www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(4): 789-794

www.thepharmajournal.com
Received: 23-01-2023
Accepted: 28-02-2023

Kamble KB
Ph.D Scholar, Dairy Science, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth Rahuri, Maharashtra, India

Kamble DK
Professor, Dairy Science, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth Rahuri, Maharashtra, India

Chougale CC
Ph.D Scholar, Dairy Science, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth Rahuri, Maharashtra, India

Desale RJ
Principal, Agriculture Technical School, Dhule, Maharashtra, India

Corresponding Author:
Kamble KB
Ph.D Scholar, Dairy Science, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth Rahuri, Maharashtra, India

Effect of levels of nisin on sensory attributes of custard apple (*Annona squamosa* L.) enriched shrikhand

Kamble KB, Kamble DK, Chougale CC and Desale RJ

Abstract
Sensory evaluation plays a vital role not only in product development but also in determining the shelf-life of a product. From the consumers point of view, the sensory status of the product is the primary characteristics based on which the quality of the product is decided. Sensory parameters of custard apple enriched Shrikhand studied during storage included colour and appearance, body and texture, flavour and overall acceptability. As the storage period progressed, the score for colour and appearance, body and texture, flavour and overall acceptability were decreased. The shelf life of custard apple enriched Shrikhand prepared by using stevia was preserved with nisin preservative at different levels viz. 20 IU, 25 IU and 30 IU and packed in pre-sterilized polypropylene cups was found 15, 21 and 24 days at 6±1°C, respectively, as against 12 days at 6±1 °C without preservative Shrikhand.

Keywords: Shrikhand, nisin, Sensory evaluation, shelf life etc.

Introduction
The Indian culture and tradition place a strong emphasis on cultured dairy products. The market potential for traditional dairy products in India are imperiled and is expected to expand even more as a result of mass manufacturing technologies. Shrikhand is indigenous ethnic fermented milk food assumes special importance due to the pleasant taste. Shrikhand is regarded as a pleasant food item during the summer season. Shelf life is defined as the number of days a product can be stored at a certain temperature and can be consumed safely, without deterioration of sensory characteristics such as taste, colour and texture. The shelf life is therefore determined by organoleptic quality. Nisin is a food preservative produced by *Lactococcus lactis* subsp. *lactis* widely being used for preservation of wide range of dairy products.

Materials and Methods
Materials: The fresh, clean whole buffalo milk was procured from local market. Good quality custard apple pulp was procured from local market in a single lot. Good quality readymade market stevia leaf extract manufactured by Anubhav Biotech Ltd. permitted by FSSAI was procured from ayurvedic medical at ahemednagar district in a single lot. The freeze-dried culture of LF-40 was procured from National Collection of Dairy culture (NCDC) unit, N.D.R.I., Karnal (Haryana) and used @ 1 per cent of milk for preparation of *dahi* for every trial. Nisin manufactured by Freda Company was used as a preservative in the Shrikhand. Clean, suitable size muslin cloth was used for straining of whey. Polypropylene cup was used for storing of Shrikhand, was procured from local market in single lot.

Treatment
In all the treatment the custard apple pulp (10 per cent) and readymade market stevia leaf extract (RMSLE 1.5 per cent W/V) of *chakka* was kept constant.
T_0 - Control sample
T_1 - Shrikhand with 20 IU nisin
T_2 - Shrikhand with 25 IU nisin
T_3 - Shrikhand with 30 IU nisin

