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Evaluation of Nutrient Content in crunchy bar developed from Popped Pearl Millet (*Pennisetum glaucum*)

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ABSTRACT

The present study aimed at making the millets available to people in ready-to-eat form with some enhanced nutritional properties. A bar was developed through popping processing using pearl millet as main ingredient. The breakfast cereal was prepared by heating, mixing and cooling popped pearl millet, popped amaranth, puffed Bengal gram, flax seeds, sunflower seeds, raisins , and sugar. The product was found to have 10.84 % protein, 4.39% fat, 5. 43% fibre, 3.17 mg/100g zinc, 5.13 mg/100g iron and 215.63 mg /100g phosphorus. The popped pearl millet bar developed in the present study was nutritionally superior and can be used as a novel product. Therefore, it could be concluded that pearl millet grain has a wide range of opportunity for utilization in production of ready-to-eat, nutritionally rich cereal bar products along with better sensory qualities, which on commercial scale may open new avenues for better marketing and utilization of this important but underutilized grain.
Government decides to declare Year 2018 as "National Year of Millets" Production of Millets will definitely help in providing nutritional security & preventing malnutrition, especially to the poor: Shri Radha Mohan Singh

KEYWORD
Pearl Millet, Nutrient ready-to-eat

INTRODUCTION

Production of food grains has achieved new heights in the country. A greater stress is now on development of suitable practices for reduction of post - harvest losses and on value addition. The farmers are currently getting little profit from their produce for their inability to either store or to process the produce into value added products. At the same time, the problem of malnutrition in the country is huge. According to the World Bank estimates, India is one of the highest ranking countries in the world in terms of the number of children suffering from malnutrition (http://en.wikipedia.org/wiki/Malnutrition_in_India). The pattern of preparation and consumption of foods have been radically changing and demand for ready-to-eat, instant and synthetic foods is continuously increasing. This hassled to development of varieties of food items which are convenient to use and are therefore gaining ever increasing popularity. Development of nutritional and healthy food products with suitable combination of vast range of available ingredients will go a long wayin alleviating the problem of malnutrition in the country.

Pearl millet *(Pennisetum glaucum (L.) R. Br.)* originated in Central tropical Africa and is widely distributed in the drier tropics and India. It was introduced into the Western state in the 1850's and became established as minor forage in the Southeast and Gulf Coast states. The plant was probably domesticated as a food crop some 4000 to 5000 years ago along the Southern margins of the Central highlands of the Sahara. It has since become widely distributed across the semiarid tropics of Africa and Asia. Pearl millet has traditionally been an important grain, forage, and stover crop primarily in the arid and subtropical regions of many developing countries. As pearl millet cultivation expands into non-traditional areas in temperate and developed countries, production constraints from diseases are assuming greater importance. Dissemination of accurate information on diseases of the crop has not kept pace with the increased interest in pearl millet as a viable crop in non-traditional areas. Pearl millet is well adapted to growing areas characterized by drought, low soil fertility, and high temperature. It performs well in soils with high salinity or low pH Because of its tolerance to difficult growing conditions, it can be grown in areas where other cereal crops, such as maize or wheat, would not survive. It is hence recognized as an important crop in meeting the nutritional demands of an increasing population. It constitutes an important source of dietary calories, protein and micronutrients. It is rich in vitamins, potassium, phosphorus, magnesium, iron, zinc, copper and manganese. The photochemical like tannins, phytates (Onyango *et al.*, 2013) act as antioxidant properties. It has low glycaemic index, small amount of flavonoids are present and it is gluten free millet. Traditionally millets are pulverized to whole meal and are used in the form of unleavened pancake, dumpling, thin porridge etc.; however, processing and diversification of this millet for other food uses and value added products has not been fully exploited. Even though potential of this millet for preparation of ready-to-eat foods exists very little effort has gone on this aspects of millet. Processing of expanded or puffed cereals has been known since several centuries.

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Methods involving high temperature short time treatments have been applied to prepare puffed or popped or expanded cereals and legumes. Puffing gelatinizes the starch and produces ready-to-eat products and such products are commonly used as snack, breakfast food or as key ingredients in snack formulations. Popped cereals or millets are crisp and crunchy foods with desirable aroma and are highly appreciated for their lightness and adaptable for mixes. (Malleshi and Desikachar, 1981; Chandrasekhar and Chattopadhyay, 1990; Mariotti, Alamprese, Pagani and Lucisano, 2006)

The present study aimed at making the millets available to people in ready-to-eat form with some enhanced nutritional properties.

