



P-ISSN: 2349-8528

E-ISSN: 2321-4902

IJCS 2019; 7(3): 3889-3894

© 2019 IJCS

Received: 04-03-2019

Accepted: 06-04-2019

Rajender Kumar

Research Scholar, National Dairy Research Institute, Karnal, Punjab, India

Sivakumar S

Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, Punjab, India

Rekha Chawla

Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, Punjab, India

Effect of storage conditions on physico-chemical parameters of aerobically packed paneer nuggets: A ready to eat snack food

Rajender Kumar, Sivakumar S and Rekha Chawla

Abstract

Paneer nugget is a ready-to-eat and steam cooked dairy based snack food. During the storage period, physico-chemical parameters play an important role to know the stability of the food product and to have an idea about the shelf life of the product. To evaluate the shelf life of paneer nuggets product was packed in LDPE and stored at two controlled temperatures ambient ($25 \pm 1^\circ\text{C}$) and refrigeration ($4 \pm 1^\circ\text{C}$) temperature under aerobic conditions till spoilage. To have an idea about the physico-chemical parameters, samples were tested for changes in pH, acidity, water activity, free fatty acids, HMF value, tyrosine value and at the regular interval of 1 day at controlled ambient (25°C) temperature and after 3 days for refrigeration (4°C) temperature under aerobic packaging. The effect of storage period was significant on physico-chemical parameters and multiple comparison tests indicated the mean values for different storage parameters differ significantly ($p < 0.05$) on different days of storage.

Keywords: Storage conditions, aerobically, packed paneer

Introduction

From the past to present condition, milk and milk products have been recognized as important part of Indian diet. India is currently the largest producer of milk in the world. The main ingredients for preparation of paneer nugget is Paneer, a South Asian variety of soft cheese manufactured with the help of coagulant citric acid used in the preparation of a several culinary preparations and snacks.

Under refrigeration conditions, the shelf life of paneer is up to 7 days, however the freshness lost after two to three days. The shelf life of paneer is one day at ambient temperature. The shelf life can further enhanced by conversion into ready to eat paneer nugget, steam cooked product prepared with addition of spices mix, condiments refined wheat flour, skim milk powder and sodium caseinate. There is an ever-growing demand of low-fat paneer by different health aware consumers, therefore researchers are encouraged to develop new types and varieties of paneer-based products. Paneer prepared by different varieties of milk results in variation in the composition and the faulty techniques leads to losses of milk solids in which have an impact on physico-chemical parameters of the product. The type of packaging method and packaging material plays an important role in enhancement of shelf life. Normally, paneer blocks of required size/weight are packaged in polyethylene pouches, heat sealed and stored under refrigeration conditions. Suitable packaging material with required barrier properties preventing the paneer nugget from the different deteriorative changes such as physical and chemical aspect. (Gokhale and Pandya 2009; Krishna Kumari 2009) [7, 11]

Material and Method

All samples for storage study of paneer nuggets were manufactured and analysed in the laboratory of the College of Dairy Science and Technology. Paneer nuggets were prepared by the procedures followed by Kumar *et al.* (2018) [13]. To evaluate the shelf life of paneer nuggets product was packed in LDPE and stored at controlled ambient ($25 \pm 1^\circ\text{C}$) and refrigeration ($4 \pm 1^\circ\text{C}$) temperature under aerobic conditions till spoilage. The product was analysed for its physico-chemical properties at the regular interval of 1 day at controlled ambient ($25 \pm 1^\circ\text{C}$) and 3 days at refrigeration ($4 \pm 1^\circ\text{C}$) temperature conditions.

