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Development and Quality Evaluation of Prebiotic Enriched Food Products

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ABSTRACT

Prebiotic substances a better logical foundation for identification and a framework for more fully realizing the medicinal promise of gut microbiota modulation. Benefits include better lipid metabolism, relief from constipation, decreased risk of gastrointestinal disorders, better vitamin and mineral absorption, prevention of type II diabetes, assistance in blood glucose regulation, weight loss, and immune system activation. Prebiotic enriched three food products were developed; fibre fix yogurt, chialuxe and gut glow smoothie. Each in four variations along with control product. The sensory evaluation of the developed variations of developed products was done by a panel of selected judges. The top performing variant from each product was selected and analyzed for the prebiotic analysis. Further, the shelf life of the selected prebiotic enriched products was assessed through organoleptic evaluation and microbial analysis. The selected variations are fibre fix yogurt Y2, chialuxe C3 and gut glow smoothie S2. Probiotic analysis of the freshly prepared products confirmed the presence of beneficial bacteria such as Lactobacillus spp. and Bifidobacterium, which are known to support gut health and immunity. The Fibre Fix Yogurt contained 51% Lactobacillus and 49% Bifidobacterium, while Chialuxe and Gut Glow Smoothie each had 54% Lactobacillus and 46% Bifidobacterium.

Key words: Development, Popularization, Prebiotics, Inulin, Sensory evaluation.

1. INTRODUCTION

Diverse eating lifestyles are demanding various types of functional foods which are non-dairy based but equally potent as cow's milk, can be consumed along with their regular food and which are rich in nutritional values, capable of stopping or preventing diseases and can contribute to their optimal health. The modern health movement focuses on the mantra that no good thing in life should be artificial and has inspired consumers to shun chemicals and artificial ingredients. The functional beverage market includes energy drinks, fortified juices, sports drink, dairy and dairy alternative drinks, enhanced water, ready-to-drink tea and coffee.

Today's consumer is smart and understands the link between plant power, clean diet and sustainable health. The answer to all this lies in the development of functional foods that are based on plants and are non-dairy milk alternatives. This ever-increasing demand for quality functional foods gives a vast space to study and develop a legume milk based functional food which is nutritional, tasty, affordable with pro- and prebiotic benefits

and which should be highly acceptable by the consumers.

Prebiotics fermented substrates that exclusively stimulates microflora growth in the gastrointestinal tract and therefore improve host production, composition and activity health. Fructo-Oligo Saccharides (FOS), inulin, oligo-fructose, lactulose and Galacto-Oligo Saccharides (GOS) showed characteristics such as gastric acidity 2 tolerance. Mammalian enzymes have been established and fermented by gastrointestinal micro flora, in order to promote further production and growth of beneficial microorganisms. Prebiotic are compounds that possess intestinal resistance and selective fermentation which includes oligosaccharides, sugar alcohols and polysaccharides.

Despite their proven health benefits, the intake of prebiotic-rich foods among the general population remains inadequate. This may be due to a lack of awareness, limited availability of appealing food products fortified with prebiotics, and insufficient understanding of their long-term benefits. Traditional dietary sources of prebiotics 3 include inulin, Fructooligosaccharides (FOS), galactooligosaccharides (GOS), and resistant starches, which are naturally present in foods such as chicory root, garlic, onions, leeks, bananas, whole grains, and seeds like flaxseed and chia. However, the consumption of these foods in their raw form may not always be practical or enjoyable for all population groups, especially children and the elderly.

The authors Gibson & Roberfroid (1995) provided the knowledge of prebiotics as dietetics modular to the intestinal microbiota. They defined prebiotics as a feeding ingredient that is resistant to digestion and has beneficial effects because it can selectively stimulate the growth and/or activity of a limited number of bacteria in the colon when fermentation is being suffered, thus gaining a primary role in intestinal physiology.

Healthy food implies functional food that, in addition to conventional nutritional benefits, has a beneficial impact on more basic body functions. Functional foods generally contain health-promoting components beyond traditional nutrients. It can be an unmodified natural food; a food in which a component has been enhanced through special growing conditions, breeding or biotechnological means or a food to which a component has been added to provide benefits.

OBJECTIVES

- To formulate and develop food products enriched with prebiotic foods.
- To evaluate the organoleptic characteristics of the developed prebiotic-enriched products
- To determine the shelf-life stability of the prebiotic-enriched products
- To quantify the prebiotic content in the developed products specifically Bifidobacterium and Lactobacillus species.

2. EXPERIMENTAL PROCEDURE

2.1 Selection of ingredients

The raw materials selected for the development of prebiotic enriched food products are inulin, yogurt, banana, chia seeds and milk. Inulin is a type of soluble dietary fiber classified as a prebiotic, meaning it promotes the growth and activity of beneficial gut bacteria, especially Bifidobacteria and Lactobacilli. Yogurt is widely recognized for its health benefits, but it is primarily considered a probiotic food rather than a prebiotic. Bananas, especially when slightly unripe (green), are a natural source of prebiotic fibers, mainly resistant starch and Fructooligosaccharides (FOS). Milk itself is not a natural prebiotic, but it plays an important supportive role in prebiotic nutrition and gut health. Chia seeds are tiny nutritional powerhouses that offer several health benefits, including prebiotic properties.