MATERIALS AND METHODS

Selection of ingredients

The ingredients selected for the preparation of popped pearl millet bar (PPMB) were Pearl millet (*Pennisetum glacuum*), grain amaranthus (*Amaranthus gangeticus*) the pulse roasted bengal gram (*Cicer arietinum*), Flax seeds, and sunflower seeds, sugar and resins were procured from local market. The grains were cleaned to remove dust and other extraneous materials and stored at room temperature in plastic containers.

About 5 kg of pearl millet was equilibrated to a moisture content of 18 % by adding water and tempered for 6 h in a closed container. The tempered grains were popped by high temperature and short time (HTST) treatment in a domestic grain popper (Nova popcorn maker NPC-1212) at 230±5 °C (Malleshi *et al.* 1986). Amaranthus was popped by subjecting the grains to direct heat contact in an open pan. Flax seeds and sunflower seeds were toasted at a temperature of about 70 °C until the seeds turned to light brown color.

Preparation of syrup mixture: Sugar syrup was prepared using sugar. The syrup was continuously heat at last CMC was added and mixed thoroughly. Finally this prepared syrup mixture was heated to 85^0Bx.

The roasted mix was added to the syrup/binder mixture and the mixture was continuously stirred to obtain homogeneous mixture. The mixture was immediately transferred to a mildly greased rectangular tray, firm pressed with a wooden roller and then cut into bars of 14mm thickness with a serving size of 40 grams.

Physical Analysis

The physical characteristics such as weight, diameter, width and bulk density of the developed bar were evaluated.

Nutrient analysis of the Pearl millet bar

The nutritional content (protein, fat, crude fibre, ash) of the raw and popped grains were evaluated as suggested by AOAC (2000). The carbohydrate content was calculated by the difference method. The total calcium, phosphorus, Fe and Zn were estimated by Atomic Absorption Spectrophotometry (AOAC 2000).

Sensory evaluation of Popped pearl millet bar

The bar samples were subjected to sensory evaluations by 10 semi trained panellists using 9-point Hedonic scale (from Like extremely to dislike extremely) to determine the acceptability of product with respect to colour, flavour, taste, texture and overall acceptability (Obatolu *et al.*, 2006).

RESULTS AND DISCUSSION

Physical Characteristics of PPMB The physical characteristics such as weight, diameter, width and bulk density of the developed bar were evaluated and presented in Table 1.

Table 1: Physical characteristics of PPMB

Physical parameter	Value
Weight (gm.)	40
Diameter (cm)	8.5
Width (cm)	1.7
Bulk Density (kg/C)	292.45

Nutrient content of pearl millet bar

The moisture content in the prepared PPMB was found to be 6.33g/ 100g, indicating low moisture content. The developed PPMB provided 412.2 kcal of energy per 100g, which qualified the product as a good energy dense snack for the sportspersons. The bar consisted of 82.3g carbohydrate, 10.84.7g protein and 4.39g fat (Table 2). The total ash content of the bar was 1.39g/100g. The calcium, phosphorus, iron and Zn content on analysis were found to be 58.7, 215.65mg, 5.13mg and 3.17 mg respectively.

Table 2: Nutrient Content of Pearl Millet

Component	PPMB
Moisture g/100g	1.10±0.03
Total Ash g/100g	1.39±0.02
Protein g/100g	10.84±0.05
Total fat g/100g	4.39±0.12
Crude Fibre g/100g	0.09
Carbohydrate g/100g	82.35±0.11
Energy value Kcal/100g	412.2±0.03
Calcium mg/100g	58.70±0.73
Phosphorus mg/100g	215.65±0.37
Fe mg/100g	5.13±0.01
Zn mg/100g	3.17±0.02

The energy contribution of the developed CSB was on par with the millet ladoo developed by Geetu singh (2005) and Mridula et.al. (2015).

Sensory Analysis of PPMB

The PPMB developed under different trials was evaluated for higher acceptability through sensory analysis. Appearance is the very first quality that improves a product's acceptability. The highest mean score for appearance of 7.7 was obtained by the bar. Popping induces desirable aroma and snack products based on them are highly acceptable (Bunkar *et. al.*, 2012). The overall quality of the product was high (8.0) which aptly reflected its acceptability.

