The Bioscan 13(1): 05-08, 2018
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
www.thebioscan.com

CHEMICAL AND SENSORY EVALUATION OF FLAT BREAD SUPPLEMENTED WITH PEARL MILLET AND SOY PROTEIN ISOLATES

PARAMJOT KAUR, MONIKA SOOD* AND JULIE D. BANDRAL
Division of Food Science and Technology,
Faculty of Agriculture, SK University of Agricultural Sciences and Technology of Jammu ,Chatha, Jammu -180 009 (J&K)
e-mail: monikasoodpht@gmail.com

KEYWORDS
Pearl millet
Minerals
Polyphenols
Phytic acid
Sensory parameters

Received on :
18.05.2017

Accepted on :
24.02.2018

***Corresponding author**

ABSTRACT

In the present study flat bread was prepared by incorporation of 10, 20, 30 and 40 per cent of pearl millet flour with refined wheat flour and 10 per cent of soy protein isolates. The developed flat bread was stored for 18 days under refrigerated conditions to ascertain the changes in chemical and sensory characteristics. The magnesium content was observed maximum (116.56mg/100g) in T_1 (00: 100: 00:: pearl millet flour: refined wheat flour: soy protein isolates/whey protein isolates) whereas, T_6 (40:50:10:: pearl millet flour: refined wheat flour: soy protein isolates) recorded maximum calcium (43.93 mg/100g) and phosphorus content of 328.91mg/100g. Highest phytic acid content of 274.03 mg/100g and polyphenols content of 339.47 mg/100g were recorded in T_6 (40:50:10:: pearl millet flour: refined wheat flour: soy protein isolates) which differed significantly with rest of the treatments. There was a significant increase in free fatty acid content during 18 days of storage from 0.98 to 1.56 % as oleic acid. Thus on the basis of sensory evaluation (colour, texture and taste), the incorporation of pearl millet flour upto 20 % along with 10 % soy protein isolates were considered acceptable for development of flat bread.

INTRODUCTION

Composite flour technology refers to the process of mixing various cereal based flours to produce high quality food products in an economical way. Formulation of composite flour is vital for development of value-added products with optimal functionality. It has not only better nutritional quality but also the necessary attributes for consumer acceptance. The importance of coarse cereals in direct human consumption is declining even though poses good nutritive value.

Pearl millet (*Pennisetum glaucum*) is thus recognized as an important substitute for major cereal crops to cope up with world-wide food shortage and to meet the demands of increasing population of both developing and developed countries (Singh *et al.*, 2006 and Chouhan *et al.*, 2015). Pearl millet is locally known as *'bajra'* in India. It is the basic staple food in the poorest countries and used by the poor people. Pearl millet is rich in several nutrients as well as non-nutrients such as phenols. It has high energy and high fiber (1.2 per 100g, most of which is insoluble), 8-15 times greater alpha amylase activity as compared to wheat, has low glycemic index (55) and is gluten free. The protein content ranges from 7.02 to 13.67 per cent and it is low in lysine, tryptophan, threonine and sulphur-containing amino acids. The mineral content in pearl millet is higher than other cereals (Taylor, 2004). As a food source, it is non- glutinous and non-acid forming, so it is soothing and easy to digest. Pearl millet can be recommended in the treatment of celiac diseases, constipation and several non-communicable diseases (Nambiar *et al.*, 2011). In his review Rai *et al.* (2008) stated that the amino acid composition has significant effect on the nutritional quality of protein. The amino acid profile of pearl millet is better than that of sorghum and maize and is comparable to wheat, barley and rice. In an another review, Dykes and Rooney (2007) examined that pearl millet is rich in oil and linoleic acid accounts for 4 per cent of the total fatty acids in this oil, giving it a higher percentage of n-3 fatty acids as compared to maize in which linoleic acid accounts for only 0.9 per cent of the total fatty acids and hence, is highly deficient in n-3 fatty acids. The n-3 fatty acids play an important role in many physiological functions, including platelet aggregation, Low Density Lipid cholesterol accumulation and the immune system.