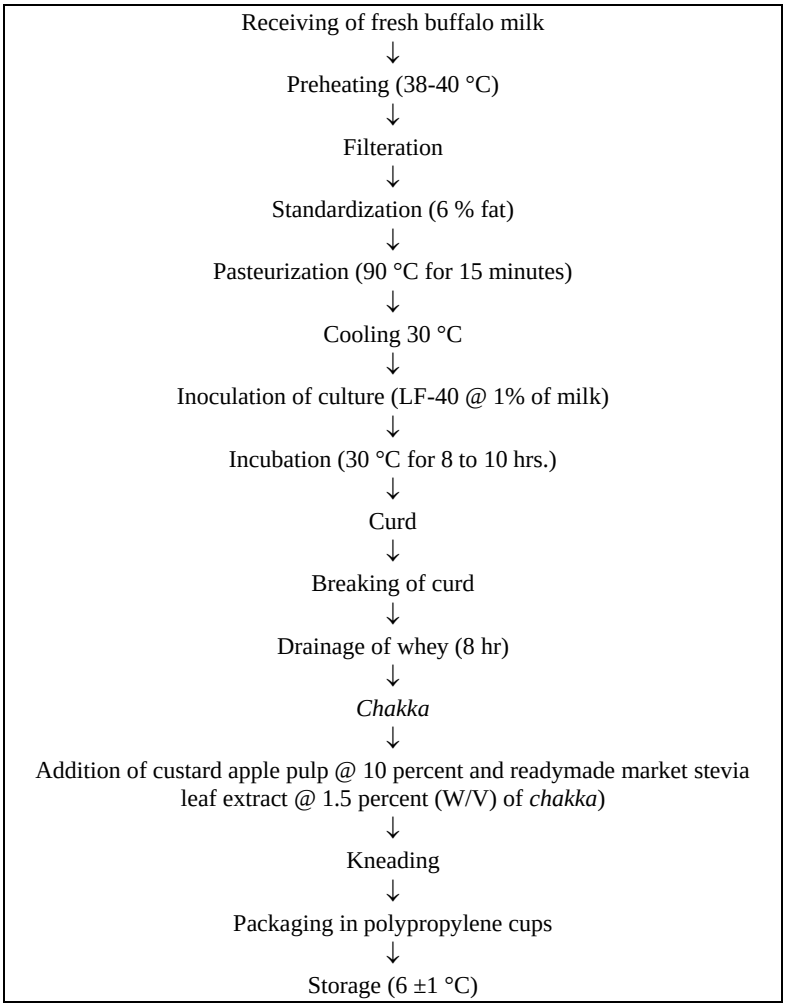
Sensory Evaluation of Custard Apple Enriched Shrikhand: Sensory evaluation of fresh and stored custard apple enriched Shrikhand samples were carried out by semi trained panel of five judges from the Department of Animal Husbandry and Dairy Science. The colour and appearance, body and texture, flavour and overall acceptability was assessed by using 9-point

Hedonic scale (Amerine *et al.* 1965) [1].

Statistical Analysis

Data generated during the course of investigation was analyzed with the help of statistical design namely Factorial Completely Randomized Design (FCRD) as per Snedecor and Cochran (1967) [16].

Preparation of Custard Apple Enriched *Shrikhand* by Using Stevia



Flow 1: Diagram for manufacture of custard apple enriched Shrikhand by using stevia

Results and Discussion

Effect of Levels of Nisin on Sensory Attributes of Custard Apple Enriched Shrikhand by Using Stevia Stored at 6±1 ℃.

Colour and appearance

The results of sensory attributes of colour and appearance of custard apple enriched Shrikhand affected by storage period are presented in Table 1 and graphically represented in Fig. 1. Fresh sample of Shrikhand without nisin and with added nisin at three levels scored high (more than 8.68) which give an indication that the samples were highly acceptable with respect to colour and appearance. On 12 day of storage, the score for colour and appearance for T_0 was 6.23±0.01, for T_1 on 15 day of storage 6.27±0.01, for T_2 on 21 days of storage 6.20±0.01 and for T_3 on 24 day of storage 6.28±0.02. The rate of decline was nearly similar in all the samples during the first 6 days, thereafter, it was higher in control sample as compare to other samples. The least decrease in colour and appearance score was observed for T_3 sample. If score 6.0 (liked slightly) was taken as minimum acceptance, all the samples were accepted from the colour point of view. Overall, the effect of storage period, treatment given and their interaction showed a significant (p<0.05) effect on colour and appearance.

As storage period progressed, the score for colour and appearance gradually decreased because the product turned dull in colour and appearance and the surface became dry due to loss of moisture which was also noticed by Nigam *et al.* (2009) [13]. These results were in agreement with the findings of Radha (2014) [15] who studied the effect of nisin on shelf life of pasteurized milk and recorded decrease in colour and appearance score over the end of storage period. Kumar *et al.* (2011) [11] also reported a similar decline in colour and appearance score during storage when apple pulp and *Celosia argentea* were added in Shrikhand. The declining colour and appearance score of Shrikhand during storage was also reported by Devi *et al.* (2019) [5] and Deshmukh *et al.* (2019) [4].