2.2 Selection of recipes

Three recipes were chosen for the creation of prebiotic-enriched food products: fibre fix yogurt, chialuxe, gut glow smoothie.

2.3 Development of prebiotic enriched food products

The development of prebiotic enriched food products involved formulating three different food items fibre fix yogurt, chialuxe, gut glow smoothie. Each product was designed to deliver health-promoting prebiotics while maintaining sensory acceptability and nutritional balance. And developed these three products in different inulin variation.

2.4 Standardization of ingredients for prebiotic products

The fibre fix yogurt was developed by the addition of inulin into prepared plain yogurt. Three yogurt blends are prepared in same manner and inulin is added in three variations that is Y1-5g, Y2-7g, Y3-10g along with a control recipe Y0 were prepared.

The chialuxe was developed by the addition of inulin into milk and chia seeds blend. Three chia seed blends are prepared in same manner and inulin is added in three variations that is C1-5g, C2-7g, C3-10g along with a control recipe C0 were prepared.

The gut glow smoothie was developed by the addition of inulin into banana and milk blend. Three banana smoothies are prepared in same manner and inulin is added in three variations that is S1-5g, S2-7g, S3-10g along with a control recipe S0 were prepared.

2.5 Preparation of prebiotic enriched food products

The ingredients used for the preparation of fibre fix yogurt were milk, yogurt starter(culture) and inulin. Add culture into milk and keep it for 7-8 hours for 40 fermentations and to form yogurt, then add inulin powder and mix well.

The ingredients used for the preparation of chialuxe were milk, chia seeds, sugar and inulin. Mix the all ingredients as per variation and keep some time.

The ingredient used for the preparation of gut glow smoothie are ripe banana, milk, sugar and inulin. Blend the all ingredients and add inulin, then mix well.

2.6 Organoleptic evaluation of developed products

Sensory evaluation of Fish Protein Concentrate incorporated products were carried out in the Nutrition Lab of Dept. of Home Science, KAHM Unity Women's College, Manjeri, Malappuram. The samples were evaluated for their sensory attributes such as Appearance, Colour, Flavour, Texture, Taste and Overall Acceptability using a 9-point hedonic scale. Twenty semi trained panel members were selected for the sensory evaluation.

2.7 Shelf-life Estimation

All the selected variants of products (Y2, C3, S2) were kept for shelf-life estimation. These selected products were kept for one week, two-week, one month and two months in room temperature in the airtight container.

2.8 Microbial Analysis

Microbial analysis helps to predict possible contamination of food. Microbial analysis of developed products was done by Clean N Care Analytical lab, Kozhikode. The initial microbial analysis done by the prepared date. The product was kept for 7days,14days, one month and two months. The changes in appearance seen within 2 days. The final microbial analysis done by after 2 days. The total bacterial count was determined by pour plate method. The microbes including yeast and mold were estimated.

2.9 Prebiotic Analysis

The prebiotic analysis of developed and standard prebiotic enriched products was analyzed from Geno bio research centre, Kottakkal, Malappuram. The bacteria are Lactobacillus spp and Bifidobacterium spp were analyzed.

2.10 STATISTICAL ANALYSIS

The collected data was consolidated, tabulated, analyzed and interpreted using appropriate statistical analysis. The data should be statistically analyzed to ensure the significance. Kendell's was used for analyzing sensory evaluation and Microsoft

excel was used for comparing prebiotic value of each item. Kendell's W (Kendell's coefficient of concordance) is a non – parametric statistics.

3. RESULT AND DISCUSSION

3.1 Development of Prebiotic enriched Products

The different type of prebiotic enriched food products was prepared by incorporate with inulin. Fibre fix yogurt, chialuxe and gut glow smoothie were prepared using selected ingredients. Three variations of each product were made along with control recipe. One variant is selected from each product by sensory threshold test

3.2 Organoleptic Evaluation of Fibre fix yogurt

Table 1: mean scores for sensory evaluation of fibre fix yogurt

Variations	Appearance	Colour	Flavour	Texture	Taste	Overall acceptability
Y_0	8.8 (4.00)	8.8 (3.80)	8.6 (3.60)	8.6 (3.75)	8.3 (3.25)	8.7 (3.85)
Y_1	7.5 (2.10)	7.6 (2.30)	7.9 (2.65)	7.6 (2.15)	7.6 (3.45)	8.5 (1.95)
Y_2	7.6 (2.25)	7.5 (2.15)	7.9 (2.70)	7.5 (2.85)	8 (2.20)	8.6 (2.10)
Y_3	7.2 (1.65)	6.9 (1.75)	6.7 (1.05)	6.9 (1.25)	6.4 (2.20)	7.5 (2.10)
Kendall's (w)value	0.819***	0.619***	0.854***	0.784***	0.808***	0.627***

