IJFANS INTERNATIONAL JOURNAL OF FOOD AND NUTRITIONAL SCIENCES
ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 13, Iss 04, 2024

Shelf life Evaluation of Ready – to – Cook Proso Millet (Panicum miliaceum) and Raw Banana (Musa paradisiaca) Flours Based Pasta with Added Beet Root Powder

Payal Talesra[1*], Vishakha Singh[2]

[1, 2]Department of Food Science and Nutrition,

College of Community and Applied Sciences,

MPUAT, Rajasthan, India

Email: [*1] p.talesra@rediffmail.com , vishakha.udaipur@gmail.com

ABSTRACT

The interdependence amongst population, food security, sustainable development and holistic nutrition entails immeasurably far greater than just an adequacy of calorie intake by a growth in population. Hence, to secure healthier times ahead, for both the people and the planet, the increasing population ought to be nourished in such a way that is healthy, equitable and sustainable. The climate – resilient, profitable, nutrient dense, locally available and adaptable neglected or underutilized species become pivotal in boosting production and revamping dietary diversity. In this attempt, the pasta was developed using underutilized proso millet and raw banana flours enriched by adding beet root powder, with an objective of assessing the shelf stability of the pasta so developed, using the two underutilized crops. The developed pasta was assessed for its sensory characteristics, moisture, free fatty acid and microbial load at regular intervals for a period of ninety days. For assessing the shelf stability of the developed pasta, it was stored in the heat sealed HDPE bags, at ambient temperature. The quality attributes were evaluated over a period of three months of storage period, at regular intervals i.e. zero day, thirty days, sixty days and ninety days. The mean scores were highest on all the parameters of sensory evaluation on 0 day. The scores on moisture, free fatty acids and total viable counts increased during the period of storage, from zero day to ninety days.

Keywords: Proso millet, raw banana flour, ready – to – cook pasta, shelf life evaluation

INTRODUCTION

Along with the environmental degradation, human health to a great extent have been gravely affected by extensive administration of chemical fertilizers and pesticides for monoculture farming of the staple crops, in spite of the fact that it has brought food security. The environment friendly agricultural production and re – diversification of crops become imperative and fundamentally crucial, to obliterate the triad load of nutritional menaces like malnutrition, zero hunger and malnutrition. To persuade food and nutrition security, encouragement of underutilized or neglected species along with the staple crops corresponds to viable and sustainable development, besides biosphere and ecosystem stability, escalate income for the marginal farmers and cultural diversity. Millets, also called nutri – cereals, have the competence to play a pivotal role in the confrontation of food insecurity and malnutrition. The millets can also be a viable solution to minimizing the surging ubiquity of malnutrition and metabolic diseases, thereby revamping the food and nutrition security in our country [1]. Treating the millets generally before usage to remove the inedible portions, enhances their sensory profile, thereby improving nutritional value and eventually increasing its shelf life [2]. The other underutilized crop is banana in its raw form, as it is consumed mostly in its ripe form and being a climacteric fruit, enormous amounts of this fruit undergo post – harvest losses. An economic way out to process the fruit in its green / raw form into its flour and then incorporating it into various products, thereby promoting its usage and furnishing greater health benefits [3]. Unripe banana is regarded as the non – processed fruit with exceptional content of resistant starch. Moreover, the edge of resistant starch in the food preparations is it's insignificant after effects on sensory profile of the finished product thereby eventually suggesting consumer compliance [4].

Off – late the demand of health and convenience foods have sky – rocketed indicating the need to develop such foods. Taking into account, the functional and nutritional gains of convenience and health foods, the pasta was developed using proso millet and raw banana flour. The main objective of developing this nutritious pasta was to assess its shelf stability.