Correspondence**Rajender Kumar**

Research Scholar, National Dairy Research Institute, Karnal, Punjab, India

Physico-chemical properties

The titratable acidity (% lactic acid) was determined as per method of AOAC (2006) [2]. Total Hydroxy methyl furfural (HMF) in paneer nuggets (stored) was determined by the method recommended by (Keeney and Bassette 1959) [10] with slight modification. The method prescribed by (Deeth *et al.* 1975) [6] was used to estimate the Free Fatty Acid (FFA) content of paneer nuggets. The tyrosine content as a measure of proteolysis in paneer nuggets determined according to the method of Hull (1947) [9]. Digital pH meter (Make: Mettler Toledo) was used to measure pH of the samples. Water activity meter (Make: Aqualab 4TE) was used for measuring the water activity of samples.

Results and Discussion

Effect of storage on physico-chemical parameters of paneer nuggets kept at controlled ambient ($25 \pm 1^\circ\text{C}$) temperature and refrigeration ($4 \pm 1^\circ\text{C}$) temperature under aerobic packaging

During the storage period, physico-chemical parameters play an important role to know the stability of the food product and to have an idea about the shelf life of the product. To have an

idea about the physico-chemical parameters, samples were tested for changes in pH, water activity, acidity, free fatty acids, HMF value and tyrosine value at the regular interval of 1 days for controlled ambient ($25 \pm 1^\circ\text{C}$) temperature and 3 days for refrigeration ($4 \pm 1^\circ\text{C}$) temperature under aerobic packaging conditions. The effect of storage period was significant on physico-chemical parameters and multiple comparison tests indicated the mean values for different storage parameters differed significantly ($p < 0.05$) on different days of storage.

pH

pH value of paneer nuggets decreased significantly ($p < 0.05$) during storage period and this might be due to the metabolism of bacteria, protein amino acid degradation resulting in formation of ammonia and consequent changes in pH. pH value decreased (Figure 1 and 2) from an initial value of 5.71 to 5.62 and 5.71 to 5.61 after 2 days of storage at controlled ambient ($25 \pm 1^\circ\text{C}$) temperature and 9 days storage at refrigeration ($4 \pm 1^\circ\text{C}$) temperature, respectively under aerobic packaging. Results are in similarity with (Rai *et al.* 2007; Ahuja and Goyal 2013).

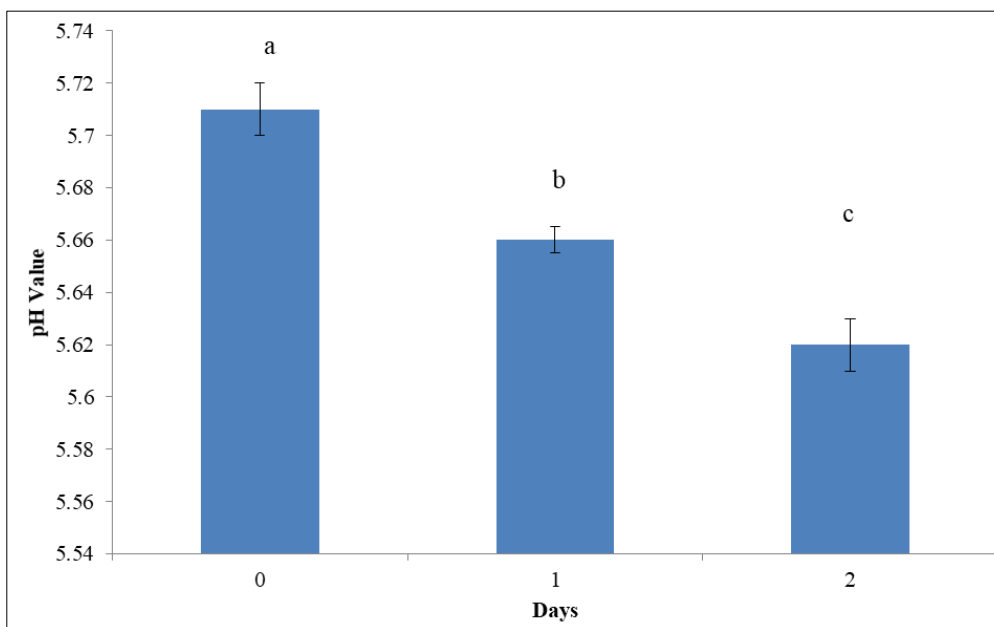


Fig 1: Effect of storage period on pH of paneer nuggets stored at controlled ambient ($25 \pm 1^\circ\text{C}$) temperature (Aerobic Packaging)