***** = highly significant at 0.1% level. **= very significant at 1% level.**
***=significant at 0.1%level ns = non-significant.**

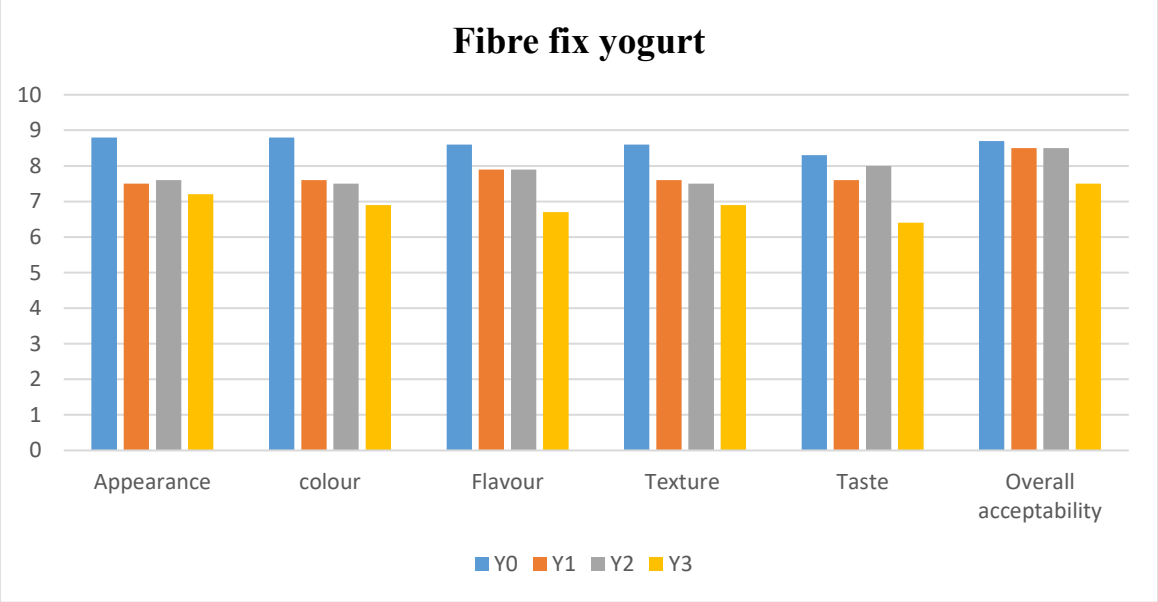

Figure 1: Graphical representation of the mean scores for organoleptic evaluation of fibre fix yogurt.

The table 1 and Figure 1 shows that the mean rank scores acquired for the appearance of the variants Y0, Y1, Y2 and Y3, was (4.00, 2.10, 2.25 and 1.65) respectively. The highest mean rank score and mean scores of colour was for Y0 ((3.80) and 8.8) and Y1((2.30) and 7.6). The lowest mean rank score and mean score were found in Y2 ((2.15) and 7.5) and Y3((1.75) and 6.9 respectively). The mean rank scores for flavor of the variants ranged from (1.05) to (3.60) along with mean scores from 6.7 to 8.6. The respective mean rank scores and mean scores acquired for texture of the variants Y0 to Y3 ranges from (1.25) to (3.75) and 6.9 to 8.6). The variant Y0 and Y2 scored the highest mean rank score and mean score for taste are ((3.25) and 8.3) and ((2.20) and 8.0) respectively. Among the mean rank scores and mean scores for the overall acceptability of the fibre fix yogurt Y0 and Y2 had the highest mean rank score and mean score ((3.85) and 8.7) and ((2.10) and 8.6 respectively). The lowest scores were

found in Y1 ((1.95) and 8.5) and Y3 ((2.10) and 7.5respectively). The results were statistically highly significant ($p < 0.001$), indicating a high level of agreement among the panelists in evaluating the sensory differences between samples.

3.3 Organoleptic Evaluation of Chialuxe

Table 2: mean scores for sensory evaluation of chialuxe.

Variations	Appearance	Colour	Flavour	Texture	Taste	Overall acceptability
C_0	8.7 (3.15)	8.8 (3.25)	8.6 (3.35)	8.5 (3.25)	8.8 (3.75)	8.8 (3.25)
C_1	8.1 (1.95)	8.2 (2.05)	7.9 (1.75)	7.9 (2.35)	7.5 (1.60)	7.9 (1.80)
C_2	8.2 (2.15)	8 (1.65)	7.8 (2.55)	7.8 (2.15)	7.8 (2.29)	8 (2.25)
C_3	8.5 (2.75)	8.8 (3.05)	8.1 (2.35)	7.9 (2.25)	8 (2.49)	8.5 (2.70)
Kendall's (w)value	0.294*	0.577**	0.369**	0.302*	0.657***	0.352*