Table 1: Effect of levels of nisin on colour and appearance score*of custard apple enriched Shrikhand by using stevia stored at 6±1 ℃

Treatment	Storage period (Days)								
	0	3	6	9	12	15	18	21	24
T_0	8.69±0.03	8.64±0.02	8.40±0.02	7.90±0.01	6.23±0.01	-	-	-	-
T_1	8.71±0.02	8.67±0.01	8.50±0.01	8.37±0.02	7.91±0.01	6.27±0.01	-	-	-
T_2	8.72±0.01	8.70±0.01	8.64±0.01	8.37±0.02	8.14±0.02	8.01±0.01	7.44±0.02	6.20±0.01	-
T_3	8.72±0.01	8.70±0.01	8.66±0.01	8.41±0.01	8.16±0.01	8.12±0.01	8.01±0.01	7.82±0.01	6.28±0.02

* Mean score±SE of 3 replication
(-) Indicates that product was spoiled and no further analysis was carried out.

Table 2: ANOVA for effect of levels of nisin on colour and appearance score*of custard apple enriched Shrikhand by using stevia stored at 6±1 ℃

Source of variation	DF	MSS	F value	CD
Between period	8	88.024	14485.14	0.06
Between Treatment	3	74.377	12239.42	0.04
Interaction	24	14.036	2309.835	0.12
Error	72	0.006	--	--

Body and texture

The changes in body and texture characteristics of all four Shrikhand samples during storage are shown in Table 3 and Fig. 2. The body and texture score of fresh samples ranged from 8.36±0.02 to 8.31±0.01. The body and texture scores of custard apple enriched Shrikhand remained more or less unchanged up to 6 days of storage under each treatment. Thereafter, the score decreased from 8.31±0.01 to 6.11±0.03 on 12 day of storage in T_0, 8.32±0.02 to 6.18±0.03 on 15 days of storage in T_1, 8.33±0.02 to 6.21±0.03 on 21 days of storage in T_2 and 8.36±0.02 to 6.22±0.01 on 24 days of storage in T_3. These changes were statistically significant (p<0.05). A very slight decrease from 8.33±0.02 to 6.21±0.03 and 8.36±0.02 to 6.22±0.01 was observed in the body and texture scores for the T_2 and T_3 samples at every 3 days interval up to end of storage period.

Table 3: Effect of levels of nisin on body and texture score*of custard apple enriched Shrikhand by using stevia stored at 6±1℃

Treatment	Storage period (Days)								
	0	3	6	9	12	15	18	21	24
T_0	8.31±0.01	8.30±0.01	8.10±0.02	7.31±0.02	6.11±0.03	-	-	-	-
T_1	8.32±0.02	8.31±0.01	8.24±0.01	8.05±0.03	7.63±0.01	6.18±0.03	-	-	-
T_2	8.33±0.02	8.31±0.01	8.28±0.01	8.13±0.01	8.00±0.04	7.94±0.01	7.50±0.03	6.21±0.03	-
T_3	8.36±0.02	8.32±0.01	8.29±0.02	8.15±0.01	8.08±0.03	7.96±0.01	7.67±0.02	7.42±0.02	6.22±0.01

* Mean score±SE of 3 replication
(-) Indicates that product was spoiled and no further analysis was carried out.

Table 4: ANOVA for effect of levels of nisin on body and texture score*of custard apple enriched Shrikhand by using stevia stored at 6±1℃

Source of variation	DF	MSS	F value	CD
Between period	8	79.580	11117.23	0.06
Between Treatment	3	72.238	10091.54	0.04
Interaction	24	13.408	1873.14	0.13
Error	72	0.007	--	

Gradual decrease in the body and texture score was observed from initial day for the sample T_0 and sample T_1. The control sample (T_0) shows faster rate of decline in scores after 9 days with respect to other samples. Pawar *et al*. (2010) [14] noticed that the decrease in score of body and texture during storage period was maximum in control *lassi* as compare to *lassi* samples added with nisin. The intensity of body and texture score significantly deteriorated with the increasing periods of storage. This may be due to the loss of moisture and microbial activity during storage period. Such trend of decrease the score for body and texture during storage of Shrikhand was also noticed by Hole *et al*. (2016) [7], Devi *et al.* (2019) [4], Jadhav (2019) [8], Kumar *et al.* (2011) [11] and Deshmukh *et al.* (2019) [4].

