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EFFECT OF ADDITION OF FRUCTOOLIGOSACCHARIDE ON STORAGE STUDY OF GOLDEN MILK

Giri S. A, Shinde E.M, and Kshirsagar R.B.

Department of Food Engineering,
College of Food Technology, VNMKV, Parbhani 431- 402

Email: sachingiri280496@gmail.com

Abstract
The goal of the current experiment was to create golden milk with the addition of various FOS concentrations. Standardizing processing methods and examining the chemical, storage, and microbiological properties of golden milk are two important objectives. FOS was utilized in the formulation to create golden milk. For T0, T1, T2, and T3, different formulations were created with varying FOS levels from 0 to 18%. Using a 9-point hedonic scale, prepared golden milk was then assessed for organoleptic features with regard to color and appearance, flavor, texture, taste, and overall acceptability. The findings of the microbiological investigation with regard to total plate count and coliform demonstrated an increase in bacterial growth while the product was held for 12 days.

Keywords: FOS, Golden milk, organoleptic evalution.

Introduction:

Milk is regarded as a "Complete Food" since it almost entirely consists of the essential elements needed for our bodies to grow normally. Milk regulates the body's fluid balance in addition to providing nutrition. Despite milk's tremendous nutritional value, some people believe it should not be consumed because it comes from animals (Nakade et al., 2020).

One of the primary groups of bifidogenic oligosaccharides is the nondigestible carbohydrate known as fructooligosaccharides (FOS). The phrase refers to a group of homologous oligosaccharides having a (2 1) fructosyl- fructose glycosidic connection. It is also known as oligofructose, oligo fructan, fructose oligomers, fructans, or glucofructans. Fructooligosaccharides, according to Lewis (1993), are made up of three sugar molecules: 1-kestose (GF2), nystose (GF3), and frutofuranosyl nystose (GF4). At the 2 1 position, fructosyltransferase (F) joins sucrose (GF) to form these compounds. The chains range in length from 2 to 60. (Sridevi *et al*., 2014).

Due to its enhanced nutritional, organoleptic, and functional qualities, FOS is a crucial component of functional foods. In most cases, fructooligosaccharides are employed in place of sugar or fat. They are

used in a wide range of food products, including frozen desserts, baked goods, breakfast cereals, fillings, dairy products, fruit preparations, dietetic products, and meal replacements, where they can replace sugar and fat while also retaining moisture, improving texture, enhancing crispness, expanding, and having a longer shelf life. (Kherade *et al*., 2021).

Numerous studies have shown that fructooligosaccharides (FOS) have useful properties, such as lowering blood pressure, lowering blood sugar and cholesterol levels, improving calcium and magnesium absorption, and inhibiting the production of the reductase enzymes that can cause cancer. FOS are not digested by the human gastrointestinal tract, and once they enter the colon, they help to nourish and proliferate a number of certain bacteria that are already present there. The enzyme that would be in charge of hydrolyzing FOS is secreted by the bifidobacteria, and its name is ß fructosidase. Bifidobacteria saw an increase in average counts, however Bacteroides, Fusobacterium, and Clostridium sp. saw significant declines. (Roberfroid, 1993).

Materials and Methods

Materials

Jaggery, fresh turmeric rhizomes (Var. Selam), and soybean (MAU-71) were all procured locally in the Parbhani region. The dairy division of the VNMKV, Parbhani College of Agriculture provided cow milk of the Kandhari breed. The fructo-oligosaccharide was purchased from a Parbhani food-grade analytical business. The obtained raw material was cleaned, the unnecessary material was taken out, and it was then utilised to extract the soy milk and turmeric rhizome juice, respectively.

Standardized recipe for the preparation of Golden A2 Milk

The standardised recipe for making Golden A2 milk, based on FOS and organoleptic analysis, is shown in the table below.

Recipe formulation of preparation of golden A2 milk

Sample	Cow milk(ml)	Soymilk (ml)	Turmeric rhizome juice(ml)	FOS(g)
T0	70	20	10	0
T1	70	20	10	6
T2	70	20	10	12
T3	70	20	10	18

Standardization of Golden A2 milk (Sample T2)

Ingredients	Quantity per 100 ml
	FOS
Cow milk	70
Soy milk	20
Fresh Turmeric rhizome juice	10
Fructo-oligosaccharide	12

Chemical composition of golden milk

golden milk, including moisture, fat, protein, total carbohydrate, crude fibre, ash, and mineral composition, was tested. According to the procedures outlined by the AOAC, 2000, the proximate composition of

Storage study

Golden A2 milk was studied for 15 days while being packed in appropriate glass and PET bottles and kept at room temperature and in the refrigerator. Its pH, TSS, acidity, and general acceptability were examined for alterations as a result of storage conditions. The development or proliferation of microorganisms, along with an offensive flavour and odour, determine whether a product is unsatisfactory.