***** = highly significant at 0.1% level. **= very significant at 1% level.**
***=significant at 0.1%level ns = non-significant**

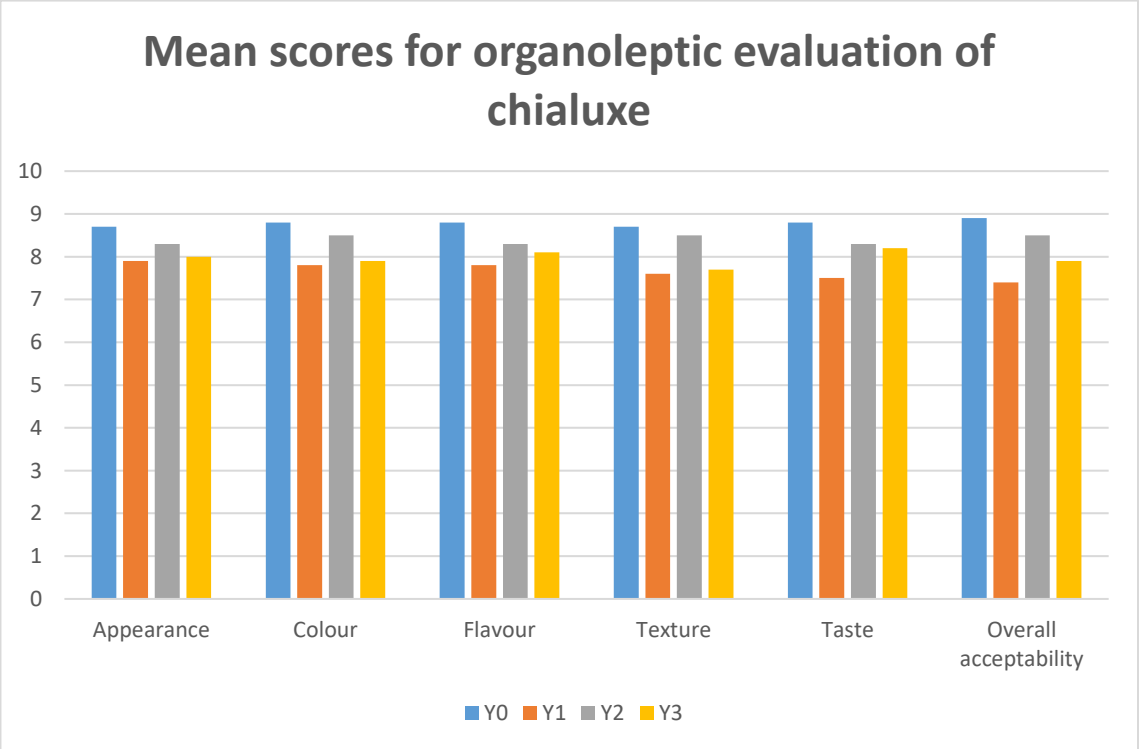

Figure 2: Graphical representation of the mean scores for organoleptic evaluation of chialuxe

The mean rank scores acquired for the appearance of the variants C0, C1, C2 and C3, was (3.15,1.95,2.15 and 2.75) respectively. The highest mean rank score and mean scores for color was for C0 ((3.25) and 8.8) and C3((3.05) and 8.8). The lowest mean rank score and mean score were found in C1 ((2.05) and 8.2) and C2((1.65) and 8 respectively). The mean rank scores for flavor of the variants ranged from (2.55) to (3.35) along with mean scores from 7.8 to 8.6. The respective mean rank scores and mean scores acquired for texture of the variants C0 to C3 ranges from (2.15) to (3.25) and 7.8 to 8.5. The variant C0 and C3 scored the highest mean rank score and mean score for taste are ((3.75) and 8.8) and ((2.49) and 8.0) respectively. while, respective lowest scores were found for C1((1.60) and 7.5) and C2 ((2.29) and 7.8). Among the mean rank scores and mean scores for the overall acceptability of the fibre fix yogurt C0 and C3 had the highest mean rank score and mean score ((3.25) and 8.8) and ((2.70) and 8.5 respectively). The lowest scores were found in C1 ((1.80) and 7.9) and C2 ((2.25) and 8 respectively).

