

Development and physico-chemical properties of pearl millet spicy cookies

K. DEEPA AND KASHIBAI KHYADAGI

Department of Food Science and Nutrition, College of Rural Home Science
University of Agricultural Sciences, Dharwad - 580 005, Karnataka, India
E-mail:deepakatralli@gmail.com

(Received: August, 2016 ; Accepted: March, 2017)

Abstract: Pearl millet is the second largest growing crop among millets. It is highly nutritious, with good quality protein, adequate fat, micronutrients, vitamins, insoluble dietary fiber and phytonutrients. Study was undertaken to develop acceptable pearl millet spicy cookies. Two pearl millet varieties (Market sample and GHB variety) were taken for the cookies preparation and refined wheat flour as control. Standardization of spicy pearl millet cookies at different proportion level revealed that 25 per cent was found highly acceptable and physical characteristics of cookies showed that for weight, volume, bulk density and spread ratio there was no significant differences were noticed among both pearl millet varieties. Pearl millet cookies had more weight, spread ratio and little harder texture than control (refined wheat flour cookies). Organoleptic evaluation of spicy cookies had no significant differences for all sensory attributes in both pearl millet spicy cookies and control cookies indicating pearl millet spicy cookies were on par with the refined wheat flour cookies (control). Proximate composition and minerals such as calcium iron and zinc content was high in pearl millet cookies compared to refined wheat flour cookies.

Key words: Pearl millet, Characteristics, Organoleptic, Spicy cookie

Introduction

Millets are called as future food as they contribute to multiple securities of food, nutrition, health, livelihood, fodder and ecology. Among millets, pearl millet is the second largest growing crop. The characteristics of adoption to environmental stress and good nutritional features combined with yield potential make pearl millet (*Pennisetum glaucum*) an important cereal crop to address the emerging challenges of global warming, water shortages, land degradation and food related health issues. It is the rich source of fibre and minerals especially iron, calcium, zinc and high in fats among cereals and hence can provide all the nutrients at the least cost compared to wheat and rice (Singh, 2012).

Large share of pearl millet is consumed by the rural and urban poor, while it forms a small share in the basket of high income consumers, as it is rated as inferior grain and considered as poor people's food. However, during the last two decades it is becoming less important as staple food because demand for coarse cereals like pearl millet and sorghum as human food is decreasing in many countries, due to increased production and availability of preferred cereals (such as rice and wheat) at subsidized prices, rising income, rapid urbanization, and change in food habits. In order potential use of nutritious pearl millet possible alternative awareness are preparations of convenience processed foods like bakery products (Yadav *et al.*, 2011). Bakery products have become essential food items of the vast majority of population and still remain the cheapest of the processed ready to eat products in the country. The demand for bakery products will continue to increase in future. Hence they are concerns and monitor dietary habits. Baked products such as cookies are very popular among all age groups, especially with children. Cookies hold a significant place in the baking industry due to variety in taste, texture and aroma. Cookies are low moisture, foods with longer shelf life, generally prepared out of refined wheat flour, fat and sugar. Cookies are

high fat - food products and obtain texture and flavour characteristics from the shortening used in the preparation of cookies (Florence *et al.*, 2014). Therefore to improve cookies nutritive value, there is a need for replacing refined wheat flour with flour of better nutritive quality like pearl millet flours. Hence study was undertaken to develop pearl millet spicy cookies.

Material and methods

The present study was conducted in the year 2015-16. The pearl millet GHB variety grown in Regional Agricultural Research Station, Vijayapur, University of Agricultural Sciences, Dharwad during *rabi* season was procured for investigation. The commercially available Pearl millet sample and all other raw materials for cookies preparation were purchased from local market Dharwad. Two pearl millet varieties (Market sample and GHB variety) were taken for the cookies preparation and refined wheat flour as control.