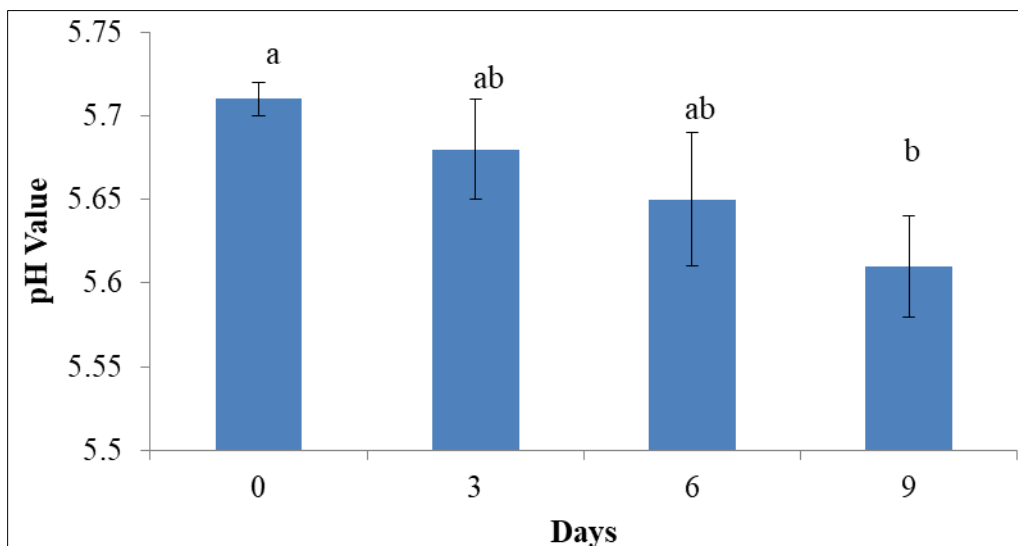


Fig 2: Effect of storage period on pH of paneer nuggets stored at refrigeration ($4 \pm 1^\circ\text{C}$) temperature (Aerobic Packaging)

Acidity

The effect of storage on acidity of paneer nuggets was found significant ($p < 0.05$) at refrigeration ($4 \pm 1^\circ\text{C}$) temperature and controlled ambient ($25 \pm 1^\circ\text{C}$) temperature conditions under aerobic packaging. The acidity value increased (Figure 3) from an initial content of 0.96 to 1.03 and 0.96 to 1.07 (Figure 4) after 2 days of storage at controlled ambient ($25 \pm 1^\circ\text{C}$)

temperature and 9 days storage at refrigeration ($4 \pm 1^\circ\text{C}$) temperature, respectively in aerobic packaging. The increase in acidity during storage period may be proliferation of microorganisms and changes brought therein. The results are in accordance with results obtained by (Rai *et al.* 2008; Arora *et al.* 1996; Ahuja and Goyal 2013)^[14,3].

