



DEVELOPMENT AND EVALUATION OF AMARANTH BASED NUTRIENT RICH SNACK BARS

D. SHARANYA RANI*, K.S. KUMAR, AFIFA JAHAN AND P. NARESH

Department of Food and Nutrition, College of Home Science, Saifabad
PJTSAU Agricultural University, Hyderabad-500030, Telangana.

ABSTRACT

In the present study, grain amaranth based snack bars were prepared and evaluated for its nutrient and sensory status. Apart from the basic recipe (jaggery), the experimental bar contains ingredients like pumpkin seeds, sesame seeds, tofu, groundnuts and gum acacia, respectively. Basic and experimental bars have been evaluated for the nutrient and sensory parameters using standard analytical methods. Shelf life, change in acceptability and microbiological quality have been assessed by packing the bars in HDPE and LDPE covers and storing at room temperature for one month. The results indicated that the experimental product had better texture than the basic product apart from maintaining rich moisture (4.1%), protein (4.1%), and fat (2.84%), respectively. The evaluation results of sensory parameters inferred that there was no significant change in taste, color and flavour in respect of basic and experimental bars during the entire storage period. The experimental sample was found to have better acceptability for both fresh and stored products. Microbial analysis indicated that TBC, TMC and mould count in the fresh and stored basic bars was 10 cfu / g, where as the experimental bars had the counts below detectable levels (BDL). From the study, it can be concluded that the value added amaranth based nutritious bar could be very useful in supplementing some of the nutrients for school age and adolescent group.

KEYWORDS: Amaranth based grain bar, Dietary supplementation, Nutrient content, Sensory evaluation.

INTRODUCTION

Several food based strategies and techniques have been developed in India for combating malnutrition in terms of dietary modification, supplementation and fortification (Jessica and varma *et al.*, 2007; Carle and Hasler, 2002). The methods used for supplementation or fortification should be such that it should allow nutritional benefit, convenient and appealing as a food item. In this connection, grain bars have an advantage over other food items used for supplementation, in which a bar can come in handy when there is no time to sit down and eat a food item as in case of school children, college going adolescents, working men or women and sport persons. Food bars, are the snack foods that contains good sensory characteristics, contributing rich contents of protein, lipids and carbohydrates. The development of food bars can be carried out through blending the grains, nuts and other ingredients along with some binding material like gums, liquid glucose and sucrose etc. The mixture is then shaped into a bar by passing through a roller (Al-Hooti *et al.*, 1997) or baked in a baking oven at moderate heat i.e. below 150°C (Brisske *et al.*, 2004).

Whole cereal grains can be popped, toasted or roasted and incorporated in to the shape of bar. Many of these bars have been developed to provide a specific nutritional need. A good nutrition bar has a balanced formula of nutrients viz. 10 to 15 g of protein, 20 to 30 g of carbohydrate, and 5 to 7 g of fat. (Donald and Kasarada, 2000.) A nutrition bar attempts to provide nutritional benefit to the body that is appealing and convenient as a food item.

Grain amaranth is a versatile pseudo cereal with diverse food uses with greatest benefit being its nutritional value. It is very high in protein compared to other grains such as corn and oats. It is also rich in calcium, vitamin B5, magnesium, and iron. Amaranth is high in lysine, a limiting amino acid as in other cereals and millets. Though several types of snack bars are made and sold in to cater the need of different segments of population in developed countries, great advances in this area have not been attempted in developing countries like India. Therefore, attempts can be made for making nutritious bars in India for sustaining the health of individuals. Keeping in view, the need for developing value added, ready to eat snack bars using different functional foods for combating or

*Corresponding author, E-mail: sharanyafst@gmail.com

preventing malnutrition in different segments of population, the present study has been formulated to develop and evaluate amaranth based nutritious snack bars for the supplementing adolescence and sport persons.

MATERIALS AND METHODS

The study was conducted at Post Graduate Research Centre, College of Home Science, Rajendranagar, Hyderabad. All the ingredients used for preparation of the product were procured from the local super market. Amaranth seeds, Pumpkin seeds, Sesame, Ground nuts, Jaggery were cleaned to remove the extraneous matter. The amaranth seeds were popped by dry hot air popcorn popper at a temperature of 180°C. Tofu was cleaned in a running tap water to remove other particles and stored at freezer temperature. Acacia gum was powdered and then stored at room temperature. Basic recipe and different formulations used for preparing the bar is presented in Table 1.

