

International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2026): 5.29
IJABR 2026; SP-10(7): 1816-1822
www.biochemjournal.com
Received: 08-04-2026
Accepted: 13-05-2026

Vidyavathi C Kamble
Ph.D. Scholar, Department of
Food Science and Nutrition,
College of Community Science,
University of Agricultural
Sciences, Dharwad,
Karnataka, India

Sarojani J Karkannavar
Professor, Department of Food
Science and Nutrition, College
of Community Science,
University of Agricultural
Sciences, Dharwad,
Karnataka, India

Corresponding Author:
Vidyavathi C Kamble
Ph.D. Scholar, Department of
Food Science and Nutrition,
College of Community Science,
University of Agricultural
Sciences, Dharwad,
Karnataka, India

Storage study and organoleptic evaluation of browntop millet (*Brachiaria ramosa*) based Ribbons

Vidyavathi C Kamble and Sarojani J Karkannavar

DOI: <https://www.doi.org/10.33545/26174693.2026.v10.i7Sv.9309>

Abstract

The present study evaluated the storage stability and organoleptic quality of browntop millet (*Brachiaria ramosa*) ribbons using different packaging techniques under ambient storage conditions for 150 days. The developed product was packed using multilayered nylon pouches (control), modified atmosphere packaging (MAP), and modified atmosphere packaging combined with ultraviolet (MAP + UV) treatment. Storage quality was assessed at 30 day intervals by determining moisture content, free fatty acid (FFA) content, microbial load and sensory characteristics using a nine-point hedonic scale. Moisture and FFA content increased progressively during storage in all treatments; however, the increase was significantly lower in MAP + UV, followed by MAP, compared to the control. At 150 days, MAP + UV recorded the lowest moisture content (3.29%) and FFA content (1.51%), while the control showed the highest values (3.65% and 2.40%, respectively). Total bacterial count remained within permissible limits in all treatments, with the lowest microbial growth observed in MAP + UV. No fungal growth or *Escherichia coli* contamination was detected throughout the storage period. Sensory scores gradually declined during storage, but MAP + UV maintained the highest overall acceptability index (66.45%) after 150 days. The findings demonstrate that combining modified atmosphere packaging with UV treatment effectively preserves the physicochemical, microbiological and sensory quality of browntop millet ribbons, extending their shelf life up to 150 days under ambient conditions.

Keywords: Browntop millet ribbon, modified atmosphere packaging combined with ultraviolet, moisture content, Free fatty acid, Bacterial count, organoleptic scores

Introduction

Millet were once given minimal importance, despite being recognized globally as a remarkable grain (Hassan *et al.*, 2021) ^[11]. Belonging to the Poaceae family, they were among the earliest crops to be cultivated and harvested (Gari, 2020) ^[10]. The 100 g serving of browntop millet contained 7.32 g of moisture, 11.64 g of protein, 5.28 g of fat, 8.62 g of ash, 16.08 g of crude fiber and 362.64 kcal of energy. The study also reported that browntop millet had the highest levels of ash, fat and crude fiber compared to other millets, such as barnyard, foxtail, proso, kodo, little and finger millet (Hemamalini *et al.*, 2020) ^[12]. Additionally, millets were a significant source of iron, manganese, phosphorus, magnesium, vitamin B and antioxidants. While they were generally a good source of essential amino acids, with the exception of lysine and threonine, they were notably high in sulfur-containing amino acids such as methionine and cysteine (Singh *et al.*, 2012) ^[24].

Browntop millet demonstrates versatility, serving as a potential nutri-cereal for human consumption, as well as fodder and game bird feed (Sheahan, 2014) ^[23]. Grains of non-shattering 4 varieties of browntop millet can be utilized to make unleavened bread or porridge or cooked whole similar to rice. Traditionally, browntop millet is processed by polishing and cooking to produce rice-like dishes such as gruel, anna and kheer. Alternatively, it can be ground into flour for making flatbreads like roti and dosa. Additionally, browntop millet holds cultural significance in certain rituals and traditional ceremonies, which likely contributes to its continued cultivation in specific regions (Kimata *et al.*, 2000) ^[14].

Like other millets, browntop millet necessitates processing before consumption as it is neither ready to eat nor cook.

Traditional processing methods commonly employed include milling for size reduction and dehulling, as well as techniques such as puffing, germinating and fermentation (Rao, 2018) [21].