METHODOLOGY

ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 13, Iss 04, 2024

The organic unpolished proso millet was cleaned for any foreign material and then ground into flour using Indica semi automatic flour mill. The raw banana was cut into thin sliced and dried in Yorco Hot Air Sterilizer (Oven). The dried slices were coarsely crushed using a pestle mortar and then ground into powder in a mixer grinder. Similarly, the beet root was also dried and powdered in a mixer grinder. All the developed flours were stored in zip – lock bags (55 micron) at ambient temperature and were used to develop the pasta. Standardized ratio of proso millet and raw banana flour was used for extruding the pasta, after certain preliminary combination trials. The beet root powder was added in a specific ratio to improve the visual appeal of the pasta. The pasta was made using Anna A – 45 pasta making machine (Figure 1). The extruded pasta was dried overnight in the trays (Figure 2) and finally was packed in HDPE bags (120 micron) (Figure 3). The vacuum packed pasta bags were stored at ambient temperature for shelf life quality evaluation.

Figure 1: Preparation of pasta using single screw extruder

Figure 2: Drying of prepared pasta in trays

ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 13, Iss 04, 2024

Figure 3: Pasta vacuum packed in HDPE bags for storage

Figure 4: Pasta sample packed in HDPE bags for assessment of total viable count during the study period

The shelf life evaluation of the developed pasta was done in terms of its sensory characteristics, moisture content, free fatty acid value and microbial load (total viable counts) (Figure 4). The developed pasta was stored in vacuum packed HDPE bags at ambient storage temperature during the study period. All the quality attributes were analyzed at regular intervals of 30 days for a period of three months i.e. 0 day, 30 days, 60 days and 90 days.

The sensory characteristics of the developed pasta were assessed using a Hedonic rating Scale, where numerical values ranged from 9 (like extremely) to 1 (dislike extremely). The estimation of moisture, free fatty acid and total viable count were estimated using standard instruments and methods.

DATA ANALYSIS

The sensory profile, moisture content and free fatty acid were analyzed using one – way Analysis of Variance (ANOVA) to arrive at the logical interpretation. ANOVA was exercised to work out the significant difference in the sensory characteristics, moisture content and free fatty acid content in the developed pasta over the study period of ninety days. The total viable count was expressed as general mean.

RESULTS

The results of different quality attributes studied for the developed pasta are discussed under different sub – headings.

Sensory Profile

The observations of the sensory evaluation of the pasta over a study period are tabulated in the Table 1. For all the parameters the mean scores were found to be highest on 0 day. The scores on the colour were observed to be 8.80, 8.55, 8.40 and 8.50 on 0 day, 30 days, 60 days and 90 days. The decline in the score of appearance was observed from 0 day (8.90) to 90 days (7.85). The scores for flavor reduced from 8.85 (0 day) to 8.55 (30 days) to 8.05 (60 days) and eventually to 7.45 (90 days). Highest score of 8.55 was found on 0 day for texture which dropped to 7.45 on 90^{th} day. Similarly a reducing trend was found on overall acceptability, where scores decreased from 8.95 (0 day) to 8.55 (30^{th} day) to 8.30 (60^{th} day) to eventually 8.05 (90^{th} day).

Much the similar results in the pearl millet based pasta were observed during the study period of six months [5]. Similar were the results reported for pearl millet flour and wheat pasta on overall acceptability [6]. In another research, the results revealed that cereal bran enriched pasta was found acceptable up to four months of their study period [7].

Despite gradual reduction in the sensory scores of the pasta during the study period, the scores on almost all the parameters were liked very much, indicating stupendous acceptance of the product throughout the storage period.