Sesame, tofu, pumpkin and groundnut seeds were coarsely powdered and mixed together. Jaggery was dissolved in hot water and strained. Powdered gum acacia was added to it and then cooked to a soft ball stage. The mixture along with popping amaranth seeds was added to the cooked syrup and mixed thoroughly. The mixture was poured on pre greased surface and rolled out. It was allowed to set and then cut into shape of bar of 3/4 cm thickness. The bars were then packed into Low Density Polyethylene and High Density polyethylene covers.

Fresh basic and experimental products were evaluated for their organoleptic properties and textural character. Sensory evaluation was done to assess the acceptability by a panel of 20 judges. The panel members were selected from the staff of the Department of Food and Nutrition, College of Home Science and students from PGRC (Post Graduate Research Centre) Rajendranagar, Hyderabad. A score card was prepared, keeping in view of the quality characteristics of the product under study. The various evaluation parameters studied were colour, appearance, texture, taste and overall acceptability. A five point hedonic scale i.e. from 1-5 was prepared to rank each parameter with 5 point being assigned to the highly acceptable parameter.

Standard AOAC (2005) procedures were followed to estimate the proximate composition of the developed products. Samples were analysed in triplicates for moisture, protein, fat, ash, iron and calcium contents.

Moisture was estimated by hot air oven. Protein was estimated by leco protein Analyser of Model No:FP-528(USA). Fat was estimated by Soxtherm, Model No:1029(India) using the method of AOAC(1997). Ash was determined by Fibretherm, Model No:FT-12(India). Energy and crude fibre content was calculated by using the procedures laid out in Nutritive Value of Indian Foods by Gopalan *et al.* (2007). Iron and calcium were estimated by using the Flame technique in an Atomic Absorption Spectrophotometer (A700, Perkin Elmer, USA) using the method of AOAC (1990). In addition, grain bar was microbiologically evaluated for Total Bacterial Count and Total Mould Countcount at 0 day, 15th day and 30th day using the procedures laid down by Cruikshank *et al.* (1975).

Basic and experimental products were studied for their storage stability after packing in two different packing materials i.e. LDPE, HDPE. The products were initially wrapped in layer of butter paper and then packaged in different packaging materials. The packaged products were stored at room temperature. Sensory evaluation was carried out for the stored products at 0 day, 15th day and 30th day. A group of panel members consisting of staff and students of Department of Food & Nutrition (n=20) evaluated the fresh products also evaluated the stored products 0 day 15th day &30th day. The mean scores, standard error and critical difference for all the parameters were calculated using the ANOVA and T-test.

RESULTS AND DISCUSSION

Nutrient composition

The results obtained for assessing various nutrient status components are presented in Table 2.

From the table, it can be said that the moisture content of basic bar was found to be 3.8 %. On the other hand, it was 4.1% for the experimental bar. A significant increase in the moisture was found in the sample of experimental bar prepared from popped amaranth seeds which may be due to addition of more jaggery and other ingredients in experimental bars. The moisture content may be showing increased. The protein content was found to be 9.70 g in basic bar and 10.3 g in the experimental bars respectively. A significant increase of protein levels in the experimental bars by addition of sesame seeds, pumpkin seeds, ground nuts and tofu. The obtained results are in conformity with the reported results of the study conducted by Ogle and

Table 1. Ingredients in the preparation of the basic and experimental bars

Ingredient	Basic recipe	Trial-1	Trial-2	Trial-3	Final composition
Popped amaranth seeds	60 g	60 g	50 g	43 g	50 g
Pumpkinseeds	6 g	7 g	7 g	10 g	8 g
Sesame	5 g	5 g	5 g	5 g	5 g
Tofu	7 g	7 g	6 g	10 g	5 g
Ground nuts	5 g	5 g	5 g	5 g	5 g
Jaggery	15 g	7 g	25 g	25 g	25 g
Sugar	-	7 g	-	-	-
Binding-agent	2 g	2 g	2 g	2 g	2 g

Table 2. Results of proximate analysis of the snack bars (per 100 g of product)

Variable	Basic	Experimental	T-value
Moisture, %	3.8 ± 1.7	4.1 ± 5.77	12.18261**
Protein, g	9.70 ± 0.10	10.27± 0.01	14.46303**
Fat, g	2.6 ± 1.3	2.8±0.12	2.750034*
Energy, k cal	340.6*	341.2*	
Crude fibre, g	5.7*	5.3*	0.6181846
Ash, g	2.21 ± 0.3	2.8 ± 0.12	
Calcium, mg	472.24 ± 0.14	473.09 ± 0.44	4.770438**
Iron, mg	11.28 ± 0.28	16.35 ± 0.31	31.6416**

Grivetti (1985). The fat content of basic bar was found to be 2.6 g, where as for experimental bar, it was found to be 2.8 g. The obtained fat content values are less compared to other studies, due to the difference of grain and the ingredients used. The ash content of the basic bar was found to be 2.2 g, where as in the experimental bar, it was found to be 2.28 g respectively which is higher. The calcium content in basic bar was found to be 472.2 mg, where as in the experimental bar, it was 473.09 mg. The iron content in basic bar was found to be 11.5 mg, where as in the experimental bar, it was 16.35 mg.