Cereal grains, including wheat are low in protein and are deficient in some amino acids such as lysine and certain other amino acids (Kumar and Kumar, 2011). However, legumes are higher in proteins (18 to 24 per cent) than cereal grains and can be used to support certain amino acids such as lysine, tryptophan or methionine (Rababah *et al.*, 2006). Therefore, soy protein is preferred because of its low cost, accessibility, widely varying functional properties and high content of good quality protein. Of all soy protein products, soy protein isolates (SPI) has the mildest flavour, higher protein content (90 per cent) and a good balance of amino acid patterns. It is highly recommended for solving protein-malnutrition in developing countries, as an expensive high protein resource. The present investigation, therefore, was undertaken to expand the utility of pearl millet through value addition and to ascertain the chemical and sensory characteristics of developed flat bread.

MATERIALS AND METHODS

The pearl millet grains were obtained in a single lot from the Dryland Research Sub Station, Dhiansar, SKUAST-Jammu. The grains were sorted, milled and were ground to flour and used for further product development. On the other hand, the refined wheat flour was procured from market and was blended with pearl millet flour along with soy protein isolates to make protein enriched products. This composite flour mixture was used for development of flat bread. The flat bread was prepared by incorporation of 10, 20, 30 and 40 per cent of pearl millet flour with refined wheat flour and 10 per cent of soy protein isolates.

Treatment details

Treatments	% Pearl Millet Flour	%Refined Wheat Flour	% Soy Protein Isolates
T_1	0	100	0
T_2	0	90	10
T_3	10	80	10
T_4	20	70	10
T_5	30	60	10
T_6	40	50	10

For the preparation of flat-bread, yeast was mixed in luke warm water and sugar solution was dissolved in the yeast. The dough was made and kept for fermentation for 5-6 hours. Then again mixed and baked after proofing. The process for preparation of flat bread was standardized in the laboratory as per the method given by Dogra *et al*. (2001). The treatment combinations of prepared flat-bread were packed in polyethylene pouches (150 gauge) and then stored for a period of 18 days at refrigerated conditions. The stored products were analyzed for physico-chemical changes and sensory characteristics at an interval of 6 days.

Minerals (AOAC, 2005)

The organic matter present in the sample (1g) was wet digested with 25 ml of diacid mixture (HNO_3 : $HClO_4$ in 5:1) and kept overnight. Digestion was done next day by heating till clear white precipitates settled down at the bottom. The crystals were dissolved by diluting in double distilled water. The contents were filtered through Whatman filter paper no. 42. The filtrate was made upto the volume of 25 ml with double distilled water. The digested samples were analysed for the determination of magnesium, phosphorus and calcium using Atomic Absorption Spectrophotometer.

Antinutritional factors

Phytic acid content was estimated by known method of Sadasivam and Manickam (2005). The colour intensity was read to 480 nm. Polyphenols were estimated by the method of Sadasivam and Manickam (2005). Absorbance was measured at 650 nm against a blank. A standard curve was prepared using different concentrations of catechol.

Free Fatty Acid (AACC, 2000)

Ground sample (5 g) was taken to determine the free fatty acids. To the sample in stoppered flask benzene (50 ml) was added and kept for 30 minutes with frequent shakings. After filtration, measured aliquot (10 ml) of supernatant liquid was added with equal amount of alcohol (95 per cent) and few drops of indicator and titrated against 0.02 N KOH till permanent pale colour persisted. Results were expressed as per cent oleic acid

Sensory evaluation

Sensory evaluation depends upon the responses given by different sense organs. The samples were evaluated on the basis of colour, texture and taste by semi-trained panel of 7-8 judges by using 9 point hedonic scale assigning scores 9- like extremely to 1- dislike extremely. A score of 5.5 and above was considered acceptable (Amerine *et al*., 1965).

Statistical analysis

The data obtained were statistically analyzed using completely randomized design (CRD) and CRD factorial for interpretation of results through analysis of variance. Each value was mean of three replications. Data was compared at 5 per cent level of significance.

RESULTS AND DISCUSSION

Storability of composite flour blended flat bread

Minerals

There was a significant decrease in the mineral content during 18 days of storage (Table 1). Among various treatments, T_6 recorded the lowest magnesium content of 104.65 (mg/100g) followed by T_5 having magnesium content of 108.78 (mg/100g) at 0 day storage. However, after 18 days of storage, highest phosphorus content of 328.10 (mg/100g) was recorded by treatment T_6 followed by T_5 with phosphorus content of 327.76 (mg/100g). The highest mean calcium content of 43.93 (mg/100g) was recorded by treatment T_6 and the lowest mean calcium content of 39.59 (mg/100g) was recorded by treatment T_1.