Convenience food has become a widespread dietary trend in both developed and developing countries. There are various reasons for the popularity of convenience foods today. They enable consumers to minimize the time and effort invested in food-related tasks such as meal preparation, shopping, cooking and post-meal cleanup (Brunner *et al.*, 2010) [6]. The previous concept of convenience foods was over shadowed by the changing definition. Over time, consumers are focusing on the healthy aspects of convenience foods. This could be due to the increasing prevalence of several lifestyle diseases like obesity, hypertension and other illnesses linked to convenience food consumption. The majority of the most recent innovations and advancements in convenience food products are connected to healthy options containing minimal salt, sugar, low calorie and other therapeutic foods (Raj *et al.*, 2021) [19].

A variety of technologies had been developed to create and promote ready-to-eat (RTE), ready-to-use (RTU), ready-to-drink (RTD), ready-to-cook (RTC) and ready-to reconstitute (RTR) mixes for both conventional and modern Indian cuisine. The popularity of dry mixes for various traditional Indian dishes had spread globally (Prasad *et al.*, 2000) [16].

In food production, UV light is employed to extend the shelf life of food items and decrease the presence of pathogenic microorganisms. UV treatment has been successfully used to enhance the shelf life of fruit juices, beverages, vegetables, fruits, meat, poultry and seafood products by effectively eliminating pathogenic microorganisms and reducing ripening intensity (Csapo *et al.*, 2019) [8]. UV treatment is emerging as a promising method for commercially treating the surfaces of fresh-cut fruits. Its ability to sanitize and inhibit microbial growth without compromising fruit quality has gained recent recognition. UV light irradiation is increasingly viewed as a more effective germicidal treatment compared to chlorine, hydrogen peroxide or ozone. Advances in UV-light science and technology have demonstrated its potential for significantly extending the shelf life of fresh fruits and vegetables. Low doses of short-wave UV-C light (190-280 nm wavelengths) have shown efficacy in controlling various storage rots in fruits and vegetables. UV-C exposure induces natural defences and triggers responses against fungi and bacteria (Ribeiro *et al.*, 2012) [20].

Developed products are packaged using modified atmospheric packaging and vacuum packaging techniques. Modified atmospheric packaging works by decreasing oxidative changes and minimizing biochemical and microbiological activity, thereby extending the shelf life of products. Vacuum packaging reduces oxygen levels within sealed packages, creating an anaerobic environment that inhibits the growth of spoilage bacteria, particularly aerobic types responsible for slime, off-odors and texture alterations (Nunez *et al.*, 1986) [15].

Hence, the current research was conducted with an objective Storage study and Organoleptic Evaluation of Browntop millet (*Brachiaria ramosa*) based Ribbons.

Materials and Methods

The present investigation was conducted at the Department of Food Science and Nutrition, College of Community Science, University of Agricultural Sciences Dharwad, Karnataka. Dehusked browntop millet grains were procured from Green Organics. The browntop millet based ribbons composition was taken from standardized recipe of ICAR-NAE project on “Nutrient composition, value addition and commercialization of lesser exploited millets” at Food Science and Nutrition, College of Community Science, UAS, Dharwad.

The developed browntop millet based ribbons were evaluated for storage efficacy by using different packing methods like multi layered nylon pouches and MAP (modified atmosphere packaging) packaging methods using suitable packaging material. The developed browntop millet based ribbons was packed until the product stays good in quality.

Experiment 1-T₁-Multi layered nylon pouches packing (control)

T₂-Modified atmosphere packing without UV

T₃-Modified atmosphere packing with UV

Storage parameters viz., moisture (AOAC, 2019) [3], free fatty acids (%) (Azeman *et al.*, 2015) [5] microbial load (Diliello, 1982) [9] and organoleptic evaluation was done by using Nine point Hedonic scale once in a month according to standard procedures.

The statistical analysis of the data was conducted using IBM SPSS software version 22 and MS Excel 2019. To test the significance of the results, several statistical tests were employed, including the one-way ANOVA test, t-test and Duncan's new multiple range test.

Results and Discussion

Table 1: Moisture content (%) of browntop millet ribbons during by different methods

Storage methods	Days of storage					
	0	30	60	90	120	150
Control	2.26	2.34	2.46	2.61	3.20 ^a	3.65 ^a
MAP	2.26	2.32	2.39	2.56	2.71 ^b	3.38 ^b
MAP + UV	2.26	2.30	2.34	2.45	2.54 ^c	3.29 ^b
F value	0.005	0.65	2.79	2.98	220.18	14.95
CD	0.08 ^{NS}	0.08 ^{NS}	0.12 ^{NS}	0.16 ^{NS}	0.08 ^{**}	0.16 ^{**}
SEm	0.02	0.02	0.03	0.04	0.02	0.04

Note: Values are expressed as mean ± standard deviation of three replications. Values in a column with different superscripts are significantly different ($p < 0.01$) and with the same superscripts are non-significant. CD: Critical difference, S.Em: Standard error of mean. **significant at 1 percent level.