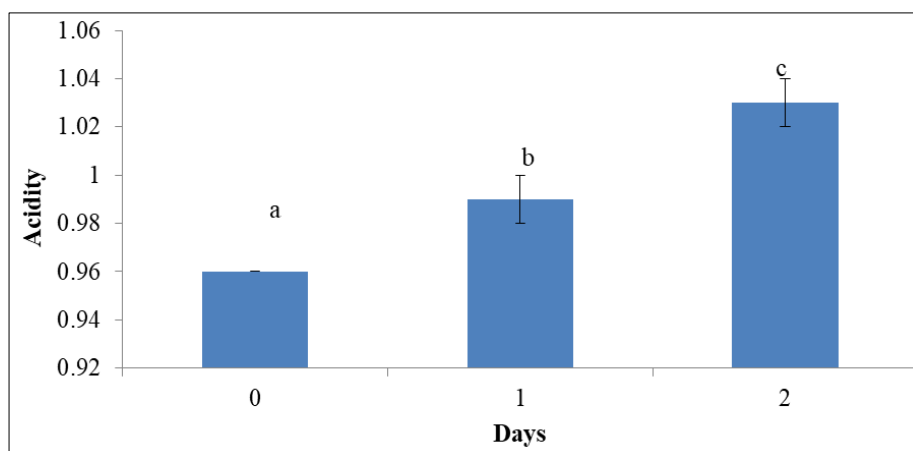


Fig 3: Effect of storage period on acidity of paneer nuggets stored at controlled ambient ($25 \pm 1^\circ\text{C}$) temperature (Aerobic Packaging)

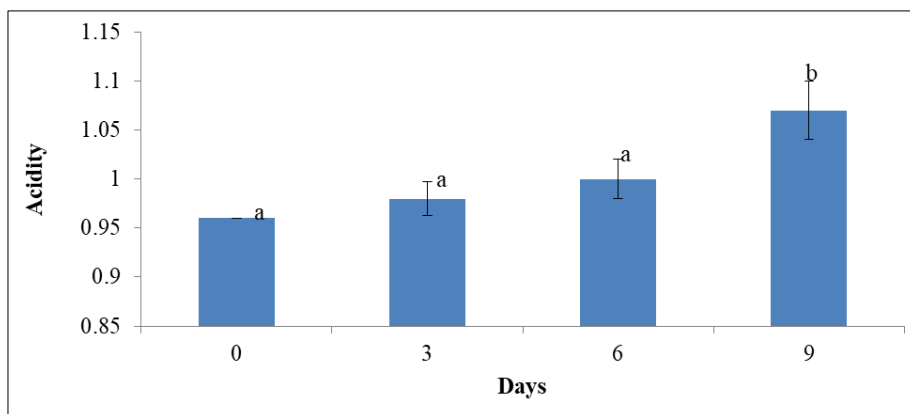


Fig 4: Effect of storage period on acidity of paneer nuggets stored at refrigeration ($4 \pm 1^\circ\text{C}$) temperature (Aerobic Packaging)

Free fatty acids

The extent of fat oxidation in paneer nuggets was measured in terms of FFA value. The release of free fat during the cooking of paneer nuggets along with presence of high moisture content might be responsible for lipolysis during storage. The increase in FFA value was more at controlled ambient ($25 \pm 1^\circ\text{C}$) compared to refrigeration ($4 \pm 1^\circ\text{C}$) temperature. The effect of storage on free fatty acids values was found to be significant ($p < 0.05$) at both temperature conditions of aerobic packaging. The FFA value increased from an initial content of

$0.16 \mu\text{eq/g}$ to $0.20 \mu\text{eq/g}$ (Figure 5) and $0.16 \mu\text{eq/g}$ to $0.22 \mu\text{eq/g}$ (Figure 6) after 2 days of storage at controlled ambient ($25 \pm 1^\circ\text{C}$) temperature and 9 days storage at refrigeration ($4 \pm 1^\circ\text{C}$) temperature, respectively under aerobic packaging. The increase in free fatty acids content was due to break down of triglycerides to fatty acids with the passage of time and the results are in accordance with results obtained by (Rai *et al.* 2007; Arora *et al.* 1996 and Ahuja and Goyal 2013; Kumar and Bector 1991)^[3, 12]