The increase in calcium and phosphorus with the incorporation of pearl millet flour might be due to the high content of these minerals in pearl millet flour when compared with refined wheat flour. These results are in conformity with the findings of Natal *et al*. (2013) in potato breads fortified with soy flour.

Antinutritional factors

Phytic acid content significantly increased in all the treatments with the increase in the percentage of pearl millet flour (Table 2). The highest mean phytic acid content after 18 days of storage was recorded in T_6 and lowest in T_2. However, phytic acid content decreased with the advancement of the storage period. The decrease in phytic acid during baking and storage might be due to the hydrolysis of phytic acid, enzymatically to phytases or chemically to lower inositol phosphates such as inositol pentaphosphate (IP5), inositol tetraphosphate (IP4), inositol triphosphate (IP3) and possibly the inositol di and mono phosphate (Burbano *et al*., 1995). Similar results were found during bread-making in which phytic acid content decreases due to the action of phytases as well as the high temperature (Plaami, 1997). The present results are in accordance with the findings of Christine *et al*. (2012) in wheat-beniseed composite flour bread.

Table 1: Effect of treatments and storage period on mineral content (mg/100g) of composite flour blended flat bread

Treatments	Magnesium Storage period (days) 0	6	12	18	Mean	Phosphorus Storage period (days) 0	6	12	18	Mean	Calcium Storage period (days) 0	6	12	18	Mean
T_1	117.28	116.85	116.23	115.90	116.56	310.23	309.35	309.03	308.82	309.36	40.08	39.67	39.54	39.06	39.59
T_2	115.53	115.00	114.46	114.01	114.75	326.86	326.68	326.47	326.20	326.55	42.24	42.01	41.86	41.75	41.97
T_3	113.57	112.98	112.16	111.73	112.61	327.32	327.00	326.73	326.52	326.89	43.03	42.80	42.63	42.19	42.66
T_4	111.63	111.02	110.58	109.94	110.79	328.00	327.85	327.63	327.31	327.70	43.97	43.75	43.58	43.20	43.62
T_5	108.78	108.01	107.88	106.72	107.85	328.56	328.29	327.94	327.76	328.14	44.17	43.98	43.60	43.37	43.78
T_6	104.65	103.98	102.53	101.07	103.06	329.67	329.15	328.72	328.10	328.91	44.29	44.01	43.82	43.59	43.93
Mean	111.91	111.31	110.64	109.89		325.11	324.72	324.42	324.12		42.96	42.70	42.50	42.19	

	CD (P= 0.05)	CD (P= 0.05)	CD (P= 0.05)
Treatments	1.66	0.82	0.89
Storage	1.35	0.67	0.72
Treatments × Storage	N.S.	N.S.	N.S.

Table 2: Antinutritional factors (mg/100g) and free fatty acid (% as oleic acid) content of composite flour blended flat bread during storage

Treatments	Phytic acid Storage period (days) 0	6	12	18	Mean	Polyphenols Storage period (days) 0	6	12	18	Mean	Free fatty acid Storage period (days) 0	6	12	18	Mean
T_1	241.99	240.88	237.91	232.74	238.38	247.79	243.52	238.35	230.65	240.08	0.20	0.42	0.67	0.89	0.55
T_2	239.97	238.00	235.98	230.77	236.18	243.83	242.98	237.01	230.17	238.49	0.80	0.90	1.08	1.17	0.99
T_3	244.03	243.97	241.86	240.69	242.39	269.52	267.87	265.54	260.24	265.79	1.03	1.21	1.40	1.57	1.30
T_4	252.58	251.22	249.34	247.18	250.08	300.84	297.73	294.30	291.16	296.01	1.11	1.34	1.58	1.79	1.46
T_5	263.97	262.04	259.72	256.96	260.67	328.13	326.58	322.55	317.17	323.61	1.27	1.50	1.71	1.93	1.60
T_6	277.70	275.42	272.76	270.24	274.03	343.76	341.98	338.56	333.59	339.47	1.46	1.63	1.82	2.01	1.73
Mean	253.37	251.76	249.60	246.43		288.98	286.78	282.72	277.16		0.98	1.17	1.38	1.56	

	CD (P= 0.05)	CD (P= 0.05)	CD (P= 0.05)
Treatments	1.63	1.66	0.02
Storage	1.33	1.35	0.01
Treatments × Storage	N.S.	N.S.	0.03

Table 3: Effect of treatments and storage period on sensory scores of composite flour blended flat bread