Flavour

The average sensory score for fresh and stored sample is given in Table 5 and statistical analysis of which is given in Table 6 and Fig. 3. All the fresh samples were highly acceptable and score ranged from 8.42±0.02 to 8.36±0.02. The score decreased significantly (p<0.05) during storage. The rate of decline was higher in T_0 (i.e. without preservative) than T_1, T_2 and T_3 samples. The flavour scores decreased from 8.42±0.02 to 6.00±0.02, 8.40±0.01 to 6.04±0.01, 8.39±0.01 to 6.05±0.03 and 8.36±0.02 to 6.05±0.01 for T_0, T_1, T_2 and T_3, respectively at the end of 12, 15, 21 and 24 days of storage. On 12 days of storage treatment T_0, on 15 days of storage treatment T_1, on 21 days of storage treatment T_2 and on 24 days of storage treatment T_3 showed score lower than 7.00. These fall under the category "liked slightly to liked moderately" on a 9-point Hedonic scale. Considering a flavour score of 6.0 as the minimum desirable for an "acceptance" of product, the keeping quality of custard apple enriched Shrikhand could be taken as 12 days for T_0, 15 days for T_1, 21 days for T_2 and 24 days for T_3 at 6±1 °C temperature.

These results were in agreement with Radha (2014) [15] who studied the effect of nisin in pasteurized milk and recorded the

mean flavour score of control sample was 9.20±0.20 on 0 day and it decreased to 7.60±0.24 on 8 day, thereafter, flavour evaluation could not be conducted in control samples due to spoilage but in case of nisin added samples flavour scores remained within "fair to good" category until 16 days of storage. The small decrease in flavour score may be attributed to slight loss of freshness which is inherent with any food product. The effect between period and treatment and their interaction exerted a significant (p<0.05) effect on flavour score during storage. The changes in flavour score may be attributed to the corresponding increase in the acidity of the product during storage (Borate *et al.* 2011) [3] and free fatty acid content of Shrikhand during storage period. The higher free fatty acid content might have resulted from the hydrolysis of fat leading to development of slightly rancid off-flavour in the product. The declining flavour score during storage in Shrikhand was also reported by Nigam *et al.* (2009) [13], Hole *et al.* (2016) [7], Jadhav (2019) [8], Deshmukh *et al.* (2019) [4], Devi *et al.* (2019) [4] and Andharepatil (2020) [2].

Table 5: Effect of levels of nisin on flavour score*of custard apple enriched Shrikhand by using stevia stored at 6±1 ℃

Treatment	Storage period (Days)								
	0	3	6	9	12	15	18	21	24
T_0	8.42±0.02	8.38±0.01	8.05±0.04	7.42±0.01	6.00±0.02	-	-	-	-
T_1	8.40±0.01	8.35±0.01	8.22±0.01	8.04±0.04	7.82±0.02	6.04±0.01	-	-	-
T_2	8.39±0.01	8.34±0.01	8.26±0.01	8.09±0.01	7.94±0.01	7.27±0.02	6.79±0.03	6.05±0.03	-
T_3	8.36±0.02	8.35±0.02	8.29±0.01	8.13±0.01	8.05±0.04	7.87±0.02	7.43±0.01	7.02±0.05	6.05±0.01

* Mean score±SE of 5 replication
(-) Indicates that product was spoiled and no further analysis was carried out.

Table 6: ANOVA for effect of levels of nisin on flavour score*of custard apple enriched Shrikhand by using stevia stored at 6±1 ℃

Source of variation	DF	MSS	F value	CD
Between period	8	83.984	5160.90	0.10
Between Treatment	3	65.683	4036.28	0.06
Interaction	24	12.259	753.37	0.20
Error	72	0.016	-	-

Overall acceptability

The average overall acceptability scores for fresh and stored samples are given in Table 7 and Fig. 4. All the fresh samples were highly acceptable with scoring of 8.47±0.02, 8.47±0.01, 8.48±0.01 and 8.48±0.02 for T_0, T_1, T_2 and T_3, respectively. The rate of decline in overall acceptability in sample without preservative was more as compared to samples with preservative, indicating a significant (p<0.05) effect of nisin. The treatment T_3 (30 IU nisin) had maximum shelf life as compare to other samples.