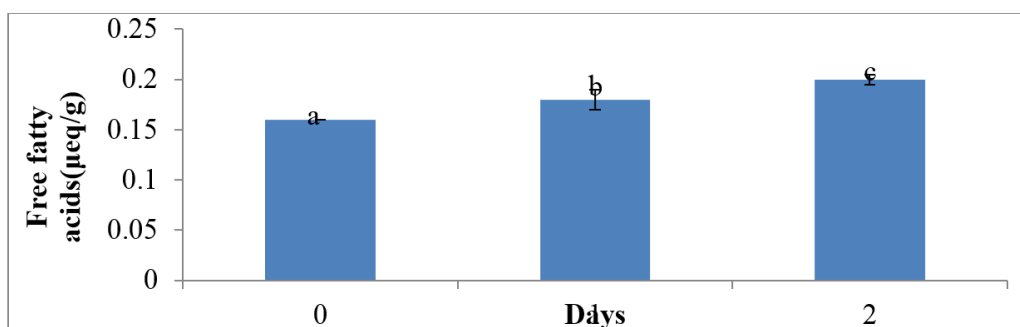


Fig 5: Effect of storage period on free fatty acid content of paneer nuggets stored at controlled ambient ($25 \pm 1^\circ\text{C}$) temperature (Aerobic Packaging)

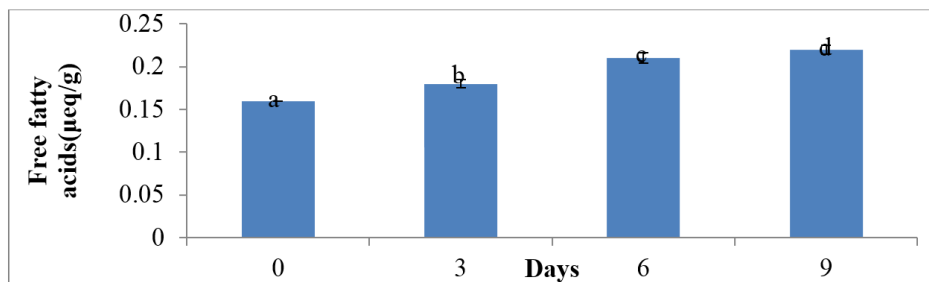


Fig 6: Effect of storage period on free fatty acid content of paneer nuggets stored at refrigeration ($4\pm 1^\circ\text{C}$) temperature (Aerobic Packaging)

Water activity

During storage significant ($p < 0.05$) decrease in water activity of paneer nuggets was noticed at controlled ambient ($25 \pm 1^\circ\text{C}$) temperature and refrigeration ($4\pm 1^\circ\text{C}$) temperature in aerobic packaging. The initial water activity of 0.979 was observed for paneer nuggets which decreased from 0.979 to 0.971 (Figure 7) and 0.979 to 0.956 (Figure 8) after 2 days of

storage at controlled ambient ($25 \pm 1^\circ\text{C}$) temperature and 9 days storage at refrigeration ($4\pm 1^\circ\text{C}$) temperature, respectively under aerobic packaging. This can be due to loss of monolayer moisture from paneer nuggets and texture of the product which allowed easy evaporation of water from the surface. Similar trend was observed by (Ahuja and Goyal 2012)^[1].

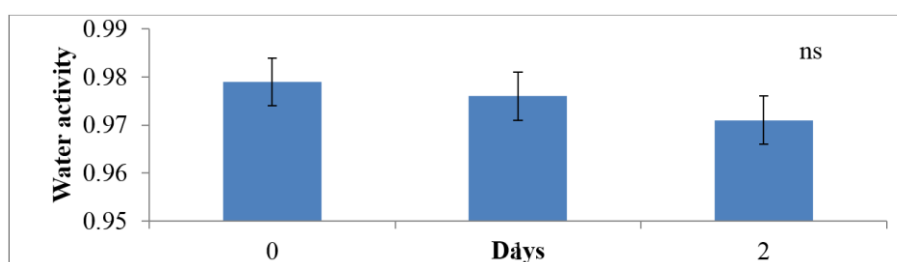


Fig 7: Effect of storage period on Water activity of paneer nuggets stored at controlled ambient ($25\pm 1^\circ\text{C}$) temperature (Aerobic Packaging) (ns-non significant)