Table 2: Free fatty acid content (%) of browntop millet ribbons during by different methods

Storage methods	Days of storage					
	0	30	60	90	120	150
Control	0.72	0.97 ^a	1.48 ^a	1.96 ^a	2.28 ^a	2.40 ^a
MAP	0.72	0.81 ^b	0.92 ^b	1.15 ^b	1.42 ^b	1.86 ^b
MAP + UV	0.72	0.79 ^b	0.88 ^b	0.95 ^c	1.28 ^c	1.51 ^c
F value	0	19.82	715.16	992.47	255.49	997.24
CD	0.06 ^{NS}	0.08 [*]	0.06 [*]	0.06 ^{**}	0.10 ^{**}	0.06 ^{**}
SEm	0.01	0.02	0.01	0.01	0.03	0.01

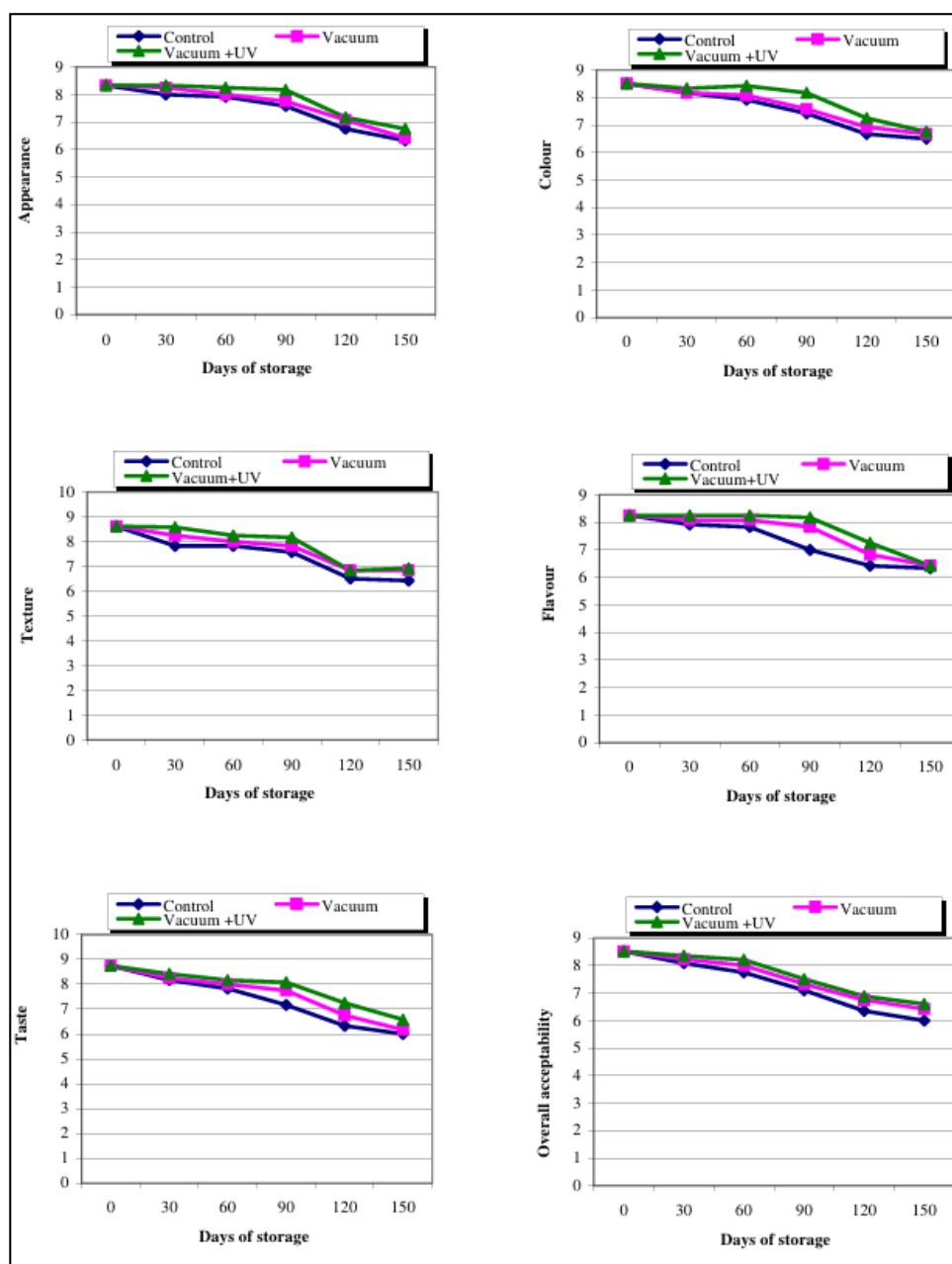
Note: Values are expressed as mean $\pm$ standard deviation of three replications. Values in a column with different superscripts are significantly different ($p < 0.01$) and with the same superscripts are non-significant. CD: Critical difference, S.Em: Standard error of mean. **significant at 1 percent level.