These results were in agreement with the findings of Radha (2014) [15] who studied the effect of nisin on shelf life of pasteurized milk and recorded that compared to control milk sample the nisin added sample had more overall acceptability and shelf life. However, all the samples were found to be liked slightly during the entire storage study. Pawar *et al.* (2010) [14] noted that the overall acceptability score decreased as the storage period progressed in the control *lassi* and *lassi* samples added with 100 IU/ml, 200 IU/ml, 300 IU/ml and 400 IU/ml nisin. The highest level of nisin i.e. 400 IU/ml had maximum shelf life as compared to other samples. Ghube (2016) [6] conducted a study on shelf life of Shrikhand prepared by using black carrot juice stored at 7 ℃ and concluded that as the storage period increases the score for overall acceptability was decreases.

The decreased score for overall acceptability with advancement of storage period may be attributed to the declining colour and appearance, body and texture and flavour of the products. These results were in agreement with the findings of Nigam *et al.* (2009) [13], Nadaf *et al.* (2012) [12], Jadhav (2019) [8], Sonawane *et al.* (2007) [17] and Jain *et al.* (2003) [9] who reported decrease in overall acceptability score of Shrikhand during storage period.

Table 7: Effect of levels of nisin on overall acceptability score*of custard apple enriched Shrikhand by using stevia stored at 6±1 ℃

Treatment	Storage period (Days)								
	0	3	6	9	12	15	18	21	24
T_0	8.47±0.02	8.44±0.01	8.18±0.02	7.54±0.01	6.11±0.01	-	-	-	-
T_1	8.47±0.01	8.44±0.02	8.32±0.02	8.15±0.01	7.78±0.01	6.16±0.02	-	-	-
T_2	8.48±0.01	8.45±0.01	8.39±0.01	8.19±0.01	8.02±0.01	7.74±0.01	7.24±0.02	6.15±0.01	-
T_3	8.48±0.02	8.45±0.01	8.41±0.01	8.23±0.01	8.09±0.04	7.98±0.03	7.70±0.03	7.42±0.01	6.18±0.01

* Mean score±SE of 3 replication
(-) Indicates that product was spoiled and no further analysis was carried out

Table 8: ANOVA for effect of levels of nisin on overall acceptability score*of custard apple enriched Shrikhand by using stevia stored at 6±1 ℃

Source of variation	DF	MSS	F value	CD
Between period	8	83.727	4173.438	0.11
Between Treatment	3	70.660	3522.077	0.07
Interaction	24	13.193	657.656	0.23
Error	72	0.020	--	

Conclusion

From the present study it was concluded that, during storage of Shrikhand, the sensory scores for all attributes were decreased significantly (p<0.05) in four samples. On the basis of sensory evaluation, the custard apple enriched Shrikhand without nisin could be stored for 12 days at 6±1 °C, custard apple enriched Shrikhand containing 20 IU nisin could be stored for 15 days at 6±1 °C, custard apple enriched Shrikhand containing 25 IU nisin could be stored for 21 days at 6±1 °C, custard apple enriched Shrikhand containing 30 IU nisin could be stored for 24 days at 6±1 °C. Hence, use of 30 IU nisin in preservation of custard apple enriched Shrikhand is recommended.

