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Assessment and comparison study of millet bar with farmer practice through on farm trial (2018-19)

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Abstract

A study was conducted during 2018-19 in the guidance of ICAR-KVK, Vamban, Pudukkottai District, Tamil Nadu Agricultural University, Coimbatore. The farmers encounter various problems for adopting millets viz., lack of millet processing industries, problem in marketing, lack of nutritional knowledge and health benefits, lack of acceptance as regular food and lower economic returns. The developed millet bar was packed in poly ethylene pack and sensory evaluated for the period of 60 days at room temperature. The millet bar was low cost, nutri-dense and convenient snack for all age groups. The present study was undertaken to develop different millet bar and to evaluate the sensory acceptability, shelf life and benefit cost ratio of millet bar through On Farm Trial for entrepreneurship development program.

Keywords: On farm trial - millet bar - keeping quality - sensory evaluation - BC Ratio

Introduction

Food bars are considered as snack food with good sensory and nutritional characteristics due to their high content of proteins, carbohydrates, vitamins and minerals (Estevez *et al.*, 2000) [2]. Ready-to-eat breakfast cereals and their product play an important role in the human diet with a specific function and physiological benefits to the human being and are considered as the economically competitive source of nutrients (Paul *et al.*, 2010) [4]. Cereal bars appear due to the necessity of having a product combining easiness and nutritional quality, in order to either improve or substitute snacks between meals, to complement meals, or simply gain energy in a healthy way. The consumption of cereal bars has increased mainly among young consumers (Dutcosk *et al.*, 2006) [1]. Sports snacks prepared from composite mixture of various ingredients assure a mutual complementation of nutrients to supply adequate energy and increase muscular endurance of sportspersons (Padmashree, 2012) [7]. Millets are tiny seeded grains more protein, dietary fiber, energy and minerals. Millets also being low cost, nutritious and locally available indigenous food. In the present study, millet flour bar, millet bar with popped finger millet, popped bajra, popped sorghum and beta-carotene enriched millet bar was developed, sensory and shelf life stability was evaluated in polypropylene packaging under ambient and room conditions.

Problem definition / description

Lack of awareness about processing and value addition of millets. The millet now referred as Nutri-cereal instead of coarse grain contains higher proportion of complex carbohydrates, resistant starch and slow rising sugar. Millet grain is highly nutritious with good quality protein, vitamins, dietary fibre, phyto-chemicals and rich in minerals. Value added products from millet have the potential to add value to business and has a large potential for growth as consumers believe that millets and millet based foods contribute directly to their health. The present study has made use of millets and addition of mango pulp for β -Carotene enrichment to evaluate the keeping quality and sensory characteristics.

Review of literature

Ryland *et al.*, (2010) [10] revealed that to formulate a nutritious acceptable snack bar partially replacing oats with micronized flaked lentils (MFL). These MFL bars and two commercial bars were evaluated by a consumer panel and a descriptive panel.

The highest mean acceptability values for one commercial sample (6.5) and three MFL bars (6.0) were not significantly different and corresponded to 'like slightly' on the 9-point hedonic scale.

Cereal bars are prepared from multi-component includes cereals, fruit, nuts, sugars and having long shelf-life 6-12 months. The bars offer a fast, convenient food source that requires no preparation, a long shelf life and no refrigeration. (Giri *et al.*, 2012) [3].

The study revealed that the date paste, dried apricot paste, skim milk powder, roasted gram flour, peanuts and sodium chloride were used in different four proportions. The results indicated that water activity, colour, texture and moisture of bars were affected significantly, whereas crude fat, protein, fibre, nitrogen free extract and ash were not significantly affected with the addition of apricot paste. The studies further revealed that potential exists to produce economical fruit bars with commercial value (Rehman *et al.*, 2012) [9].

The bar was developed using oat and wheat as major cereal ingredients and their shelf life was assessed. Fatty acids (14) were identified in which oleic (50.91%), linoleic (22.50%) and palmitic (12.63%) acids were found to be the major fatty acids. Fortification of a bar with vitamin C, B1 and B2 content to meet 50% RDA enhanced vitamin contents and the maximum retention was observed in bars packed under vacuum in MP films (Padmashree *et al.*, 2013) [8].