Microbial analysis

. The greatest and most popular quality assessment method used in food testing labs is microbial investigation. The Indian Standard Institute (ISI) (1969) approach was used for studying the microbes in products like health drink mixes. The results for the evaluation of the total plate count and the total coliform count were indicated as colony forming units per gram(cfu/g).

Determination of total plate count (TPC) of prepared products

Pour plate technique was employed to isolate the bacterium. By total plate count, bacteria were examined on nutrient agar media (Harrigan and Mccance, 1966). Nutrient agar media were sterilised at 15 psi for 15 minutes. On nutritional agar medium, the fifth dilution (10-2, 10-3, 10-4, 10-5, and 10-6) was applied. Laminar air flow was used during the entire procedure to keep everything sanitary. After 48 hours of 37°C incubation, microbial colonies on the plates were counted using a digital colony counter.

$$\text{TPC (CFU/ml)} = \frac{\text{Number of colonies} \times \text{Dilutions}}{\text{Volume of sample taken}}$$

Determination of coliform count of Golden A2 milk

Coliform count of prepared products was evaluated by using violet red bile agar solid plating medium. The dilution was prepared i.e. 10^{-2}, 10^{-3}, 10^{-4}, 10^{-5} and 10^{-6} and then 1 ml of diluted prepared product was plated in pour plate method on a violet red bile agar medium. The plates were incubated at 37±10ºC temperature for 18 to 24 hours and coliform count were counted by colony counter.

Results and Discussion

Chemical composition of Golden A2 milk

Sample T2 with 12% FOS was chosen for further investigation based on the findings of the organoleptic examination of the data summarised in tables no. 1 and 2.

The nutritional profile of the food product is determined in part by the product's immediate composition. Understanding the compositional changes and losses that take place throughout processing is made easier with the help of the nutritional profile.

The information in table 1 above interprets the nutritional value of the chosen Golden milk sample, which is cow milk that has been sweetened with FOS. Cow milk and FOS-based Golden A2 milk's respective moisture contents were calculated to be 88.1 0.5% and 76.9 0.3%. The tabulated data shows that the moisture content of A2 milk FOS has decreased. Similar results are assessed for milk mixes.(Kundu *et al.*, 2018).

Table 1 : Chemical composition of Golden A2 milk

Parameter (%)	**T_0**	**A2 milk (FOS)**
Moisture	88.1± 0.5	76.9±0.3
Protein	3.5 ± 0.4	3.67 ± 0.1
Fat	3.4 ± 0.07	5.2 ± 0.2
Carbohydrate	4.03 ± 0.3	9.57 ±0.3
Ash	0.66 ± 0.02	0.74 ± 0.05
Dietary fiber	-	3.7 ± 0.14

*Data represent mean ± standard deviation (n)

According to Hajirostamloo, 2009, the protein content (%) of the FOS-based A2 milk was found to be 3.67 0.1, which is consistent with these findings. The soymilk's fat content may affect how easily the proteins in the emulsion dissolve. On the other hand, adding soy milk really boosted the amount of fat content. In comparison to control milk (3.4 0.07%), A2 milk (FOS) had a fat content of 5.2 0.2%. It was

discovered that the ash concentration of the control sample, 0.66 0.02%, was lower than that of the A2 FOS milk, 0.74 0.05%. Table 1 shows, fortunately, that the inclusion of FOS considerably enhanced the amount of dietary fibre in the T2 sample. This demonstrates unequivocally that fresh turmeric rhizome with soymilk

Storage studies of Golden A2 milk at room temperature and Refrigerated condition

The storage experiments for Golden A2 milk FOS were conducted at 4°C in the refrigerator and at room temperature. The periodic time interval of 15 days was used to analyse variables such as pH, Titratable Acidity, TSS, and overall Acceptability.

Table 3 shows that throughout the course of a 9-day storage period, the pH of the sample (FOS) held in PET bottles and glass bottles at room temperature went from 5.9 to 5.2 and 5.9 to 5.3, respectively. The sample's titratable acidity did not appreciably rise while it was stored in a glass bottle. The sample held in glass bottles had no further impact on TSS. During a 9-day storage period, it was discovered that the sample's overall acceptability had dropped from 8.5 to 7.7 in a PET bottle, while its organoleptic quality score had dropped from 9 to 7.8 in a glass bottle. It was found that the sample started to degrade after more than 6 days at room temperature.

