used to determine the extent of differences that existed amongst the varying levels of FOS added products in terms of being equal, superior or inferior to the standard products.

RESEARCH FINDINGS AND DISCUSSION

The mean scores for organoleptic attributes of butter milk, lemon juice, milk and soup added with varying levels of FOS are presented in Table 1. The panelists did not detect any significant changes in the organoleptic attributes of FOS added soup and beverages when compared to control. However, a non-significant gradual increase in the scores for taste and flavour of lemon juice and milk was observed.

Inulin and FOS have shown strong blending capacity in various foods without significantly affecting its organoleptic quality use of inulin and oligofructose in fruit yoghurts, milk-based drinks, milk, spreads, cheese and ice cream have also been reported (Coussement, 1996) which have also been marketed in Europe.

Bread and cookies could be incorporated with inulin up to 20 per cent without bringing about statistically significant change in organoleptic attributes (Parnami and Sheth, 2010).

Organoleptic attributes of FOS added selected products in comparison with the standard product as per the difference test:

Table 2 represents per cent subjects indicating the extent to which the FOS added at various levels in different products resemble the standard product with respect to colour and appearance.

Except for soup, no significant difference was observed in the products added with FOS at varying levels. Though not significant, slight improvements were observed in butter milk as 26 per cent subjects reported improvement in colour and appearance in butter milk after the addition of FOS at 6 per cent level. A similar trend was seen with the increasing number of subject reporting improvement in the colour and appearance of milk with the increase in the level of FOS addition.

Significantly large number of subjects found the soup quality to be superior to the standard with the increasing level of addition of FOS. FOS imparts lighter shade to the soup which was perceived better than slightly darker shade of the soup by the panelist (Table 2).

Table 3 and 4 represent per cent subjects indicating deviation in the taste and after taste of the products added

Table 1 : Mean values for organoleptic attributes of FOS added soup and beverages

% FOS	Organoleptic attributes																			
	Colour and appearance				Taste				After taste				Consistency				Overall acceptability			
	Bm	Lj	Mk	Sp	Bm	Lj	Mk	Sp	Bm	Lj	Mk	Sp	Bm	Lj	Mk	Sp	Bm	Lj	Mk	Sp
0%	7.59	7.78	7.67	7.55	7.15	7.78	7.33	7.33	6.70	7.63	7.30	7.30	7.33	7.78	7.63	7.78	6.85	7.70	7.48	7.48
	1.50	1.05	1.21	1.53	1.85	1.05	1.39	2.07	1.99	1.24	1.75	2.05	1.30	1.28	1.39	1.42	1.91	1.35	1.52	1.94
2.5%	7.30	7.85	7.48	7.63	6.89	7.85	7.26	7.22	6.67	7.67	7.37	7.07	6.89	7.70	7.85	7.89	6.89	7.70	7.52	7.40
	1.51	1.20	1.22	1.64	1.31	1.20	1.23	2.17	1.50	1.33	1.47	2.18	1.50	1.38	1.23	1.55	1.60	1.17	1.42	2.00
4%	7.55	7.89	7.55	7.63	7.22	7.89	7.18	7.41	6.63	7.74	7.37	7.11	7.18	7.96	7.37	7.74	7.07	7.74	7.52	7.40
	1.34	1.05	1.01	1.76	1.25	1.05	1.30	1.71	1.76	1.13	1.60	1.87	1.41	1.12	1.33	1.70	1.52	1.13	1.45	1.97
5%	7.63	7.85	7.96	7.74	6.92	7.85	7.59	7.33	6.67	7.81	7.41	7.15	7.04	8.07	7.89	7.55	6.96	7.89	7.70	7.44
	1.44	1.26	0.94	1.35	1.61	1.26	1.36	1.69	1.62	1.24	1.57	2.09	1.40	1.30	1.19	1.78	1.65	1.25	1.35	1.78
6%	7.63	7.63	7.85	7.74	7	7.63	7.63	7.67	6.41	7.52	7.67	7.59	7.11	8.11	8	7.89	6.81	7.67	7.78	7.62
	1.47	1.42	1.26	1.32	1.39	1.42	1.30	1.75	1.69	1.40	1.79	1.57	1.45	1.31	1.07	1.48	1.64	1.39	1.28	1.57
7.5%	7.52	7.96	8.11	7.74	7.22	7.96	8.18	7.48	6.92	8	7.96	7.33	7.30	8.11	8.07	7.70	7.15	8.11	8.11	7.44
	1.37	1.12	1.31	1.53	1.28	1.12	1.39	1.79	1.38	1.10	1.43	1.90	1.26	1.01	1.41	1.54	1.35	1.15	1.55	1.91
Anova	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Note: mean value represent the average of 5 determinants in triplicates.
NS- The difference between the mean values within the column is not significant
Maximum score for all the organoleptic attributes was 10
Bm- butter milk, Lj- lemon juice, Mk - milk, Sp - soup
FOS - fructo oligosaccharide