3.4 Organoleptic Evaluation of Gut glow smoothie

Table 3: Mean scores for sensory evaluation of gut glow smoothie

	Appearance	Colour	Flavour	Texture	Taste	Overall acceptability
S_0	8.7 (3.40)	8.8 (3.45)	8.8 (3.50)	8.7 (3.40)	8.8 (3.50)	8.9 (3.60)
S_1	7.9 (1.90)	7.8 (1.80)	7.8 (1.75)	7.6 (1.75)	7.5 (1.35)	7.4 (1.35)
S_2	8.3 (2.60)	8.5 (2.95)	8.3 (2.55)	8.5 (3.00)	8.3 (2.65)	8.5 (3.05)
S_3	8 (2.10)	7.9 (1.80)	8.1 (2.20)	7.7 (1.85)	8.2 (2.50)	7.9 (2.00)
Kendall's (w)value	0.394**	0.642***	0.480*	0.505*	0.609***	0.752***

***** = highly significant at 0.1% level. **= very significant at 1% level.**
***=significant at 0.1%level ns = non-significant.**

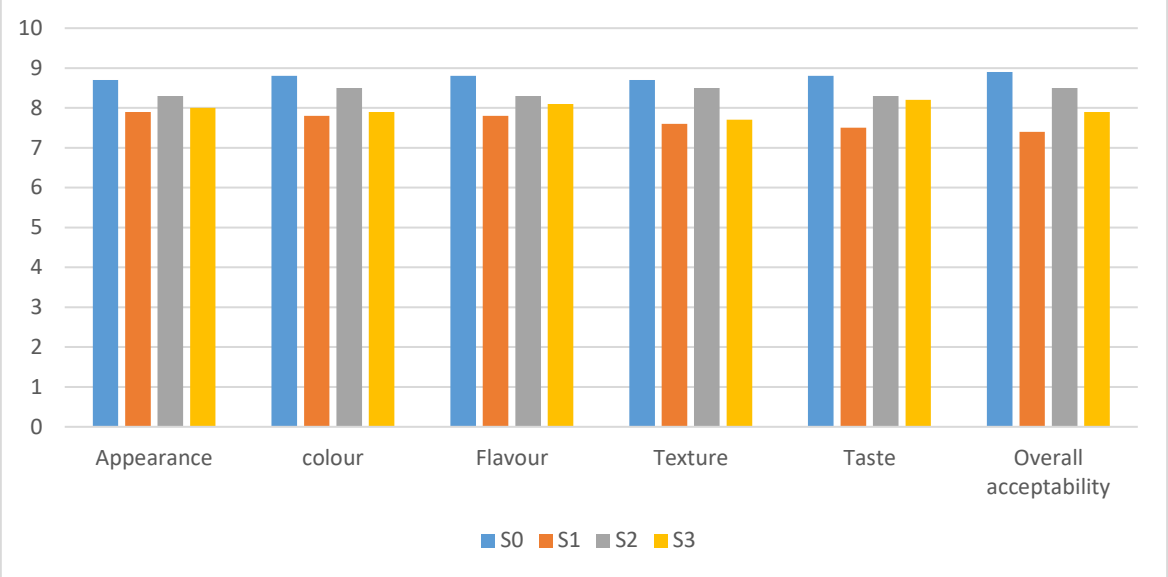

Figure 3: Graphical representation of the mean scores for organoleptic evaluation of gut glow smoothie

The mean rank scores acquired for the appearance of the variants S0, S1, S2 and S3, was (3.40, 1.90, 2.60 and 2.10) respectively. In the mean rank scores obtained for the colour of the variants, the highest was for S0 ((3.45) and 8.8) and S2((2.95) and 8.5). The lowest were found in S1 ((1.80) and 7.8) and S3((1.80) and 7.9 respectively). The mean rank scores for flavor of the variants ranged from (1.75) to (3.50) along with mean scores from 7.8 to 8.8. The respective mean rank scores and mean scores acquired for texture of the variants S0 to S3 ranges from (1.75) to (3.40) and 7.6 to 8.7. The variant S0 and S2 scored the highest mean rank score and mean score for taste are ((3.50) and 8.8) and ((2.65) and 8.3) respectively. while, respective lowest scores were found for S1((1.35) and 7.5) and S3 ((2.50) and 8.2 respectively). Among the mean rank scores and mean scores for the overall acceptability of the gut glow smoothie S0 and had the highest mean rank score and mean score ((3.60) and 8.9) and ((3.05) and 8.5 respectively). The lowest scores were found in S1 ((1.35) and 7.4) and S3 ((2.00) and 7.9 respectively).

3.5 Selection of most acceptable products

From the four variations of fibre fix yogurt Y1, Y2, Y3 and control yogurt Y0, Y2 is found to be highly acceptable and it was selected for further studies. Y2 was made with 95% milk ,5% and 7gram of inulin. In the preparation of chialuxe C1, C2, C3 and control chialuxe C0, C3 scored the maximum. C3 was prepared with 45% milk ,50% chiaseed,5% sugar and 10gram of inulin. In the preparation of gut glow smoothie, S1, S2, S3 and control smoothie S0, S2 scored the maximum. S2 was prepared with 45% milk,50% banana ,5%sugar and 7gram of inulin. Totally three

products were selected based on the acceptability score obtained for different quality attributes for further studies by applying Kendall's coefficient of concordance.

3.6 Organoleptic evaluation of the prebiotic enriched products during storage

Sensory evaluation of prebiotic enriched products was done initially and after one week. The score for appearance, colour, flavor, and texture although gradually and significantly decreased throughout the storage period, none of the products were unacceptable.