Table 1: Effect on sensory analysis of pasta during the study period

S. No.	Treatment	Colour		Appearance		Flavour		Taste		Texture		Overall Acceptability	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	0 day	8.80	0.35	8.90	0.32	8.85	0.34	8.85	0.34	8.55	0.44	8.95	0.16
2	30 days	8.55	0.44	8.55	0.44	8.55	0.37	8.60	0.46	8.30	0.54	8.55	0.50
3	60 days	8.40	0.70	8.05	0.37	8.05	0.28	8.20	0.35	7.90	0.32	8.30	0.63
4	90 days	8.05	0.55	7.85	0.41	7.45	0.44	8.00	0.41	7.45	0.44	8.05	0.60
	GM	8.45	0.58	8.34	0.56	8.23	0.64	8.41	0.50	8.05	0.60	8.46	0.59
	Se	0.17		0.12		0.11		0.12		0.14		0.16	
	CD5%	0.48		0.35		0.33		0.36		0.40		0.46	
	CD1%	0.64		0.47		0.44		0.48		0.53		0.62	
	CV	6.22		4.63		4.39		4.66		5.46		6.00	

Moisture Content

During the study period, the increase in the moisture content was observed. The content of moisture rose from 6.79 initially to 6.81 on 30th day to further 6.84 on 60th day and finally to 6.83 on 90th day. The statistical analysis of the moisture content of pasta over a study period is tabulated in Table 2.

The probable reason for the increase in the content of moisture could be caused specifically due to the adsorptive characteristic of a product, penetrability of the packaging material and volatile storage or environmental conditions (temperature and relative humidity) outside [8]. Similar trend of increase in moisture was mentioned in a little millet pasta, even in different types of

packaging [9]. The changes in the moisture content were reported significantly upon storage owing to alterations in temperature situations of the environment [7].

Table 2: Effect on moisture content of the developed pasta during the study period

S. No.	Treatment	Pasta	
		Mean	SD
1	0 day	6.79	0.02
2	30 days	6.81	0.06
3	60 days	6.84	0.01
4	90 days	6.89	0.01
	GM	6.83	0.05
	Se	0.02	
	CD5%	0.06	
	CD1%	0.09	
	CV	0.43	

Free Fatty Acid

Alike the moisture content, an increase in the free fatty acid content was observed in the pasta during storage. The values increased from 0.40% to 0.50% to 0.57% to eventually 0.79 % on zero day, thirty days, sixty days and ninety days, respectively. The results of an increase in the free fatty acid values is content is compiled in Table 3.

The oxidation of lipids was specified as the predominant factor affecting the textural parameters, apart from the alterations in the moisture content [10]. An increase in the free fatty acid content of pearl millet based pasta during storage i.e. from 0.48% to 0.82% was mentioned in a study [5].

Alike results were reported in the free fatty acid values of pasta, as a result of breakdown of lipids during the storage [11].

Table 3: Effect on free fatty acid of the developed pasta during the study period

S. No.	Treatment	Pasta	
		Mean	SD
1	0 day	0.40	0.02
2	30 days	0.50	0.01
3	60 days	0.57	0.07
4	90 days	0.79	0.01
	GM	0.56	0.15
	Se	0.02	
	CD5%	0.07	
	CD1%	0.10	
	CV	6.27	

Total Viable Count

Total viable counts were employed to assess the microbiological quality with respect to the extent of comprehensive microbial contamination. The counts in the pasta upon storage soared from 4.5 x 10^2 cfu / g to 1.8 x 10^4cfu / g on zero day to ninetieth day, respectively. The total viable counts of the developed pasta over the study period are consolidated in Table 4.

In another study, pasta was developed from geminated tiger nut flour, where they reported significant increase in the total viable counts in the control as well as the treatment, all

throughout their study period [12]. Similarly, an increase in the total viable counts in both the refined flour noodles and quality protein maize assimilated noodles, was also noticed [13]. All these outcomes reveal an increase in the total viable counts of the pasta, during storage.

Table 4: Effect on total viable count of the developed pasta during the study period

Developed Product	Total Viable Count on PCA (cfu/g)			
	0 day	30 days	60 days	90 days
Pasta	4.5×10^{2}	3.5×10^{3}	6.0×10^{4}	1.8×10^{4}

Despite an increase in the values of quality parameters, the developed pasta was acceptable at the end of storage period, as the values were still in the permissible limits, as per the standards [14].