Table 3: Total bacterial count ($\times 10^3$ cfu/g) in browntop millet ribbons during by different methods

Storage methods	Days of storage					
	0	30	60	90	120	150
Control	-	4.3	5.5	6.3	7.2	*
MAP	-	2.8	3.6	4.9	5.6	6.5
MAP + UV	-	-	2.4	2.9	3.7	4.2

Note: Values are presented as mean $\pm$ standard deviation of three replications.

*Study was discontinued Cfu-colonies forming units

**Fig 1:** Organoleptic scores of browntop millet ribbons during storage

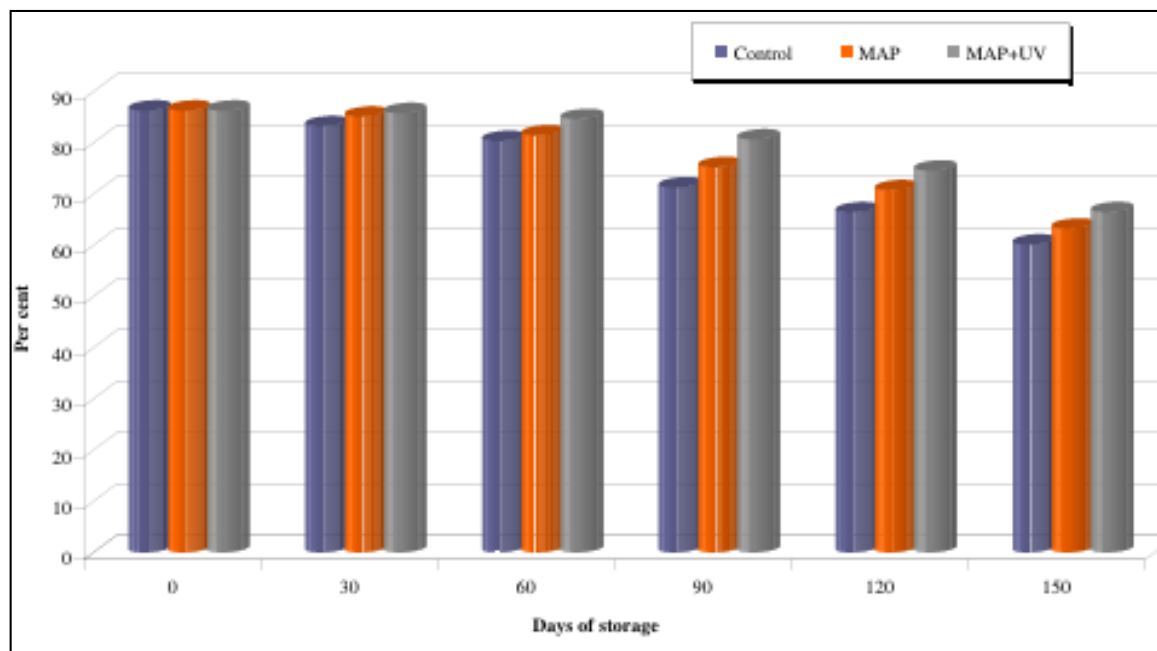


Fig 2: Acceptability indices of browntop millet ribbons

Table 1 presents the moisture content of browntop millet ribbons during storage under three different treatments like Control, MAP (Modified Atmosphere Packaging) and MAP + UV. On 0th day, the moisture content was the same for all treatments, recorded at 2.26 percent. Over the storage period, the moisture content increased in all treatments. In the control treatment, the moisture content rose steadily, reaching 3.65 percent by 150th day. The MAP treatment showed a gradual increase, with the moisture content reaching 3.38 percent by 150th day. The MAP + UV treatment exhibited a more moderate increase in moisture content, reaching 3.29 percent by 150th day.