Fibre fix yogurt

Table 4: Mean scores for organoleptic evaluation of fibre fix yogurt during storage

Quality attributes	Initial	After one week	Kendall's (w) value
Appearance	7.6 (2.00)	5 (1.00)	1.000*
Colour	7.5 (1.50)	7.5 (1.50)	0.000 ns
Flavour	7.9 (2.00)	4.5 (1.00)	1.000**
Texture	7.5 (1.65)	7.2 (1.35)	3.00*
Taste	8 (2.00)	4.5 (1.00)	1.000**
Overall acceptability	8.5 (2.00)	5.1 (1.00)	1.000**

***** = highly significant at 0.1% level. **= very significant at 1% level.**
***=significant at 0.1%level ns = non-significant.**

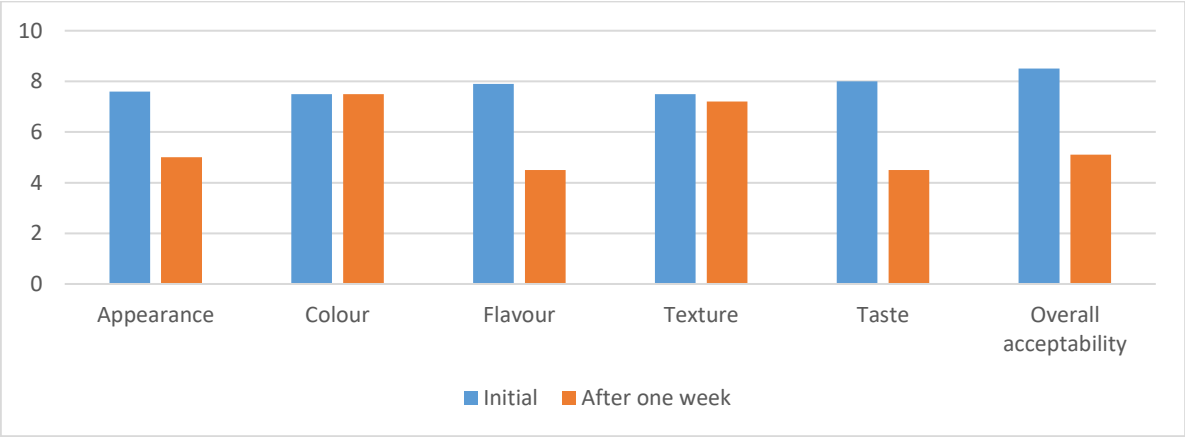

Figure 4: Mean scores for organoleptic evaluation of fibre fix yogurt during storage

The mean score for overall acceptability of the fibre fix yogurt was initially 8.5. It was decreased to 5.1 during after one week of storage. Based on Kendall's value, the agreement among judges in the evaluation of appearance of the yogurt was found to be statistically very significant. The score for certain organoleptic characteristics of yogurt like appearance, flavor, texture and taste decreased and colour has no changes noticed. The overall acceptability decreased.

Chialuxe

Table 5: Mean score for the organoleptic evaluation of chialuxe during storage

Quality attributes	Initial	After one week	Kendall's (w) value
Appearance	8.5 (2.00)	5.1 (1.00)	1.000**
Colour	8.8 (2.00)	4.9 (1.00)	1.000**
Flavour	8.1 (2.00)	3.9 (1.00)	1.000**
Texture	7.9 (2.00)	4 (1.000)	1.000**
Taste	8 (2.00)	3.2 (1.00)	1.000**
Overall acceptability	8.5 (2.00)	4 (1.00)	1.000**

***** = highly significant at 0.1% level. **= very significant at 1% level.**
***=significant at 0.1%level ns = non-significant.**