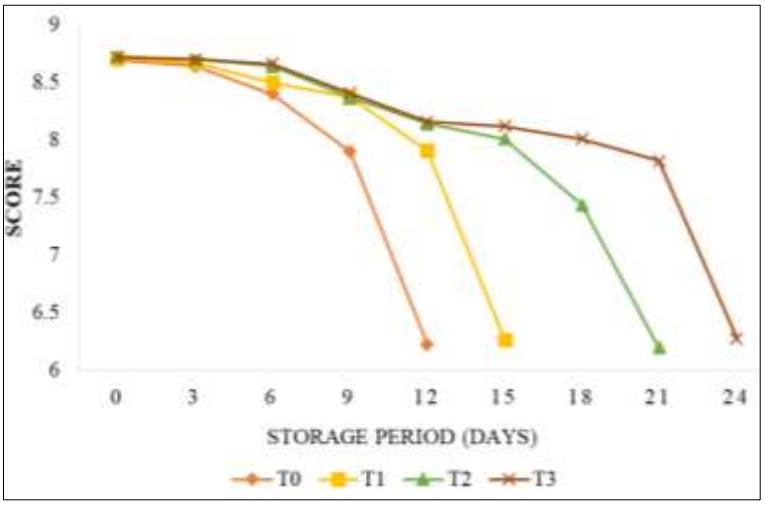


Fig 1: Effect of levels of nisin on colour and appearance score of custard apple enriched *shrikhand* stored at 6±1℃

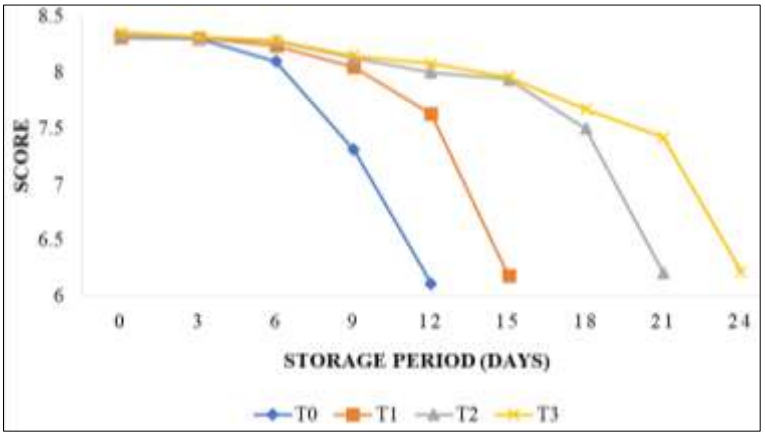


Fig 2: Effect of levels of nisin on body and texture score of custard apple enriched *shrikhand* stored at 6±1℃

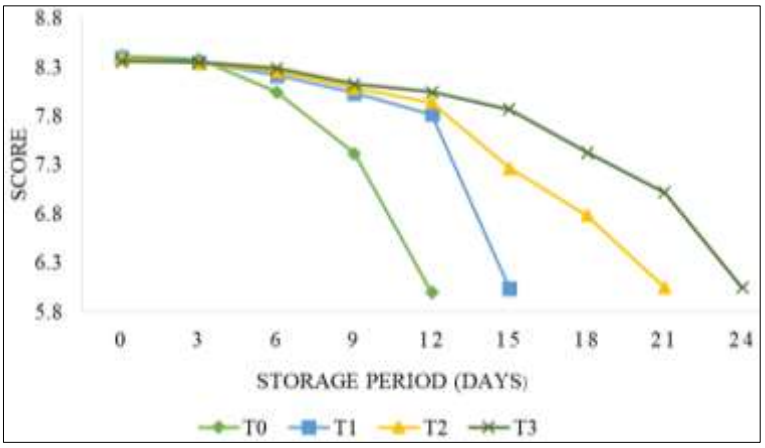


Fig 3: Effect of levels of nisin on flavour score of custard apple enriched *shrikhand* stored at 6±1℃