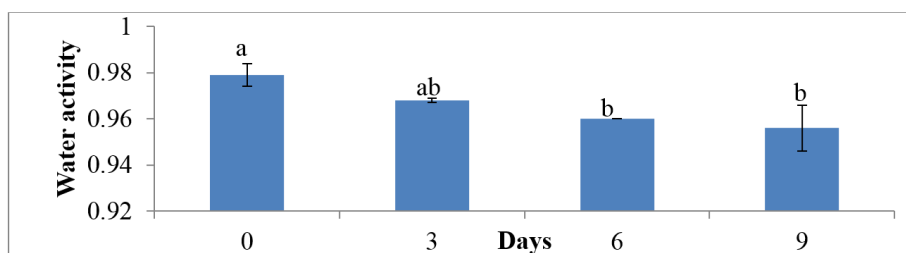


Fig 8: Effect of storage period on water activity of paneer nuggets stored at refrigeration ($4\pm 1^\circ\text{C}$) temperature (Aerobic Packaging)

HMF value

The HMF value of paneer nuggets was measured to study the extent of browning during storage. The increase in HMF value observed during both conditions (ambient/refrigeration) of aerobic packaging. This may be due to Maillard type browning reactions which are fast in dairy products during longer storage. A significant ($p < 0.05$) increase in HMF content of all samples was recorded during storage at controlled ambient ($25 \pm 1^\circ\text{C}$) temperature in aerobic packaging. The initial HMF value of paneer nugget samples

2.69 ($\mu\text{mol}/\text{kg}$) was observed which increased from 2.69 (Figure 9) to 3.38 ($\mu\text{mol}/\text{kg}$) and 2.69 to 3.96 ($\mu\text{mol}/\text{kg}$) (Figure 10) after 2 days of storage at controlled ambient ($25 \pm 1^\circ\text{C}$) temperature and 9 days storage at refrigeration ($4\pm 1^\circ\text{C}$) temperature, respectively in aerobic packaging. Similar findings related to increase in HMF values during storage has also been reported by earlier workers (Singh *et al.* 2007; Arora *et al.* 1996; Chavan *et al.* 2010 and Chawla *et al.* 2015)^[15, 3, 4, 5].

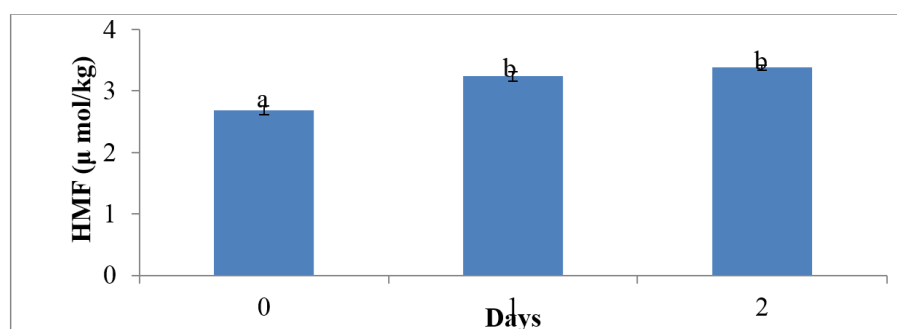


Fig 9: Effect of storage period on HMF value of paneer nuggets stored at refrigeration ($4\pm 1^\circ\text{C}$) temperature (Aerobic Packaging)