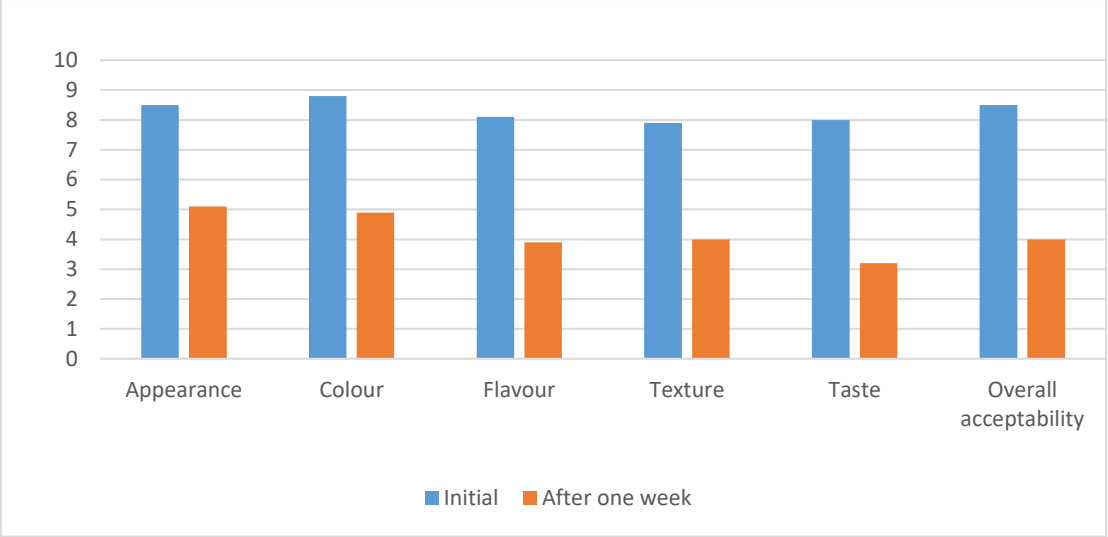

Figure 5 Mean scores for organoleptic evaluation of chialuxe during storage

The mean score for overall acceptability of the chialuxe was initially 8.5. It was decreased to 4 during after one week of storage. Based on Kendall's value, the agreement among judges in the evaluation of appearance of the chialuxe was found to be statistically very significant. The score for certain organoleptic characteristics of chialuxe like appearance, flavor, colour, texture and taste were decreased. The overall acceptability decrease.

Gut Glow Smoothie

Table 6: Mean score for the organoleptic evaluation of gut glow smoothie (S2) during storage

Quality attributes	Initial	After one week	Kendall's (w) value
Appearance	8.3 (2.00)	4.1 (1.00)	1.000**
Colour	8.5 (2.00)	5.2 (1.00)	1.000**
Flavour	8.3 (2.00)	3 (1.00)	1.000**
Texture	8.5 (2.00)	3.9 (1.00)	1.000**
Taste	8.3 (2.00)	2 (1.00)	1.000**
Overall acceptability	8.5 (2.00)	4 (1.00)	1.000**

***** = highly significant at 0.1% level.** ****= very significant at 1% level.**
***=significant at 0.1%level** **ns = non-significant.**

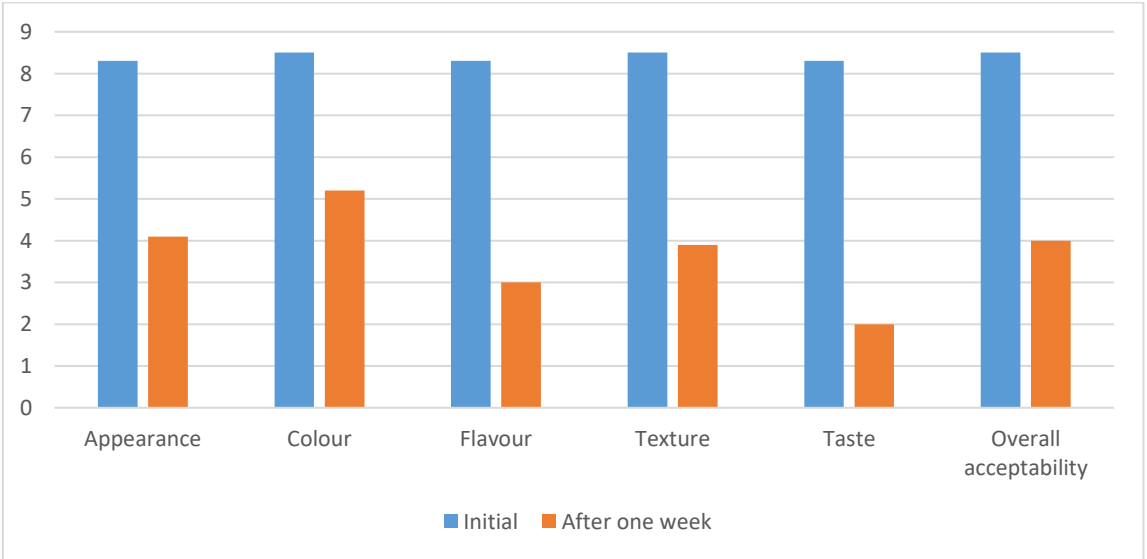

Figure 6: Mean scores for organoleptic evaluation of gut glow smoothie during storage

The mean score for overall acceptability of the smoothie was initially 8.5. It was decreased to 4 during after one week of storage. Based on the Kendall's value, the agreement among judges in the evaluation of overall acceptability of the smoothie was found to be statistically very significant.

3.7 Microbial analysis

Microbiological analysis of food products is the use of biological, molecular or chemical methods for the detection of microorganism in a material. The method used for microbial analysis is FSSAI Manual of Methods of Analysis of Foods (Microbiological Analysis), 2015.