Table 2: Per cent subjects indicating the colour and appearance of FOS added products at varying levels in difference test

Products	% FOS	Colour and appearance		
		Equal	Superior	Inferior
Butter milk	2.5	81	15	4
	4	74	19	7
	5	85	11	4
	6	85	8	7
	7.5	67	26	7
χ^2		4.13^{NS}	4.17^{NS}	0.80^{NS}
Lemon juice	2.5	70	19	11
	4	67	22	11
	5	63	33	4
	6	70	26	4
	7.5	70	11	19
χ^2		0.81^{NS}	4.29^{NS}	4.77^{NS}
Milk	2.5	74	22	4
	4	74	22	4
	5	74	22	4
	6	70	26	4
	7.5	85	7	8
χ^2		1.88^{NS}	3.69^{NS}	2.13^{NS}
Soup	2.5	74	15	11
	4	82	11	7
	5	92	4	4
	6	70	26	4
	7.5	56	37	7
χ^2		6.45^{NS}	12.27*	1.67*

NS= Non-significant, * indicates significance of value at P=0.05

Table 3: Per cent subjects indicating the taste of FOS added products at varying levels in a difference test

Products	% FOS	Taste		
		Equal	Superior	Inferior
Butter milk	2.5	59	33	8
	4	41	44	15
	5	45	37	18
	6	59	34	7
	7.5	26	52	22
χ^2		8.53^{NS}	2.98^{NS}	3.92^{NS}
Lemon juice	2.5	63	26	11
	4	63	30	7
	5	74	22	4
	6	56	18	26
	7.5	63	22	15
χ^2		2.05^{NS}	1.06^{NS}	7.13^{NS}
Milk	2.5	67	30	3
	4	78	18	4
	5	67	15	18
	6	67	26	7
	7.5	78	18	4
χ^2		1.88^{NS}	3.52^{NS}	0.70^{NS}
Soup	2.5	59	30	11
	4	44	37	19
	5	63	33	4
	6	70	22	8
	7.5	48	41	11
χ^2		5.02^{NS}	2.33^{NS}	5.74^{NS}

NS= Non-significant

Table 4: Per cent subjects indicating aftertaste of FOS added products at varying levels in a difference test

Products	% FOS	After taste		
		Equal	Superior	Inferior
Butter milk	2.5	70	26	4%
	4	48	33	19
	5	49	44	7
	6	56	37	7
	7.5	33	41	26
χ^2		7.83^{NS}	2.37^{NS}	7.48^{NS}
Lemon juice	2.5	74	19	7
	4	78	15	7
	5	67	26	7
	6	63	30	7
	7.5	74	15	11
χ^2		1.95^{NS}	2.71^{NS}	0.40^{NS}
Milk	2.5	74	19	7
	4	85	11	4
	5	74	19	7
	6	67	26	7
	7.5	85	11	4
χ^2		4.34^{NS}	2.93^{NS}	1.67^{NS}
Soup	2.5	67	26	7
	4	52	30	18
	5	74	15	11
	6	59	26	15
	7.5	63	225	15
χ^2		3.18^{NS}	3.10^{NS}	1.67^{NS}