Analysis of a sample (FOS) kept at a cold temperature included measurements of TSS, pH titrable acidity, and overall acceptability. The findings showed that for samples held in PET and glass bottles, the acidity rose from 6.0 to 5.0 and 6.3 to 5.5, respectively. There was an increase in titrable acidity. TSS of the sample kept in a PET bottle ranged from 19 to 20 throughout a 12-day holding period. It is clear that TSS increased over the course of storage, which may be the result of oligosaccharide hydrolysis. The same outcomes were also reported by (Deka and Sethi, 2001)

Table 3 : Storage study of Golden A2 milk at room temperature (FOS)

Storage study (FOS)								
Parameters	**pH**		**Titratable acidity**		**TSS**		**Overall acceptability**	
Days	PET	Glass bottles	PET	Glass bottles	PET	Glass bottles	PET	Glass bottles
0	5.9	5.9	0.68	0.68	19	19	8.5	9
3	5.6	5.7	0.72	0.71	19.3	19.2	8	8.5
6	5.2	5.3	0.77	0.74	19.6	19.5	7.7	7.8
9	-	-	-	-	-	-	-	-

*Data represent mean ± standard deviation (n)

Table 4: Storage study of Golden A2 milk at refrigerated condition (FOS)

Storage study (FOS)								
Parameters	**pH**		**Titratable acidity**		**TSS**		**Overall acceptability**	
Days	PET	Glass bottles	PET	Glass bottles	PET	Glass bottles	PET	Glass bottles
0	6.0	6.3	0.62	0.63	19	19	8.5	9
3	5.8	6.2	0.64	0.65	19.2	19.2	8.3	8.7
6	5.5	6.0	0.67	0.67	19.5	19.4	8	8.4
9	5.2	5.7	0.70	0.70	19.8	19.6	7.7	8.0
12	5.0	5.5	0.73	0.72	20	19.9	7.1	7.9

*Data represent mean ± standard deviation (n)

Overall acceptability of sample stored in PET bottle was significantly reduced as compare to sample stored in glass bottle.

Microbial load of Golden A2 milk

Total viable count for pasteurised milk is specified as not exceeding 30 103 cfu/ml, and coliform should be less than 10 coliforms/ml (FSSAI, 2017).

The total viable count and coliform count of the sample held at room temperature and refrigerator temperature were determined through the use of microbiological analysis. The analysis was performed every three days because the commodity is perishable. The raw milk sample was pasteurized before being processed into Golden A2 milk, resulting in the microbiological load for total plate count and coliform count being summarized as follows.

Table 5: Microbial load (TPC) of Golden A2 milk (Room temperature)

Storage period (Days)	**Total plate count**	
	Control	**Sample (FOS)**
0	ND	ND
3	$1.1x10^2$	$9.5x10^2$
6	$2.2x10^2$	$12.3x10^2$
9	$3.0x10^2$	$15x10^2$
12	$7x10^2$	$20x10^2$

The information in the table above showed that the bacterial and coliform numbers were initially undetected. The longer storage time was evident in the higher viable and coliform counts. At day 6, the total plate count for the sample (FOS) and the control sample at room temperature was 12.3x102 cfu/ml and 2.2x102 cfu/ml, respectively. Furthermore, the TPC for the control at the 12th day at room temperature was 7x102 cfu/ml, while the TPC for the sample (FOS) was 20x102 cfu/ml.

Table 6: Microbial load (TPC) of Golden A2 milk (Refrigerated condition, ±(4^0C))

Storage period (Days)	Total plate count	
	Control	Sample (FOS)
0	ND	ND
3	ND	3.1×10^2
6	0.4×10^2	5.3×10^2
9	1.1×10^2	9.5×10^2
12	2.8×10^2	10.3×10^2

Table 7 : Microbial load (Coliform count) of Golden A2 milk (Room temperature)

Storage period (Days)	Coliform count	
	Control	Sample (FOS)
0	ND	ND
3	ND	ND
6	ND	ND
9	0.4×10^2	0.6×10^2
12	0.8×10^2	1.2×10^2

Table 8 : Microbial load (Coliform count) of Golden A2 milk (Refrigerated condition, ±(4^0C))

Storage period (Days)	Coliform count	
	Control	Sample (FOS)
0	ND	ND
3	ND	ND
6	ND	ND
9	ND	ND
12	0.4×10^2	0.7×10^2

On the sixth day, the control sample's total plate count at refrigeration temperature was found to be 0.4x102, and on the twelfth day, it was 2.8x102.Additionally, the TPC for sample (FOS) was discovered to be $10.3x10^{2.}$

For the control sample (FOS), the coliform count at room temperature and at refrigeration temperature were recorded. Up to the sixth day, no coliforms were observed in the findings for the room temperature test. The coliform colony was visible on day 9, and the product after that point was deemed undesirable.

The coliform count at ambient temperature and at refrigeration temperature were noted for the control sample (FOS). No coliforms were found in the results of the room temperature test up until the sixth day. On day 9, the coliform colony became apparent, and the product was declared unsuitable at that time.

Conclusion

The findings suggest that the manufacturing of golden A2 milk was standardised by adjusting the amounts of cow milk, soy milk, and fresh turmeric rhizome juice. The golden A2 milk sample T2 was chosen based on organoleptic examination; it combines cow milk, soy milk, and rhizome juice in the following proportions: 70:20:10. The FOS was 12% when T2 was added. Over the current milk-based, calorie-dense beverages, the created Golden A2 milk is an excellent and generally acceptable milk beverage.The manufactured golden A2 milk T2 (FOS) was determined to be microbiologically safe for up to 12 days when stored in glass bottles in the refrigerator.

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