The results indicated that there were no significant differences in moisture content across treatments at 0th day to 120th day. However, on 150th day, significant differences were observed. The control treatment had significantly higher moisture content compared to both the MAP and MAP + UV treatments. The MAP and MAP + UV treatments were more effective in controlling moisture content at later storage periods, with MAP + UV showing slightly better moisture retention than the MAP treatment.

Table 2 shows the free fatty acid content of browntop millet ribbons during storage under three different treatments like Control, MAP (Modified Atmosphere Packaging) and MAP + UV. On 0th day, the free fatty acid content was the same across all treatments, recorded at 0.72 percent. Over the storage period, the free fatty acid content increased in all treatments, with the control treatment showing the highest rise. By 150th day, the free fatty acid content in the control treatment reached 2.40%, while the MAP treatment reached 1.86 percent and the MAP + UV treatment showed the lowest increase, reaching 1.51 percent.

The results revealed significant differences in free fatty acid content starting from 30th day onwards. On 30th day, the control treatment exhibited significantly higher free fatty acid content compared to MAP and MAP + UV treatments. This trend continued throughout the storage period, with the control treatment consistently showing the highest free fatty acid content. These results, indicate that the MAP and MAP + UV treatments were more effective in reducing the increase in free fatty acid content compared to the control

treatment, with MAP + UV showing the lowest increase in free fatty acid levels over the storage period.

Table 3 presents the storage study of total bacterial count ($\times 10^3$ cfu/g) in browntop millet ribbons, the results showed a gradual increase in bacterial growth over time for the control and modified atmosphere packaging (MAP) treatments. For the control, bacterial counts increased from undetectable levels at day 0 to 4.3×10^3 cfu/g at day 30, reaching 7.2×10^3 cfu/g by day 120th, at which point the study was discontinued. In the MAP treatment, bacterial counts also increased from undetectable levels at day 0th day to 2.8×10^3 cfu/g at day 30th, reaching 5.6×10^3 cfu/g by day 120th and continuing to 6.5×10^3 cfu/g at day 150th. For the MAP + UV treatment, bacterial counts were undetectable at days 0th and 30th but by day 60th counts were recorded at 2.4×10^3 cfu/g, which increased to 4.2×10^3 cfu/g by day 150th. There is no fungal growth was detected throughout the entire storage period across all treatments. The control, modified atmosphere packaging (MAP) and MAP with UV treatments all showed undetectable levels of fungal contamination from 0th day to 150th. The treatments included the control, modified atmosphere packaging (MAP) and a combination of MAP with ultraviolet (UV) light. Throughout the entire storage period, from 0th day to 150th day *E. coli* was not detected in any of the treatments.

Figure 1 shows the organoleptic score of browntop millet ribbons during storage period. Control, modified atmospheric packing and modified atmospheric packing with UV were drawn 30 days interval for 150 days and analyzed for sensory qualities using nine-point hedonic scale.

The initial appearance score in the control method of packaging was 8.33, but it decreased to 6.33 after 150 days of storage. In modified atmospheric packing, the initial appearance score was also 8.33, which slightly decreased to 6.42, though this change was not significant. In modified atmospheric packing with UV treatment, the initial appearance score was 8.33 and it significantly decreased to 6.75 after 30 days of storage.

The initial colour score in the control method of packaging was 8.50, but it decreased to 6.50 after 150 days of storage.

In modified atmospheric packing, the initial colour score was 8.50, which slightly decreased to 6.67, though this change was not significant. In modified atmospheric packing with UV treatment, the initial colour score was 8.33 and it significantly dropped to 6.75 after 150 days of storage.

The initial texture score in the control method of packaging was 8.56, but it decreased to 6.22 after 150 days of storage. In modified atmospheric packing, the initial texture score was also 8.56, which slightly decreased to 6.51, though this change was not significant. In modified atmospheric packing with UV treatment, the initial texture score was 8.56 and it significantly dropped to 6.68 after 150 days of storage.

The initial flavour score in the control method of packaging was 8.25, but it decreased to 6.28 after 150 days of storage. In modified atmospheric packing, the initial flavor score was also 8.25, which slightly decreased to 6.42, though this change was not significant. In modified atmospheric packing with UV treatment, the initial flavor score was 8.25, and it significantly dropped to 6.67 after 150 days of storage.