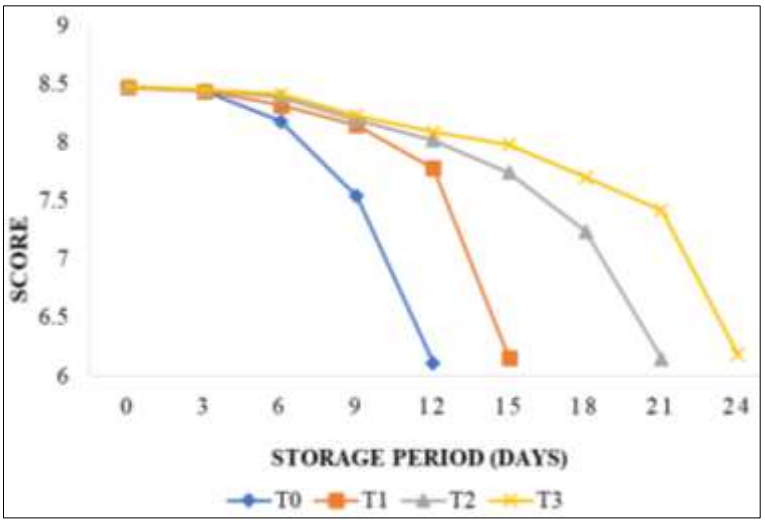


Fig 4: Effect of levels of nisin on overall acceptability score of custard apple enriched *shrikhand* stored at 6±1°C

References

1. Amerine MA, Pangborn RM, Roesster EB. Principles of Sensory Evaluation of Food. Academic press, INC, New York, USA; c1965.
2. Andharepatil PS. Preparation of Shrikhand blended with dragon fruit (Hylocereus undatus) pulp. M.Sc. (Agri.) thesis, V.N.M.K.V., Parbhani, (M.S.), India; c2020.
3. Borate AJ, Gubbawar SG, Shelke RR, Chavan SD. Studies on keeping quality of Shrikhand prepared from buffalo milk blended with soymilk. Food Science Research Journal. 2011;2(2):205-210.
4. Deshmukh AP, Padghan PV, Shinde SP. Effect of rose petal powder on shelf life of Shrikhand. The Pharma Innovation Journal. 2019;8(9):434-437.
5. Devi R, Khanna N, Argade A, Vaquil Chaudhary V, Ahlawat SS. Studies on shelf-life of developed strawberry pulp based Shrikhand incorporated with soy milk at refrigeration (4±1 ℃) temperature. Haryana vet. 2019;58(2):292-294.
6. Ghube PS. Studies on preparation of Shrikhand by using black carrot juice. Ph.D. Thesis, V.N.M.K.V., Parbhani, (M.S.), India; c2016.
7. Hole DV, Kahate PA, Shelke RR, Ingale ST, Khandare NO. Studies on keeping quality of Shrikhand prepared from cow milk blended with unripe banana. Asian J. Dairy and food Res. DR. 2016;1107:1-4.
8. Jadhav SS. Effect of safflower colour extract on quality of Shrikhand. Ph.D. thesis, V.N.M.K.V., Parbhani, (M.S.), India; c2019.
9. Jain A, Desai HK, Upadhyay KG. Sensoric profile of market Shrikhand sold in Gujarat State. Indian Journal of Dairy Science. 2003;56(5):292-294.
10. Kumar P, Das A, Upadhyay S, David J, Thakur SN. Changes in physico-chemical, microbial and organoleptic attributes of Shrikhand fortified with litchi pulp and lactulose during storage at refrigerated temperature. Journal of Pharmacognosy and Phytochemistry. 2019;8(5):169-173.
11. Kumar S, Bhat ZF, Kumar P. Effect of apple pulp and celosia argentea on the quality characteristics of Shrikhand. American Journal of Food Technology. 2011;6(9):817-826.
12. Nadaf NY, Patil RS, Chaitanya HZ. Effect of addition of gulkand and rose petal powder on chemical composition and oraganoleptic properties of Shrikhand. Recent Research in Science and Technology. 2012;4(10):52-55.
13. Nigam N, Singh R, Upadhayay PK. Incorporation of chakka by papaya pulp during the manufacture of Shrikhand. Journal of Dairying, Foods and Home Science. 2009;28(2):115-118.
14. Pawar BK, Chaure RM, Choudhari DM, Kamble DK. Effect of nisin on shelf life of lassi. Journal of Dairying, Foods and Home Science. 2010;29(2):79-85.
15. Radha K. Nisin as a biopreservative for pasteurized milk. Indian Journal of Veternary and Animal Science Research. 2014;43(6):436-444.
16. Snedecor GW, Corchan WG. Statistical Method. 6th Ed. Oxford and I.D.B. Pub. Co., Calcutta, India; c1967.
17. Sonawane VK, Chavan KD, Pawar BK. Effect of levels of strawberry pulp and sugar on chemical composition during storage of Shrikhand. Journal of Dairying, Foods and Home Science. 2007;26(3):153-158.