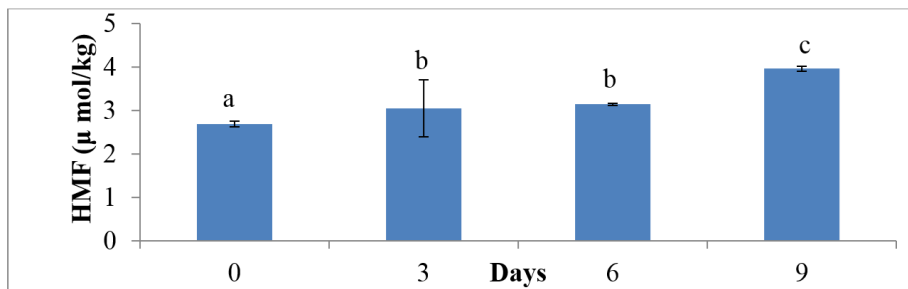


Fig 10: Effect of storage period on HMF value of paneer nuggets stored at controlled ambient ($25\pm 1^\circ\text{C}$) temperature (Aerobic Packaging)

Tyrosine value

Tyrosine value is defined as the extent of partial hydrolysis of milk proteins caused by enzymes present in milk. Protease enzymes indigenous to milk as well as microbial proteases degrade the proteins which lead to release of free amino acids like tyrosine, producing bitter taste in dairy products. The value increased from 39.7 (mg/100 g) to 44.73 (mg/100 g) (Figure 11) and 39.7(mg/100 g) to 45.6(mg/100 g) (Figure 12) after 2 days of storage at controlled ambient ($25 \pm 1^\circ\text{C}$) temperature and 9 days storage at refrigeration ($4\pm 1^\circ\text{C}$) temperature, respectively under aerobic packaging. Tyrosine

values increased significantly ($p < 0.05$) during storage period, as tyrosine value measures the autolytic and bacterial proteolysis occurring in milk and milk products. Incremental increase in the tyrosine value of the paneer nuggets during storage period may be due to the increased microbial load, enhanced production of proteolytic enzymes in the late logarithmic phase of microbial growth causing autolysis and bacterial proteolysis. Results of other authors also corroborate with our findings. (Haridas and Narayanan 1976; Ahuja and Goyal 2013; Rai *et al.* 2007)^[8].

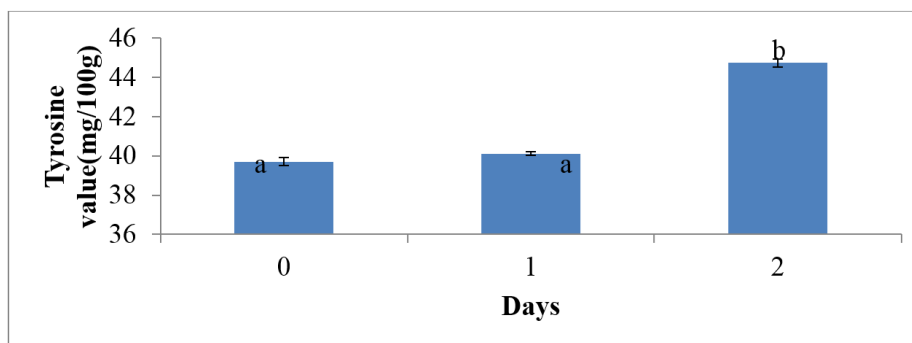


Fig 11: Effect of storage period on Tyrosine value of paneer nuggets stored at controlled ambient ($25\pm 1^\circ\text{C}$) temperature (Aerobic Packaging)