The initial taste score in the control method of packaging was 8.45, but it decreased to 6.04 after 150 days of storage. In modified atmospheric packing, the initial taste score was also 8.45, which slightly decreased to 6.24, though this change was not significant. In modified atmospheric packing with UV treatment, the initial taste score was 8.45, and it significantly dropped to 6.58 after 150 days of storage.

The initial overall acceptability score in the control method of packaging was 8.51, but it decreased to 6.00 after 150 days of storage. In modified atmospheric packing, the initial score was also 8.51, which slightly decreased to 6.42, though this change was not significant. In modified atmospheric packing with UV treatment, the initial score was 8.51, and it significantly dropped to 6.60 after 150 days of storage.

Figure 2 shows the initial acceptability index (%) in the control method of packaging was 86.28, but it decreased to 6.13 after 150 days of storage. In modified atmospheric packing, the initial acceptability index was 86.28, which slightly decreased to 63.25, though this change was not significant. In modified atmospheric packing with UV treatment, the initial acceptability index was 86.28, and it significantly dropped to 66.45 after 150 days of storage.

Discussion

In the present study, the moisture content of browntop millet ribbons was observed to increase with the duration of storage. Initially, on 0th day, the moisture content was 2.26%. By the 30th day, a slight increase in moisture was noted across all storage conditions, the results were 2.34% in the control, 2.32% in modified atmosphere packaging (MAP) and 2.30% in MAP with UV treatment (Table 1). The highest moisture content was recorded on the 150th day in the control, where it reached 3.65%, where as in the MAP with UV treatment, 3.29%, followed closely by the MAP alone at 3.38%. The moisture content result showing the highly significant difference from 120th days to 150th days of storage period. The reduced moisture gain in the MAP (100% nitrogen) and MAP with UV treatments was due to nitrogen flushing, which replaced oxygen and water vapour in the package, helping to limit moisture absorption. The

increase in moisture content in the control was primarily attributed to the hygroscopic nature of the product, the ambient storage conditions (such as temperature and relative humidity) and the type of packaging used (Palling, 1980)^[18]. These findings are consistent with those of Ajita and Jha (2017)^[1], who reported that in fried snacks, the moisture content increased from 2.5% to 3.8% in packages with nitrogen flushing, while in packages without nitrogen flushing, the moisture content increased from 2.5% to 5.5%. The free fatty acid content in browntop millet ribbons increased over the storage period. Initially, the free fatty acid content was 0.72%, on the 150th day, a noticeable rise in free fatty acid was observed, with the control (MDPE) reaching 2.40%. In comparison, the increase in free fatty acid was slower in MAP with 100% nitrogen, which recorded 1.86% and in MAP with 100% nitrogen and UV treatment, which showed the lowest free fatty acid content at 1.51% (Table 2). The present study browntop millet ribbons free fatty acid shows the significant difference from 30th day to 60th day and highly significant from 90th days to 150th days of storage. In particular, MAP with UV treatment resulted in the lowest free fatty acid increase, likely due to the combination of nitrogen flushing and UV exposure, which also helped inhibit microbial activity. In contrast, the control samples showed a increase in free fatty acid, indicating more rapid lipid oxidation and microbial growth. These results were consistent with findings by Ajita and Jha (2017)^[1], who reported that the free fatty acid content in nitrogen-flushed packages of fried snacks ranged from 0.75% to 1.22%, while in non nitrogen-flushed packages, the free fatty acid content increased from 0.75% to 1.78%. The slower increase in free fatty acid in the nitrogen-flushed packages was attributed to the inert nitrogen atmosphere, which lowered oxygen concentration and reduced the rate of lipid oxidation, thereby enhancing the stability of the snacks (Paik *et al.*, 1994)^[17].

Similarly, Singh *et al.* (2018)^[25] observed an increase in free fatty acid levels during storage of soy-fortified biscuits. According to Chew and Nayam (2020)^[7] and Aw *et al.* (2019)^[4], products with free fatty acid levels under 2.0% are considered safe for consumption. The study further indicated that browntop millet ribbons stored in MDPE (multi-layered nylon pouch) packaging exceeded the 2.0% free fatty acid threshold by the 150th day, whereas the MAP and MAP with UV treatments successfully maintained free fatty acid levels below the limit throughout the entire storage period.