Cookies were prepared by replacing refined wheat flour in different level of incorporation of pearl millet flour in 100:0, 75:25, 50:50 and 25:75 (Refined wheat flour: pearl millet flour) proportion. Refined wheat flour cookie (100:0) was taken as control. Cookies were manually prepared by following traditional creamy method and baked in a commercial baking oven with top temperature of 180°C and bottom temperature of 150°C for 25 minutes. Among all proportion 75:25 (refined wheat flour: pearl millet flour) incorporation was found highly acceptable. The highly acceptable cookie was further taken for varietal suitability (market sample and GHB variety), physical characteristics, quality analysis- proximate and micro minerals.

Physical characteristics of cookies for weight, height, volume, thickness, width, bulk density, spread ratio and spread factor were studied by using standard procedures (Anon., 1983). The cookies colour was recorded by visual observation.

Hardness texture of cookies were analyzed by using Texture Analyzer (TA.XT2, Table Microsystem and Survey, UK) and exponent software and measured in gram force (g force).

Cookies were subjected to organoleptic evaluation for sensory quality parameters such as appearance, colour, texture, taste, flavour and overall acceptability on nine point Hedonic scale by 20 semi trained judges comprising of staff and students of Department of Food Science and Nutrition, College of Rural Home Science, University of Agricultural Sciences, Dharwad, Karnataka. The moisture, fat, protein, crude fibre and total minerals content of cookies were estimated by following the standard procedure (Anon., 2005). Total carbohydrate content was calculated by difference method. The trace minerals (iron and zinc) were estimated by using the Atomic Absorption Spectrophotometer. The calcium content of cookies was analyzed by titrimetric method.

Results and discussion

Physical characteristics of spicy cookies are presented in Table 1. Visual observation of spicy cookies prepared from refined wheat flour were light yellow greenish in colour, where as pearl millet cookies exhibited dark greenish. Dough consistency of refined wheat flour was soft and stretchable, where as pearl millet dough was rough and less stretchable. The weight, volume, bulk density and spread ratio of cookies were depicted no significant difference among both pearl millet varieties spicy cookies. Pearl millet cookies had more weight, spread ratio and little harder texture than refined flour cookies. This might be due to the higher protein and crude fiber content of pearl millet flour than the refined flour. Market sample pearl millet flour cookies exhibited significantly higher height and width (4.05 cm and 5.01 cm) while, GHB variety spicy cookies had higher hardness (89.31 g force) this may be due to high protein (9.90 g %) content of GHB variety compared to the market sample pearl millet (8.87 g).

Mean organoleptic score of spicy cookies (Table 2) revealed that, overall acceptability scores of control spicy cookies were liked very much (8.5) where as pearl millet spicy cookies liked moderately (7.8 and 8.0) for all sensory parameters this may be due to dark grey colour of the grain. The high protein and fiber

content of grains made pearl millet cookies slightly hard in texture and cracks on surface of cookies that affected texture quality compared to control cookies which had soft texture and less hard. However there was no significant difference was noticed for all sensory attributes of cookies and all were acceptable (>7). Ranasalva and Visvanathan (2014) noticed incorporation of 50 per cent fermented pearl millet flour in cookies had better quality and fermentation of pearl millet reduced dark grey colour of pearl millet and enhanced the colour and acceptability of cookies. When cookies from two pearl millet varieties GHB and market sample were compared, there was non-significant difference was noticed for all sensory parameters. Among two pearl millet varieties, market pearl millet sample was more acceptable with more mean overall acceptability score for spicy cookies this could be due to the market sample was hybrid variety that influenced the taste and flavor of cookies. It can be concluded that the mean overall acceptability of pearl millet varieties was less compared to control spicy cookies however all cookies were acceptable with score >7.8.