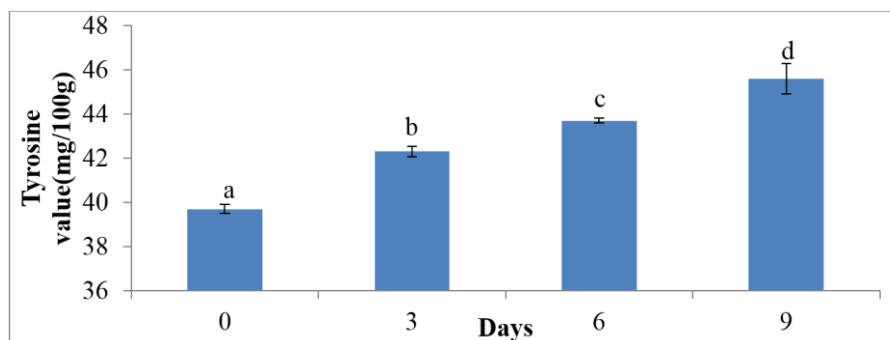


Fig 12: Effect of storage period on tyrosine value of paneer nuggets stored at refrigeration ($4\pm 1^\circ\text{C}$) temperature (Aerobic Packaging)

Conclusions

From this study, it was concluded that, parameters like Acidity, free fatty acids, tyrosine values and HMF values were significantly ($p < 0.05$) affected under the storage conditions (ambient and refrigeration) under aerobic packaging conditions. Further, this study was useful to study the quality of the product under storage conditions.

References

- Ahuja KK, Goyal GK. Combined effect of vacuum packaging and refrigerated storage on the chemical quality of paneer tikka. *J of Food Sci. and Technol.* 2012; 50:620-23.
- AOAC. Official Methods of Analysis, 15thEdn. Association of Official Analytical Chemists, Washington, DC, 2006.
- Arora KL, Sabhiki L, Kanawjia SK. Manufacture of paneer from sub-standard buffalo milk. *Indian J of Biologi. Sci.* 1996; 7:71-75.
- Chavan RS, Prajapati PS, Jana A, Hingu M, Chavan SR, Khedkar CD. Influence of storage period and temperature on physico-chemical properties and microbial quality of dietetic and diabetic rosogolla. *Karnataka J of Agri. Sci.* 2010; 23:628-31.
- Chawla R, Singh AK, Patil GR. Shelf life enhancement of functional doda Burfi (Indian milk cake) with Bio

- preservatives application. Int. J of Res. in Sci. and Technol. 2015; 5(2):26-40.
6. Deeth HC, Fitz-Gerald CH, Wood AF. A convenient method for determining the extent of lipolysis in milk. Austr. J of Dairy Technol. 1975; 30(3):109-11.
 7. Gokhale AJ, Pandya AJ. Enhancement of shelf life of paneer by adopting hurdle technology. XXXVII Dairy industry conference, Goa, Feb 7-9., 2009, 112-113.
 8. Haridas KB, Narayanan KM. Effect of addition of formalin and storage on chemical composition of paneer. J of Food Sci. and Technol. 1976; 13:155.
 9. Hull ME. Studies on milk proteins: Colorimetric determination of the partial hydrolysis of the proteins in milk. J of Dairy Sci. 1947; 30:881-84.
 10. Keeney M, Bassette R. Detection of intermediate compounds in the early stages of browning reaction in milk products. J of Dairy Sci. 1959; 42(6):945-60.
 11. Krishna Kumari E. Evaluation of the selected spices for extending the shelf life of paneer. M.Sc. Thesis Submitted to Anand Agricultural University, Anand, 2009.
 12. Kumar P, Bector BS. Enhancement of shelf life of paneer with food additives. Indian J of Dairy Sci. 1991; 44:577-84.
 13. Kumar R, Sivakumar S, Chawla R, Talwar G. Studies on optimization of paneer nuggets: ready to eat steam cooked product. Indian J of Dairy Sci. 2018; 71(1):13-19.
 14. Rai S, Goyal GK, Rai GK. Effect of modified atmosphere packaging (map) and Storage on the chemical quality of paneer. J of Dairy. Foods and Home Sci. 2008; 27(1):33-37.
 15. Singh P, Tanwar VK, Kumar S, Singh KP. Effect of storage temperature on the physico-chemical, sensory and microbiological quality of *Rosogolla*. Indian J of Dairy Sci. 2007; 60(1):19-24.