In the present study, no bacterial growth was observed initially in browntop millet ribbons stored in the control, MAP (100% nitrogen) and MAP (100% nitrogen with UV) conditions. However, bacterial growth was observed over the storage period, with the highest growth recorded in the control samples, ranging from 4.3×10^3 to 7.21×10^3 colony-forming units (CFU) on 30th day to 120th day. In comparison, bacterial growth in the MAP with 100% nitrogen was lower, ranging from 2.8×10^3 to 6.5×10^3 CFU over 0th to 150th days (Table 3). The lowest bacterial growth was observed in the MAP with 100% nitrogen and UV treatment, which ranged from 2.4×10^3 to 4.2×10^3 CFU between 60th and 150th days. This difference in microbial growth could be attributed to variations in the nutrient and moisture content of the ribbons, which can influence bacterial proliferation.

Additionally, no fungal growth or *E. coli* contamination was observed during the study. The observed increase in bacterial growth remained within the acceptable limits set by the Food Safety and Standards Authority of India (FSSAI, 2010). The MDPE (multi-layered nylon pouch) bags, which did not utilize modified atmosphere packaging, supported greater microbial growth due to the presence of oxygen inside the packaging. In contrast, the MAP samples, both with and without UV treatment, showed a more delayed growth of microorganisms throughout the storage period. This was because the air and oxygen in the MAP packaging were replaced with 100% nitrogen, which exerted a bacteriostatic effect. This finding aligns with the results of previous studies, which reported that nitrogen flushing effectively delayed microbial growth and inhibited bacterial proliferation (Akarca *et al.*, 2015^[2]; Jha *et al.*, 2015^[13]; Rodrigues *et al.*, 2018^[22]).

Based on the sensory scores the browntop millet ribbons can be stored successfully upto 150 days, the acceptability index (%) score on 150th days for control was 60.13, modified atmospheric pressure 63.25 and modified atmospheric pressure with UV 66.45 (Fig 1 and 2). Hence, MAP packaging and MAP packaging with UV treatments both are suitable methods for storage of browntop millet ribbons. Even on 150th days the free fatty acid content and microbial load were also within the permissible limit and the acceptability index of browntop millet ribbons in MAP was less compared to browntop millet ribbons in MAP with UV which may be due to UV treatment, which results in good, flavour and taste of the ribbons compared to MAP. Similar results were reported by Ajita and Jha (2017)^[1] which stated that popped pearl millet fried snack with nitrogen could be stored up to 90 days of storage.

In the MAP packaging and MAP packaging with UV treatments the increase in moisture content was highly significant from 120 days to 150 days and free fatty acid content was significant from 30 day to 60 days of storage and highly significant from 90 days to 150days. Because of this it is observed that bacterial count was slightly increased within the safe limits. The sensory evaluation is also shows acceptability index (%) more than 60.13 in control, 63.25 in MAP and 66.45 in MAP with UV hence the browntop millet ribbons can be stored up to 150 days and consumed safely.

Conclusion

The present study demonstrated that packaging methods significantly influenced the storage stability and sensory quality of browntop millet ribbons during 150 days of storage. Although moisture content, free fatty acid content and bacterial load increased progressively in all treatments, the increases were considerably lower in Modified Atmosphere Packaging (MAP) with UV treatment compared to MAP alone and the control. The MAP with UV treatment effectively minimized lipid oxidation, restricted microbial growth and maintained better sensory attributes, resulting in the highest acceptability index (66.45%) after 150 days. No fungal growth or *E. coli* contamination was detected throughout the storage period, confirming the microbiological safety of the product. The control samples exhibited comparatively higher deterioration in quality parameters. Overall, the findings indicate that MAP combined with UV treatment is the most effective packaging technique for preserving the quality, safety and consumer acceptability of browntop millet ribbons, thereby

extending their shelf life up to 150 days under ambient storage conditions.

Acknowledgement

The authors thank the honourable Vice Chancellor of the University of Agricultural Sciences, Dharwad, Karnataka for his encouragement.