Microbial analysis of fibre fix yogurt

Table 7: Microbial analysis of the fibre fix yogurt initially and after one week

SI NO	PARAMETERS	INITIAL	AFTER ONE WEEK	LIMIT
1	Yeast and mould	0.4×10^4CFU\g	7.6×10^4CFU\g	Not more than 2 CFU per gram

Microbial analysis of the fibre fix yogurt were done based on yeast and mould for initially and after one week. At initial the microbial content of yogurt is 0.4 $\times10^4$ CFU\g. When the samples analyzed again after one week of storage the growth of yeast and mould in fibre fix yogurt were 7.6×10^4 CFU\g. This indicates that microbial growth is present on fibre fix yogurt.

Microbial analysis of chialuxe

Table 8: Microbial analysis of the chialuxe initially and after one week

SI NO	PARAMETERS	INITIAL	AFTER ONE WEEK	LIMIT
1	Yeast and mould	0.31×10^2CFU\g	1.8×10^2 CFU\g	Not more than 2 CFU per gram

Microbial analysis of the chialuxe were done based on yeast and mould for initially and after one week. At initial the microbial content of chialuxe is 0.31 $\times10^2$ CFU\g. When the samples analyzed again after one week of storage the growth of yeast and mould in fibre fix yogurt were 1.8×10^2 CFU\g. This indicates that microbial growth is present on chialuxe.

Microbial analysis of gut glow smoothie

Table 9: Microbial analysis of the gut glow smoothie initially and after one week

SI NO	PARAMETERS	INITIAL	AFTER ONE WEEK	LIMIT
1	Yeast and mould	5.8×10^4 CFU\g	5.7×10^4 CFU\g	Not more than 2 CFU per gram

Microbial analysis of the gut glow smoothie was done based on yeast and mould for initially and after one week. At initial the microbial content of yogurt is 5.8×10^4 CFU\g. When the samples analyzed again after one week of storage the growth of yeast and mould in fibre fix yogurt were 5.7×10^4 CFU\g. This indicates that microbial growth is present on gut glow smoothie.

3.8 Prebiotic analysis of developed products

Prebiotic analysis was carried out to evaluate the presence and growth-promoting effect of prebiotics in the developed products. Prebiotics like inulin were added to the formulation to selectively stimulate the growth of beneficial gut bacteria. The prebiotic enriched products were assessed for the presence of probiotic strains such as Lactobacillus spp. and Bifidobacterium spp., which are known to thrive in the presence of prebiotic compounds.

Prebiotic analysis of fibre fix yogurt

Table 10: prebiotic analysis of fibre fixes yogurt (y2)

Isolated organism	Gram reaction	Result (CFU/ml)
Lactobacillus spp	Gram positive	1334 CFU\ml
Bifidobacterium spp	Gram positive	1300 CFU\ml

Prebiotic bacteria like Lactobacillus spp and Bifidobacterium were found in the fibre fix yogurt products. When the fibre fix yogurt was analyzed, it contains 51% Lactobacillus spp and 49% Bifidobacterium.

Prebiotic analysis of chialuxe

Table 11: prebiotic analysis of chialuxe (C3)

Isolated organism	Gram reaction	Result (CFU/ml)
Lactobacillus spp	Gram positive	307 CFU\ml
Bifidobacterium spp	Gram positive	263 CFU\ml

Prebiotic bacteria like Lactobacillus spp and Bifidobacterium were found in the chialuxe. When the chialuxe were analyzed, it contains 54% Lactobacillus spp and 46% Bifidobacterium.

Prebiotic analysis of gut glow smoothie

Table 12: prebiotic analysis of gut glow smoothie (S2)

Isolated organism	Gram reaction	Result (CFU/ml)
Lactobacillus spp	Gram positive	2470 CFU\ml
Bifidobacterium spp	Gram positive	2132 CFU\ml

Prebiotic bacteria like Lactobacillus spp and Bifidobacterium were found in the gut glow smoothie. When the gut glow smoothie was analyzed, it contains 54% Lactobacillus spp and 46% Bifidobacterium.

CONCLUSION

Prebiotics are specified additives that are meant to influence individual bacteria, the end results of their fermentation and the host's potential health benefits. Prebiotics, such as oligosaccharides or polysaccharides, are predominantly utilized by symbiotic species of bacteria and organisms that are thought to benefit the human host. Among various prebiotics, inulin a naturally occurring fructan found in plants like chicory root, garlic, and banana is widely recognized for its effective role in promoting gut microbiota balance. It also contributes to improved mineral absorption, blood sugar regulation, and appetite control. Inulin and other prebiotics are commonly incorporated into a variety of food products, including yogurts, smoothies, cereals, baked goods, and functional beverages. Prebiotics are considered to be resilient, whole grains rich in starch, and their intake is thought to offer various health benefits. This are not absorbed in the intestinal tract by healthy humans, and subsequently fermented into Short Chain Fatty Acids (SCFAs) by the regular microflora. Oat β-glucan, flaxseed gum, and SCFA fenugreek gum demonstrate their potential prebiotic use to boost human health (John and Kalaichelvan, 2016). Recently, mannan oligosaccharide-rich yeast cell wall material has been shown to be a valuable prebiotic material.

Declaration by Authors

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