CONCLUSION

Thus, the findings of the current research affirms that under – utilized species like proso millet and raw banana could be blended into shelf stable ready – to – eat and ready – to – cook food products. The conclusions of this research confer functional statistics about budding usages of millet flour and raw banana blends in the product formulations and development for innovative shelf stable convenience foods, with good nutritional value. Eventually, such products can induce and satisfy satiety – acclimatized diets, taste and enhance wholesome healthy exquisite food habits in the buyers. Thus, it can be deduced that development of convenience foods from different combinations of underutilized species can deal with cumbersome and time consuming food preparations at household levels along with a good shelf – life.

REFERENCES

[1] Ashoka, P., Gangaiah, B., Sunitha, N. Millets – foods of twenty first century. International Journal of Current Microbiology and Applied Sciences, 2020, **9**: 2404 – 2410. Doi:10.20546/ijcmas.2020.912.285

[2] Nazni, S. & Devi, S. Effect of processing on the characteristics changes in barnyard and foxtail millet. Journal of Food Processing and Technology, 2016, **7**: 1 – 9.

[3] Ramli, S. B., Alkarkhi, A. F. M., Yong, Y.S. & Easa, A. M. Physicochemical properties of banana peel flour as influenced by variety and stage of ripeness: multivariate statistical analysis. Journal of Agricultural Science and Technology, 2010, **4**: 1250 – 1259.

[4] Zhang, P. & Hamaker, B. R. Banana starch structure and digestibility. Carbohydrate Polymers, 2012, **87**: 1552 – 1558.

[5] Jalgaonkar, K., Jha, S. K., Nain, L. & Iquebal, M. A. Quality changes in pearl millet based pasta during storage in flexible packaging. Journal of Agricultural Engineering, 2017, **54** (3): 21 – 31.

[6] Yadav, D. N., Sharma, M., Chikara, N., Anand, T. & Bansal, S. Quality characteristics of vegetable blended wheat pearl millet composite pasta. Agricultural Research, 2014, **3** (3): 263 – 270.

[7] Kaur, G., Sharma, S., Nagi, H. P. S. & Dar, B. N. Functional properties of pasta enriched with variable cereal brans. Journal of Food Science and Technology, 2012, **49** (4): 467 – 474.

[8] Nagi, H. P. S., Kaur, J., Dar, B. N. & Sharma, S. Effect of storage period and packaging on the shelf life of cereal bran incorporated biscuit. American Journal of Food Technology, 2012, **7** (5): 301 – 310.

[9] Devi, G. S., Kumar, P. A. & Palanimuthu, V. Studies on development and storage of little millet based pasta. Madras Agricultural Journal, 2014, **101** (2): 96 – 101.

[10] Smith, J. P., Daifas, D. P., Khoury, E. W., Koukoutsis, J. & Khoury, E. A. Shelf life and safety concerns of bakery products – a review. Critical Reviews in Food Science and Nutrition, 2004, **44** (1): 19 – 55.

[11] Chaiyashit, W., Elias, R. J., Mcclements, D. J. & Decker, E. A. Role of physical structures in bulk oils on lipids oxidation. Critical Reviews in Food Science and Nutrition, 2007, **47**: 299 – 317.

[12] Fouad, M. T., Hussien, A. M. S. & El – Shenawy, M. A. Production of pasta using tiger – nut and fermented permeate with some probiotic bacteria. Egyptian Journal of Chemistry, 2022, **65** (4): 569 – 578.

[13] Vandana & Srivastava, S. Study on shelf life of QPM incorporated noodles. The Pharma Innovation Journal, 2020, **9** (12): 22 – 26.

[14] Food Safety and Standards (Packaging and Labelling) Regulations. Food Safety and Standards Authority of India. , 2011, Ministry of Health and Family Welfare.