References

1. Ajita T, Jha SK. Effect of nitrogen gas enriched packing on quality and storage life of pearl millet based fried snack. *Journal of Biosystems Engineering*. 2017;42(1):62-68.
2. Akarca G, Tomar O, Gök V. Effect of different packaging methods on the quality of stuffed and sliced mozzarella cheese during storage. *Journal of Food Processing and Preservation*. 2015;39(6):2912-2918.
3. Association of Official Analytical Chemists. Official methods of analysis. 21st ed. Washington (DC): Association of Official Analytical Chemists; 2019.
4. Aw GJK, Okoth AM, Wanjala GW. Use of peroxide value and moisture content as a measure of quality for amaranth-sorghum grains based complementary food. *Nutrition and Food Technology*. 2019;5(2):1-5.
5. Azeman NH, Yusof NA, Othman AI. Detection of free fatty acid in crude palm oil. *Asian Journal of Chemistry*. 2015;27(5):1569-1575.
6. Brunner TA, Van der Horst K, Siegrist M. Convenience food products: Drivers for consumption. *Appetite*. 2010;55(3):498-506.
7. Chew SC, Nyam KL. Refining of edible oils. *Lipids and Edible Oils*. 2020:213-241.
8. Csapo J, Prokisch J, Albert C, Sipos P. Effect of UV light on food quality and safety. 2019;12:21-41.
9. Diliello R. Standard plate count method. In: *Methods in Food and Dairy Microbiology*. Westport: AVI Publishing Co.; 1982. p. 20-29.
10. Gari JA. Review of the African millet diversity. Paper presented at: International Workshop on Fonio, Food Security and Livelihood Among the Rural Poor in West Africa. Available from: <http://www.ipgri.org>
11. Hassan ZM, Sebola NA, Mabelebele M. The nutritional use of millet grain for food and feed: A review. *Agriculture and Food Security*. 2021;10:16.
12. Hemamalini Ch, Patro TSSK Patro, Anuradha N, Triveni U, Jogarao P. Estimation of nutritive composition of seven small millets. *Journal of Pharmacognosy and Phytochemistry*. 2020;9(3):1871-1874.
13. Jha A, Kumar A, Jain P, Gautam AK, Rasane P. Effect of modified atmosphere packaging on the shelf life of lalpeda. *Journal of Food Science and Technology*. 2015;52:1068-1074.
14. Kimata M, Ashok EG, Seetharam A. Domestication, cultivation and utilization of two small millets, *Brachiaria ramosa* and *Setaria glauca* (Poaceae) in South India. *Economic Botany*. 2000;54:217-227.
15. Nunez M, Gaya P, Medina M, Rodriguez-Marin MA, Garcia-Aser C. Changes in microbiological, chemical, rheological and sensory characteristics during ripening of vacuum packaged Manchego cheese. *Journal of Food Science*. 1986;51(6):1451-1455.
16. Prasad N, Narayan M, Siddalingaswamy PM, Parameswariah K, Radhakrishna RV, Rao KR, *et al.*

- Proximate and mineral composition of some processed traditional and popular Indian dishes. Food Chemistry. 2000;68:87-94.
17. Paik JS, Shin JI, Kim JI, Choi PK. Effect of nitrogen flushing on shelf life of packaged potato chips. Packaging Technology and Science. 1994;7(2):81-85.
 18. Palling SJ. Developments in packaging. Vol. 1. London: Applied Science Publishers Ltd.; 1980. p.56-63.
 19. Raj S, Suvadarshini A, Mishra BB. Role, relevance, and significance of convenience food: A literature review approach. Global Media Journal. 2021;19:41.
 20. Ribeiro C, Canada JO, Alvarenga B. Prospects of UV radiation for application in postharvest technology. Journal of Food and Agricultural Sciences. 2012;24(6):586-597.
 21. Rao BD, Bhat BV, Tonapi VA. Nutricereals for nutritional security: Strategies for mainstreaming millets for prosperous farming and healthy society. Hyderabad: ICAR-Indian Institute of Millet Research; 2018. p.30.
 22. Rodrigues I, Trindade MA, Palu AF, Baldin JC, de Lima CG, de Alvarenga Freire MT. Modified atmosphere packaging for lamb meat: Evaluation of gas composition in the extension of shelf life and consumer acceptance. Journal of Food Science and Technology. 2018;55:3547-3555.
 23. Sheahan CM. Plant guide for brown top millet (*Urochloa ramosa*). Cape May: USDA-Natural Resources Conservation Service, Cape May Plant Materials Center; 2014.
 24. Singh KP, Mishra A, Mishra HN. Fuzzy analysis of sensory attributes of bread prepared from millet-based composite flours. LWT-Food Science and Technology. 2012;48:276-282.
 25. Singh SP, Singh SK, Maurya RP, Singh AK, Singh RV. Study of oyster mushroom cultivation (*Pleurotus flabellatus* and *Pleurotus sajor-caju*) on different substrates and economics. Annals of Plant Protection Sciences. 2018;26(1):117-121.