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Storage and cost analysis of spirulina enriched Khoa-Mishri sweet (Laddu)

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Abstract

Khoa-Mishri sweet (Laddu) is a popular traditional sweet dessert of Uttar Pradesh and Maharashtra. Both the health benefits of Mishri and Spirulina are enriched in the beverage. Mishri boosts the immune system and spirulina is highly proteinaceous. The present study was made to optimize the levels of khoa, mishri and spirulina and the optimized level (70% khoa, 30% mishri and 1g of spirulina) of laddu is manufactured and preserved with permitted additives i.e. cardamom (1.0 g), cinnamon (0.5 g), saffron (0.75 g) and potassium sorbate (800 ppm) in three different packaging materials i.e. polypropylene (SPI code 5), other plastics (SPI code 7) and cardboard packaging (in three phases), stored at two temperatures (5 °C and 30 °C) to make the sweet as an excellent diet. The sweet is acceptable upto 20 days at 5 °C and 12 days at 30 °C on the basis of deteriorating parameters, sensory attributes and microbial quality. The slowest deterioration was seen in polypropylene package (SPI code 5) followed by other plastics (SPI code 7) and cardboard packaging. The prepared Khoa-Mishri Laddu costs Rs. 382.70/kg and cost of single laddu was found to be Rs. 5.74/15g.

Keywords: Khoa, Mishri, spirulina powder, enrichment, physicochemical, textural, microbial, overall acceptability, quality assurance, deterioration

Introduction

Mawa or Khoa Mishri Laddu is very famous recipe of Rajasthan, Uttar Pradesh and Maharashtra. It is served as a sweet. Ingredients required for its preparation are Khoa or mawa, mishri crystals and for flavoring and taste, finally chopped cinnamon, cardamoms and saffron are used. It is also used as a food during Navratri festival. The shelf life of khoa-mishri based sweet at refrigeration temperature is 5 to 7 days only. The studies also conducted to enhance the shelf life by using different packing material and natural as well as chemical preservatives. If the product storage stability is increases then its availability also increases. Spices and preservatives increase the shelf life of the food products. By doing this work, stabilization of product processing as well as value addition by spirulina having protein rich laddu in market. Consumers wellbeing is jeopardized when dairy products are cooked in unsanitary conditions. The high nutritive value of Khoa, as well as its high water activity (0.96), make it ideal for bacterial growth. Microbial contamination causes adverse effects such as changes in color, odor, taste, and texture of the product, as well as outbreaks of gastrointestinal infections when products are contaminated with pathogenic bacteria (Dabholkar *et al*, 2013) [2]. Deterioration from the effects of oxygen and microbes as well as chemical changes may occur during storage. To extend the shelf life of khoa, several chemicals are used, including antioxidants (Butylated Hydroxytoluene and Butylated Hydroxyanisole), Bacteriocins (Nisin), and preservatives (sorbic acid and potassium sorbate and their salts). (Choudhary *et al*, 2015.) [1].

Materials and Method

Methods and approaches used in the current research “Development and shelf life studies of spirulina enriched Khoa Mishri sweet (Laddu)” was carried out in the laboratory of Food and Dairy Technology, Warner College of Dairy Technology, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj, 211007, India.

The study was carried out in following phases:

1. Procurement and collection of ingredients like buffalo milk, mishri, spirulina powder (online purchase of ‘ecolive’ brand) were bought from local market of Allahabad, U.P.
2. Development of value added spirulina enriched Khoa-Mishri Laddu: Most acceptable value added addition level of Spirulina powder i.e. 0.5g, 1g and 1.5g with khoa (80%, 70%, 60% and 50%) and Mishri (20%, 30%, 40%, and 50%).

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3. Cost analysis: To study the cost of the optimized product and consumer studies (Chhabra *et al*, 2008)
 1. Cost of process like heating = 15% of food cost
 2. Labour cost (shelf, etc.)= 20% of food cost
 3. Overhead cost (packaging, space, equipment etc.)= 20% of food cost
 4. Profits = 15% of food cost

Total cost of product (Rs) = food cost + cost of process like heating + labour cost + overhead cost + profits

Storage analysis

All the physicochemical, sensory and microbiological parameters are estimated after every 5 days for 5 degree Celsius and 3 days for 30 degree Celsius in three phases for three packaging materials i.e, polypropylene (SPI code 5),

other plastics (SPI code 7) and cardboard.

Results and Discussion

Cost of control laddu and spirulina enriched laddu in combination with different properties were worked out and presented in Table no 1. The ingredients cost used in the preparation of spirulina enriched Laddu was rated as per the rates prevailing (2020-21) in the market.

The production charges of control Laddu (T0) is 380.80 Rs and spirulina enriched Laddu (T1-T12) are Rs. 381.60, 389.90, 438.10, 354.40, 382.70, 410.90, 327.20, 355.50, 383.70, 300.00, 328.30, 356.50, respectively. The cost of production of final spirulina enriched Laddu (T5) is Rs 382.70. From this observation it is revealed that spirulina enriched Laddu (T5) found most economical than the other treatment combination.