The scores for colour of the bars ranged from 3.5 to 4.5 and texture 3.2 to 4.2 respectively on hedonic scales. The scores for flavour, taste, and overall acceptability ranged from 2.4 to 4.3, 2.7 to 4.5 and 3.9 to 4.9. All the parameters were highly rated by all the panellists for

experimental bars than control bars. The experimental bar was best accepted with highest total mean score ($p > 0.05$)

The two products i.e. experimental and basic bars were kept for storage after packing in LDPE and HDPE, and kept at room temperature for testing the sensory characters of the products on storage for one month. Products were evaluated for microbial quality and for sensory quality. The sensory parameters were evaluated periodically 0 day, 15th day and 30th days using hedonic rating on a scale of 5 points. Microbiological quality for TBC and TMC was assessed at the beginning and at the end of the storage period.

There was no significant change in taste, texture, colour, flavour and overall acceptability of both the basic and experimental bars during the entire storage period.

Development of Amaranth based snack bars

The interaction between treatments and packaging material was found to be non-significant ($p>0.05$) during storage period on overall acceptability of grain bars. Microbial analysis indicated that TBC, TMC and mould count in the fresh bars was 10cfu / g for the basic product where as the 10 cfu/g experimental bars had these counts below detectable levels (BDL).

From this study, it can be inferred that there is an advantage in the experimental bar which is nutritionally better as compared to basic samples. These bars can be recommended, mostly for anaemic patients and different age groups like adolescents, sports persons etc., wherein there is a need for nutrient supplementation. Moreover, it can be used as breakfast bars, meal replacement bars, “instant energy” bars for sports persons. Overall, it is concluded that the prepared snack grain bar made from amaranth seed is nutritious, gives instant energy, especially to eradicate alarming anaemia problem prevailed in lactating woman.

REFERENCES

- Al-Hooti S., Sidhu, J.S., Alotaibi, J., Alameeri H and Qabazard, H. 1997. Date bars fortified with almonds, sesame seeds, oat flakes and skim milk powder. *Plant Foods Human. Nutrition*. 51: 125–135.
- AOAC. 2005. Official Methods of Analysis for ash in flour. Association of Official Analytical Chemists. 18th Ed. Arlington VA 2209, USA. AOAC 929.09, chap 32, pp 01.
- AOAC. 2005. Official Methods of Analysis for protein. Association of Official Analytical Chemists. 18th Ed. Arlington VA 2209, USA. AOAC 984.13, chap 04, pp 31.
- AOAC. 2005. Official Methods of Analysis for moisture in flour. Association of Official Analytical Chemists. 18th Ed. Arlington VA 2209, USA. AOAC 929.03, chap 32, pp 02.
- AOAC. 1990. Official methods of analysis. Association of official analytical chemists. 14th ed. Washington, DC.
- AOAC. 1997. Official and tentative methods of the American oil chemists society. 3rd Edn. AOCS, South Sixth Street, Champaign, 820, Illinois 61820, 4-S-A.
- Brisske L.K., Lee, S.Y., Klein B.P and Cadwallader K.R. 2004. Development of a prototype high-energy, nutrient-dense food product for emergency relief. *Journal of Food Science*. 69(9): S361-S367.
- Clare M, Hasler. 2002. Functional Foods: Benefits, Concerns and Challenges. *Journal of Nutrition*. 132:3772-3781.
- Cruickshank R. 1975. Plate count bacteria in food stuffs. 11th ed. E and S Livingston Ltd, Edinburg; London p. 888-889.
- Donald, Kasarda. D. 2000. Celiac disease. In the Cambridge World History of Food. Vol-1. Cambridge University Press, Cambridge, UK, pp.1008-1022.
- Gopalan, C., Rama Sastri, B.V and Balasubramanian, S.C. 2007. Nutritive Value of Indian Foods. 47.
- Jessica, L. and Varma, 2007. Community level micro nutrient fortification of food supplement in India. *American Journal Clinical Nutrition* Vol-85, No-4, 1127-1133.
- Ogle and Grivitti 1985. Critical reviews in food science and nutrition. *Food Science*. 28: 348–400.
- Snedcor, G.W and Cochran, W.G. 1983. Statistical Methods. Oxford and IBH Company. New Delhi.