CONCLUSION

The present study was focused to explore nourishing potential of pearl millet as well as food product development

Table 3: Qualitative parameter of breakfast

Attribute	Color	Flavor	Crunchiness	Texture	Taste	Appearance	Overall acceptability
RTE-Breakfast cereal	8.0±0.73	7.9±0.71	8.0±0.72	7.8±083	8.1±0.85	7.7±0.91	8.0±0.79

for malnourished children with cost effectiveness. The breakfast cereal was prepared by heating, mixing and cooling popped pearl millet, popped amaranth, puffed Bengal gram, flax seeds, sunflower seeds, raisins , and sugar. Popping is a traditional method of processing, simple and least expensive method; prepare ready to consume cereal foods and process of complete loss of birefringence characteristics of starch granules. Nutrient analysis of popped finger and pearl millets incorporated popped pearl millet bar shown enhancement of nutrients and have good potential to fight with malnutrition in children.

REFERENCES

AACC 2001. The definition of dietary fibre. Report of the dietary fiber definition committee to the board of directors of the American Association of Cereal Chemists. Cereal Foods World 46: 112-126.

A.O.A.C. 2000. Official methods of the Association of official Agricultural Chemists, Washington, D. C., 11th Edn.

Bernaud FSR, Rodrigues TC. 2013. Dietary fiber - adequate intake and effects on metabolic health. ArquivoBrasileiro de Endocrinologia&Metabologia (São Paulo) 57: 397-405

Bunkar DS, Jha A, Mahajan A . 2012. Optimization of the formulation and technology of pearl millet based "ready-to-reconstitute" kheer mix powder. J Food Sci Technol. doi:10.1007/s13197-012-0800-2.

Geetu Singh 2005. Development of value added products from pearl millet. PhD thesis, CCS HAU, Hisar, Hrayana.

John H Muyonga, Brian Andabati, and Geoffrey Ssepuuya. (2014) Effect of heat processing on selected grain amaranth physicochemical properties. Food SciNutr. **2**(1): 9–16.

Jones D, Chinnaswamy R, Tan Y, Hanna MA (2000) Physiochemical properties of ready-to-eat breakfast cereals. *Cereal Foods World* 45:164–168.

M. Mariotti, C. Alamprese, M. A. Pagani and M. Lucisano 2006. Effect of Puffing on Ultra structure and Physical Characteristics of Cereal Grains and Flours. *Journal of Cereal Science* 43, No. 1, pp. 47-56.

Malleshi NG and Klopfenstein CF 1998. Nutrient composition and amino acid contents of malted sorghum, pearl millet and finger millet and their milling fractions. *Journal of Food Science and Technology* **35**(3): 247-249.

Malleshi, N.G. and Desikachar, H.S.R. 1981. Varietal difference in puffing quality of ragi (Eleusine coracana). J. Food Sci. Technol., (18):30-32.

Mridula D, Singh KK, Barnwal P. 2013. Development of Omega3 Rich energy bar with flaxseed. *Journal of Food Science and Technology* **50**(5):950-957.

Nambiar VS, Sareen N, Daniel M and Gallego EB. 2012. Flavonoids and phenolic acids from pearl millet (Pennisetumglaucum) based foods and their functional implications. Functional Foods in Health and Disease **2**(7): 251-264.

Obatolu, V. A., C. O. Omucti, A. A. Ebenerer 2006. Qualities of extruded puffed snacks from maize/soybean mixture. J. Food Process Engg., 29: 149-161.

Odusola KB, Ilesanmi FF and Akinloye OA. 2013. Assessment of nutritional composition and antioxidant ability of pearl millet (Pennisetumglaucum). *American Journal Research Communication* **1**(6): 262-272.

Pradeep P. M., U. Dharmaraj, B. V. Sathyendra Rao, A. Senthil, N. S. Vijayalakshmi, N. G. Malleshi and Vasudeva Singh. 2013. Formulation and nutritional evaluation of multigrain ready-to-eat snack mix from minor cereals. J. Food Sci. Technol., 51(12):3812-3820. DOI 10.1007/s13197-013-0949-3

Reddy SN, Waghmare SY, Pande V. 1990. Formulation of homemade weaning mixes based on local foods. Food Nutr Bull **12**:138–140.

Santos KMO, Aquino RC. 2008. The food pyramid: basic fundamentals of nutrition. Barueri, Manole.J Nutr Food Sci **2**:7.

Srivastava S, Dhyani M and Singh G. 2003. Popping characteristics of Barnyard and foxtail millet and their use in preparation of sweets. In: Recent Trends in Millet Processing and Utilization, Hisar, India: Chaudhary Charan Singh HisarAgril. University, pp. 38-40.

Tarpila A, Wennberg T, Tarpila S. 2005. Flaxseed as a functional food. Current Topics in Nutraceutical Research. **3**(3):167–188.