Treatments	Colour Storage period (days) 0	6	12	18	Mean	Texture Storage period (days) 0	6	12	18	Mean	Taste Storage period (days) 0	6	12	18	Mean
T_1	8.98	8.96	8.95	8.93	8.95	8.44	8.41	8.39	8.35	8.40	8.25	8.18	8.13	8.10	8.16
T_2	8.90	8.87	8.86	8.85	8.87	8.26	8.20	8.17	8.14	8.19	8.20	8.17	8.11	8.09	8.14
T_3	8.79	8.71	8.67	8.61	8.70	8.12	8.06	8.04	7.99	8.05	8.16	8.13	8.07	8.01	8.09
T_4	8.19	8.03	7.98	7.91	8.03	8.08	8.02	8.01	7.96	8.02	8.00	7.93	7.85	7.77	7.89
T_5	7.02	6.89	6.71	6.62	6.81	6.89	6.79	6.69	6.61	6.74	6.95	6.83	6.79	6.70	6.82
T_6	6.54	6.48	6.42	6.38	6.45	6.54	6.46	6.41	6.34	6.44	6.79	6.73	6.69	6.67	6.72
Mean	8.07	7.99	7.93	7.88		7.72	7.66	7.62	7.57		7.72	7.66	7.61	7.56	

	CD (P= 0.05)	CD (P= 0.05)	CD (P= 0.05)
Treatments	0.02	0.02	0.02
Storage	0.02	0.01	0.02
Treatments × Storage	0.04	0.04	0.04

Polyphenols are secondary metabolites of plants and are termed as anti-nutritional factors earlier, but now-a-days, they are considered as phyto-chemicals. Polyphenol content increased significantly (Table 2) from the mean value of 238.49 mg per 100g in treatment T_2 to 339.47 mg per 100g in treatment T_6. However, there is a decrease in the polyphenol content (288.98 to 277.16 mg/100 g) during the storage period from 0 to 18 days. Similar results in polyphenol content of breads prepared from wheat and various cereal-pulse blends have been reported by Dhingra and Jood (2001). A decrease in polyphenol content during storage in mungbean supplemented noodles have also been reported by Slathia (2014).

Free Fatty Acid

There was a significant increase in free fatty acid content during 18 days of storage from 0.98 to 1.56 per cent as oleic acid (Table 2). Treatment T_6 observed maximum increase in free fatty acid content, however, minimum value was observed in T_1. The increase in free fatty acid content of flat bread might be due to greater increase in their moisture content which promoted fat oxidation during storage, thereby increasing the acidity. Increase in free fatty acid might also be due to the formation of secondary oxidative products levelling from the breakdown of hydrogen peroxide with increase in moisture (Seiza *et al.*, 2006).

Sensory evaluation of composite flour blended flat bread

The sensory scores for colour decreased significantly in all the treatments after 18 days of storage (Table 3). The highest mean score for colour was 8.95 in T_1 followed by T_2. The colour score also declined with the increase in percentage of incorporation of pearl millet flour. This might be attributed to the higher concentration of pearl millet flour which imparted darker colour to the product or may be due to the caramelization and maillard's reaction as the protein contributed by soy protein isolates must have reacted with sugar during the baking process. Ndife *et al*. (2011) reported similar results in soy fortified breads.

Good texture indicates good quality. A general decrease in texture was observed during storage (Table 3). The highest mean score of 8.40 was observed in treatment T_1 and lowest 6.44 was observed in treatment T_6. This might be due to the presence of soy protein isolates which affected the texture (Channgern and Suriyaphan, 2011). Similar results have been reported by Ballolli (2010) in barnyard millet cookies.

A significant decrease was observed in taste scores with the advancement in storage period as well as with the incorporation of pearl millet flour (Table 3). The highest mean score of 8.16 for taste was observed in treatment T_1 and lowest 6.82 was observed in treatment T_6. Singh *et al*. (2006) reported similar results in pearl millet blended cake.

REFERENCES

AACC. 2000. *Approved Methods of American Association of Cereal Chemists*. 10th edition, AACC international, Saint Paul, Minnesotea, U.S.A.

Amerine, M. A., Pangborn, R. H. and Roseler, E. B. 1965. *Principles of sensory evaluation of food.* Academic press,New York. pp. 23-45.