Table 1: Cost production of spirulina enriched sweet (Laddu)

Treatment	Total Raw Material Cost (Rs/100g)	Heating Cost (15% Of Food Cost) (Rs/100g)	Labour Cost (20% Of Food Cost) (Rs/100g)	Overhead Cost (20% Of Food Cost) (Rs/100g)	Profits (15% Of Food Cost) (Rs/100g)	Total Cost (Rs/100g)	Total Cost (Rs/Kg)	Cost Of Per Ladoo (Rs/15g)
T0	22.40	3.36	4.48	4.48	3.36	38.08	380.80	5.71
T1	22.46	3.36	4.49	4.49	3.36	38.16	381.60	5.72
T2	22.13	3.61	4.82	4.82	3.61	38.99	389.90	6.14
T3	25.79	3.86	5.15	5.15	3.86	43.81	438.10	6.57
T4	20.86	3.12	4.17	4.17	3.12	35.44	354.40	5.31
T5	22.53	3.37	4.50	4.50	3.37	38.27	382.70	5.74
T6	24.19	3.62	4.83	4.83	3.62	41.09	410.90	6.16
T7	19.26	2.88	3.85	3.85	2.88	32.72	327.20	4.90
T8	20.93	3.13	4.18	4.18	3.13	35.55	355.50	5.33
T9	22.59	3.38	4.51	4.51	3.38	38.37	383.70	5.75
T10	17.66	2.64	3.53	3.53	2.64	30.00	300.00	4.50
T11	19.33	2.89	3.86	3.86	2.89	32.83	328.30	4.92
T12	20.99	3.14	4.19	4.19	3.14	35.65	356.50	5.34

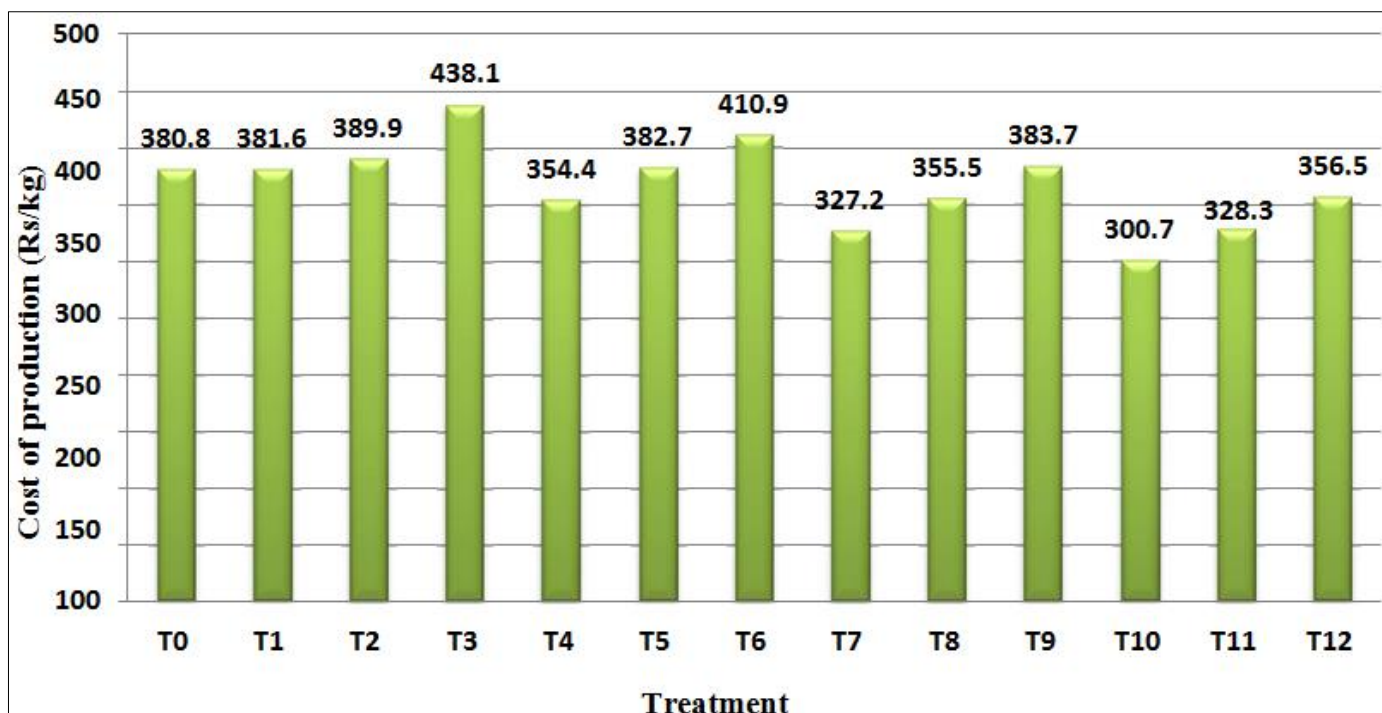


Fig 1: Figure showing the graph for cost of production of final prepared spirulina enriched Khoa-Mishri Laddu

Conclusion

Khoa mishri laddu was found to be acceptable upto 20 days at 5 degree Celsius and 12 days at 30 degree Celsius. Polypropylene (SPI code 5) was found as best packaging material in three phase storage studies as it was shown the slowest deteriorating activity against cardboard and SPI 7 other plastics. Among the natural preservatives, Cardamom (1g) enriched Khoa Mishri Laddu was found to be slowest deteriorating activity. Among all the preservatives potassium sorbate (800ppm) was found to have slowest deteriorating activity. The cost of production of final spirulina enriched Laddu (T5) is Rs 382.70. From this observation it is revealed that spirulina enriched Laddu (T5) found most economical than the other treatment combination.

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