NS= Non-significant

Table 5: Per cent subjects indicating consistency of FOS added products at varying levels in a difference test

Products	% FOS	Consistency		
		Equal	Superior	Inferior
Butter milk	2.5	70	26	4
	4	59	33	8
	5	63	30	7
	6	85	11	4
	7.5	33	56	11
χ^2		16.51**	13*	1.67^{NS}
Lemon juice	2.5	81	15	4
	4	81	11	8
	5	78	19	3
	6	70	23	7
	7.5	70	22	8
χ^2		3.70^{NS}	3.53^{NS}	0.80^{NS}
Milk	2.5	81	14	5
	4	74	22	4
	5	74	22	4
	6	74	19	7
	7.5	81	15	4
χ^2		1.00^{NS}	0.98^{NS}	0.70^{NS}
Soup	2.5	78	19	3
	4	70	26	4
	5	81	11	8
	6	63	33	4
	7.5	56	33	11
χ^2		5.74^{NS}	5.45^{NS}	2.13^{NS}

NS= Non-significant

*and ** indicate significance of values at P=0.05 and P=0.01, respectively

Table 6: Per cent subjects indicating the overall acceptibility FOS added products at varying levels in a difference test

Products	% FOS	Overall acceptibility		
		Equal	Superior	Inferior
Butter	2.5	59	22	19
milk	4	41	48	11
	5	59	225	19
	6	70	19	11
	7.5	30	48	22
χ^2		11.57 *	11.12*	1.95 NS
Lemon	2.5	63	22	15
juice	4	59	15	26
	5	52	33	15
	6	59	22	19
	7.5	59	15	26
χ^2		0.73 NS	3.69 NS	2.13 NS
Milk	2.5	70	26	4
	4	59	37	4
	5	70	22	8
	6	67	26	7
	7.5	74	22	4
χ^2		1.57 NS	2.05 NS	0.90 NS
Soup	2.5	59	19	22
	4	41	33	26
	5	70	26	4
	6	74	11	15
	7.5	44	26	30
χ^2		7.65NS	4.35NS	7.34NS

NS= Non-significant,
* and ** indicate significance of values at P=0.05 and P=0.01, respectively

with different levels of FOS. No significant deviation in the taste and after taste of the various FOS added products were observed from that of the standard product. Majority of subjects found taste of the milk equal to the standard where as taste of the butter milk was found superior to the standard. Very few subject indicated that the taste and after taste of FOS added products was inferior to the standard.

Taste and flavour has improved with the increase in per cent addition of FOS for butter milk and soup. Majority of the panel members have given equal scores for the standard and FOS added products for all the four products. No significant difference was observed in taste and flavour of the entire four products after the addition of FOS at varying levels.

Table 5 represents per cent subjects indicating deviation in the consistency of the products added with different levels of FOS. With regards to the deviation in the consistency of the butter milk, it was found that significantly ($p<0.01$) less number of the FOS added products were equal to the standard as the level of addition increased from 2.5 per cent to 7.5 per cent. Whereas more number of subjects found that consistency of buttermilk improved with the increase in the per cent addition of FOS ($p<0.05$).

Most subjects did not observed any significant change in the consistency of lemon juice, milk and soup with the increasing levels of FOS.

Table 6 represents per cent subjects indicating the extent to which the FOS added at various levels in different products resembling the standard product with respect to overall acceptability. Significant ($p<0.05$) improvement was observed in FOS added butter milk with the increasing levels of FOS. However, little deviation was observed in overall acceptability of the products from the standard product with regards to FOS added lemon juice, milk and soup at varying levels.

Conclusion:

Today's lifestyle has led to vital changes in food pattern. People are more inclined towards health, demands foods which are beneficial to their health. The present study clearly indicates that FOS can be added in all the four products which are consumed on almost daily basis in Gujarat region. There were no undesirable changes in the organoleptic attributes of the products added with FOS at varying levels and FOS was very well accepted up to 7.5 per cent level in the studied products.

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