The nutrient composition of pearl millet spicy cookies (Table 3) revealed that moisture content of GHB variety cookies (2.26 %) was significantly lower than market sample (2.54 %). The fat content was found high in market sample (25.51 %) than the refined wheat flour cookies (23.33 %) this could be due to presence of more invisible fat in pearl millet. The protein content was significantly high in GHB cookies (9.90 %) than the refined wheat flour cookies (8.22 %). Market sample pearl millet spicy cookies exhibited higher ash and crude fibre (1.31 % and 1.70 % respectively) content compared to GHB variety (1.29 % and 1.34 % respectively) and control cookies (1.18 % and 1.22 % respectively). Higher ash and crude fibre content in pearl millet spicy cookies may be due to high fiber content of pearl millet and addition of fibrous ingredients (curry leaves and coriander leaves). Pearl millet spicy cookies had higher energy than the refined wheat flour cookies (497 Kcal).

The mineral content of spicy cookies revealed that (Table 4) pearl millet cookies had significantly higher content of calcium and iron than control cookies. Calcium and iron content was high in market sample pearl millet spicy cookies (36.06 mg and 3.46 mg respectively). Mineral content was found high in both

Table 1. Physical characteristics of spicy cookies prepared from different types of pearl millet flour

Parameters	Refined wheat flour sample	Pearl millet market variety	Pearl millet GHB	F- value	S.Em ±	C.D.
Cookies colour	Light greenish yellow	Dark greenish yellow	Dark greenish yellow	-	-	-
Weight (g)	10.93 ± 0.32	11.21 ± 0.45	10.98 ± 0.49	1.374	0.20	NS
Height (cm)	3.86 ± 0.51	4.05 ± 0.05	3.81 ± 0.04	37.045	0.03	0.06**
Width (cm)	5.00 ± 0.51	5.01 ± 0.40	4.85 ± 0.08	16.324	0.07	0.07**
Thickness (cm)	5.33 ± 0.51	5.33 ± 0.51	5.16 ± 0.04	0.236	0.068	0.05*
Volume (ml)	14.33 ± 0.98	14.33 ± 0.98	14.26 ± 0.99	0.002	0.315	NS
Bulk density (g/cm ³)	0.76 ± 0.05	0.80 ± 0.05	0.76 ± 0.08	0.721	0.078	NS
Spread ratio (cm)	20.66 ± 1.00	21.13 ± 0.98	21.00 ± 0.87	0.110	0.414	NS
Spread factor	-	89.36	89.37	-	-	-
Hardness (g force)	1.01 ± 0.11	1.57 ± 0.24	1.70 ± 0.66	89.319	0.138	0.24**

** Significant at 1 % level, NS- Non significant,

Refined wheat flour - Control

Note: 25 per cent of pearl millet flour incorporation

* Significant at 5 % level

Table 2. Organoleptic scores of spicy cookies prepared from different types of pearl millet flour

Type	Appearance	Colour	Texture	Taste	Flavour	Overall acceptability
Refined wheat flour	8.7 ± 0.42	8.6 ± 0.42	8.5 ± 0.69	8.5 ± 0.48	8.5 ± 0.48	8.5 ± 0.48
Pearl millet market sample	8.3 ± 0.82	8.3 ± 0.67	7.8 ± 0.75	8.1 ± 0.89	7.9 ± 0.56	8.0 ± 0.15
Pearl millet GHB Variety	8.2 ± 0.78	8.3 ± 0.67	7.5 ± 0.57	7.9 ± 0.84	7.8 ± 0.89	7.8 ± 0.42
F- value	2.098	2.296	4.448	4.707	5.169	8.631
S.Em ±	0.17	0.16	0.20	0.18	0.19	0.17
C.D.	NS	NS	0.90*	NS	NS	0.61*

NS- Non significant Refined wheat flour - Control * Significant at 5 % level

Note: 25 per cent of pearl millet flour incorporation

Table 3. Nutrient composition of spicy cookies prepared from different types of pearl millet flour (g/100 g)