AOAC. 2005. *Official Methods of Analysis.* 17th edition. Association of Official Analytical Chemists. *Washington. DC.*

Ballolli, U. 2010. Development and value addition to barnyard millet (*Echinochloa frumantacea)* cookies. *M.Sc. thesis, University of Agricultural Sciences, Dharward.*

Burbano, C., Muzquiz, M., Osae, A., Ayet, G. and Cuadrado, C. 1995. Determination of phytate and lower inositol phosphates in spanish legumes by HPLC methodology. *Food Chem*. **52:** 321-325.

Channgern, C. and Suriyaphan, O. 2011. Texture and sensory qualities of steam cake containing soy protein isolate. *M.Sc. thesis , Burapha University, Chonburi.*

Chouhan, M. Gudadhe, N. N., Kumar Dinesh, Kumawat A. K. and Kumar, R. 2015. Transplanting dates and nitrogen levels influences on growth, yield attributes and yield of summer pearl millet. *The Bioscan*. **10(3):** 1295-1298.

Christine, E. I., Christopher E. and Godwin, I. 2012. Nutritional and organoleptic properties of wheat (*Triticum aestivum)* and beniseed (*Sesame indicum*) composite flour baked foods. *J. Food Res.* **1(3):** 84-91.

Dhingra, S. and Jood, S. 2001. Organoleptic and nutritional evaluation of wheat breads supplemented with soybean and barley flour. *Food Chem.* **77:** 479-488.

Dogra, J., Dhaliwal, Y. S. and Kalia, M. 2001. Effect of soaking, germination, heating and roasting on the chemical composition and nutritional quality of soybean and its utilization in various Indian leavened products. *J. Food Sci. Technol.* **38(5):** 453-457.

Dykes, L and Rooney, L. W. 2007. Phenolic compounds in cereal grains and their health benefits. *Cereal Food World*. **52:**105-111.

Kumar, T. P. and Kumar, J. B. 2011. Quality evaluation of dosa from millet blend incorporated composite flour. *Elixir Food Sci.* **34:** 2624-2629.

Nambiar, V. S., Dhaduk, J. J., Neha, S., Desai, Shahu and Rujuta, D. 2011. Potential functional implications of pearl millet *(Pennisetum glaucum*) in health and disease. *J. Applied Pharmaceutical Sci.* **10:** 62-67.

Natal, D. I. G., De Souza Dantas, M. I., Ribeiro Vidigal, M. C. T., Rocha Ribeiro, S. M., Silva, R. R. and Duarte Martino, H. S. 2013. Physical and sensorial properties of potato breads fortified with whole soybean flour. *Revista Chilena de Nutricion.* **40(1):** 62-70.

Ndife, J., Abdulraheem, L. O. and Zakri, U. M. 2011. Evaluation of the nutritional and sensory quality of functional breads produced from whole wheat and soya bean flour blends. *African J. Food Sci.* **5(8)**: 466-472.

Plaami, S. 1997. Myoinositol phosphates, analysis, content in foods and effect in nutrition. *Lebensmittel-Wissenschaft and Technologie*. **30:** 633-647.

Rababah, T. M., Majidi, A., Al-Mahasneh, M. A. and Ereifej, K. I. 2006. Effect of chickpea, broad bean, or isolated soy protein additions on the physicochemical and sensory properties of biscuits. *J. Food Sci.* **71(6):** S438-S442.

Rai, K. N., Gowda, C. L. L., Reddy, B. V. S. and Sehgal, S. 2008. Adaptation and potential uses of sorghum and pearl millet in alternative and health foods. *Comp. Rev. Food Sci. Food Safety.* **7:** 340-352.

Sadasivam, S. and Manickam, A. 2005. *Biochemical methods*, New age international private limited, New Delhi, pp. 8-9, 20-21 and 56-57.

Seiza, A. A., Abdullah, A. and Idris, N. A. 2006. Changes of β-carotene content during heating of red palm olein. *J. Palm Oil Res. Special issue.* pp. 99-102.

Singh, G., Sehgal, S. and Kawatra, A. 2006. Sensory and nutritional evaluation of cake developed from blanched and malted pearl millet. *J. Food Sci. Technol.* **43(5):** 505-508.

Slathia, N. 2014. Effect of supplementation of mungbean on quality attributes of composite flours. *M.Sc. thesis. SK University of Agricultural Sciences and Technology of Jammu.*

Taylor, J. R. N. 2004. *Encyclopedia of Grain Science. Elsevier Academic* Press. London. pp. 253-268.