Variety	Moisture	Fat	Protein	Crude fibre	Ash	CHO	Energy Kcal
Refined wheat flour	2.36	23.33	8.22	1.22	1.18	63.67	498
Pearl millet market sample	2.54	25.51	8.87	1.70	1.31	60.08	505
Pearl millet GHB variety	2.26	25.44	9.90	1.34	1.29	59.74	507
F- value	102.51	879.02	63.323	73.090	24.431	343.97	547
S.Em ±	0.08	0.14	0.22	0.11	0.09	0.23	0.32
C.D.	0.04**	0.14**	0.36**	0.10**	0.06**	0.40**	0.77**

** Significant at 1 % level Refined wheat flour - Control

Note: 25 per cent of pearl millet flour incorporation

pearl millet spicy cookies. Among two pearl millet varieties cookies, pearl millet market sample exhibited slightly high mineral content. Increase in the mineral content of pearl millet cookies was due to replacement of refined wheat flour with high mineral content of pearl millet flour (Table 4) (Florence *et al.*, 2014), which increased the mineral content in the cookies. Pearl millet cookies had high calcium content than the refined wheat flour (control) cookies, this may be due to high calcium content of pearl millet. The calcium content of pearl millet cookies observed were similar to little millet substituted biscuits (Amutha *et al.*, 2006).

Overall acceptability of refined wheat flour spicy cookies was high where as pearl millet spicy cookies scored less for all sensory parameter. However there was no significant difference was noticed for all sensory attributes of both pearl millet spicy cookies and control cookies and pearl millet cookies were on

Table 4. Mineral content of spicy cookies prepared from different types of pearl millet flour (mg/100 g)

Variety	Calcium	Iron	Zinc
Refined wheat flour	16.03 ± 0.00	2.50 ± 0.12	0.30 ± 0.001
Pearl millet market sample	36.06 ± 0.04	3.46 ± 0.04	0.32 ± 0.009
Pearl millet GHB variety	34.06 ± 0.07	2.71 ± 0.04	0.31 ± 0.002
F- value	7.850	72.983	5.671
S.Em ±	0.03	0.08	0.03
C.D.	0.01**	0.15*	NS

** Significant at 1 % level,

* Significant at 5 % level,

NS- Non significant

Refined wheat flour - Control

Note: 25 per cent of pearl millet flour incorporation

par with the refined wheat flour cookies (control). Pearl millet cookies were rich in all nutrients (protein, crude fiber, ash calcium, iron and zinc) content compared to refined wheat flour (control).

References

- Amutha, G. H., Malathi, D., Vivekanadan, P. and Rajaman, G., 2006, Selected functional properties, proximate composition of flours and sensory characteristics of cookies from wheat and millet- pigeon pea flour blends. *Trop. Agric. Res.*, 32 (18): 54-61.
- Anonymous, 1983, Official Methods of Analysis, 8th edition, Association of Official Analytical Chemists, Washington, D. C.
- Anonymous, 2005, Official Methods of Analysis, 18th edition, Association of Official Analytical Chemists, Washington, D. C.
- Florence, S. P., Urooj, A., Asha, M. R. and Jyotsna, R., 2014, Sensory, physical and nutritional qualities of cookies prepared from pearl millet. *J. Food Process. Technol.*, 5 (10): 78-91.
- Ranasalva, N. and Visvanathan, R., 2014, Development of cookies and bread from cooked and fermented pearl millet flour. *African J. Food Sci.*, 8(6): 330-336.
- Singh, N. B., 2012, Products, diversification, marketing and price discovery of pearl millet in India: *National Rain Fed Authority* (Ed. Saini, R. S.), NASC complex, DPS Marg, New Delhi, pp. 21-22.
- Yadav, D. N., Balasubramanian, S., Kaur, J., Anand, T. and Singh, A. K., 2011, Optimization and shelf-life evaluation of pearl millet based *halwa dry mix*. *J. Food Sci. Engg.*, 1 (7): 313-322.