Lestari *et al.*, (2017) [5] revealed that, to develop cookie bars from foxtail millet, arrowroot flour and kidney beans. Three formulae of cookie bars F1, F2, F3, which had colour values of 53.77, 58.46 and 58.31 and breaking force of 8.37, 10.12 and 5.87 N, respectively. Among three formulas F2 have a low glycemic index cookie bar with value 37.6.

Sobana (2017) [13] reported that, the composite sports bar contained 6.33% moisture, 72.5g carbohydrate, 13.7g protein, 6.1g fat. 2.29g total ash, 159.5mg calcium and iron 2.93mg per 100g. The composite sports bar provided 400 kcal of energy per 100g, which qualified the product as a good energy dense snack for the sportspersons. A gradual depletion

in the overall acceptability scores from 38.3 to 13.1 was noticed at the end of 90 days. The unit cost of preparation of the composite sports bar was Rs.14.80 per 40g.

Sanika *et al.*, (2018) [11] stated that, the sorghum nutri-bar is prepared with major ingredients sorghum flour, organic jaggery, roasted gram, oil, desiccated coconut and natural flavours. The bar provides substantial amount of carbohydrates, proteins, fats and dietary fibre. The product was packed in LDP packaging material remained safe and stable during storage for 30 days.

The preparation of cereal bar using popped sorghum -5g, popped amaranth seed-7g, groundnut-8g, roasted split chickpea-2g, dark chocolate-5g, cornflakes-8g, gulkand-5g, jaggery-38g and liquid glucose-27g. The bar provides energy-369.6 K.cal, moisture-3.6%, ash-1.12%, fat-5.1%, protein-3.32%, carbohydrates-77.86% and crude fibre-9%. The high energy and high fibre puffed cereal bar was feasible and contributes for the health benefits to all the age groups (Mogarkar *et al.*, 2018) [6].

Materials and Methods

Technology Assessed

Millet flour bar (TO1), Millet bar (TO2) and β -Carotene enriched millet bar (TO3).

Critical inputs / Selection of ingredients

The ingredients selected for the preparation of millet bar were millet flour (Finger millet, Pearl millet, Sorghum), Roasted finger millet, Roasted pearl millet, Puffed sorghum, Roasted bengal gram, Roasted groundnut, Jaggery and Mango pulp. All the required ingredients were purchased from the local markets or departmental stores. The formula for the preparation of millet bar is given in Table 1.

Pre-processing

The raw ingredients were cleaned separately to remove the external dust and dirt particles. The millets were roasted and popped in a pan separately to get aroma.

Table 1: Formula used for the preparation of millet bar

Sl. No.	Ingredients	Technology 1	Technology 2	Technology 3
		Quantity per 100g		
1.	Millet flour (Finger millet, Pearl millet, Sorghum, 2:2:3)	70	-	-
2.	Roasted finger millet	-	20	20
3.	Roasted Pearl millet	-	20	20
4.	Puffed Sorghum	-	30	30
5.	Roasted bengal gram	20	20	20
6.	Roasted ground nut	10	10	10
7.	Jaggery	40	40	40
8.	Beta carotene enriched mango	-	-	40

Preparation of syrup and millet bar

Whole puffed sorghum, powdered bajra and partially ground finger millet grits were taken. Roasted whole Bengal gram, roasted and coarsely gritted groundnuts were blended with the millet mixture. Palm jaggery syrup was prepared by addition of 60 ml of water to 40g of the powdered palm jaggery and boiled to a temperature of 122 °C till soft ball stage. The syrup was then filtered through a muslin cloth to remove any impurities. All other ingredients were added into the vessel mixed well with jaggery syrup. The mixture was transferred to a mildly greased rectangular tray, firm pressed with a wooden roller and cut into a required size.



Fig 1: Demonstration of Millet Bar



Fig 2: Millet bar with different treatments

Result and Discussion

It is observed from the Table 2 that marketing problem (100%) in their area was the major problem expressed by farmers followed by lack of millet processing techniques and industries (95%), lack of acceptance as regular food (75%), lack of nutritional knowledge and health benefits (60%) and lower economic returns (55%).

Incorporation of millets in the conventionally used refined wheat flour can improve nutritional quality (Shrestha and Srivastava, 2015) [12]. Vanishree *et al.*, (2018) [14] observed that lack of millet processing industries (100%) in their area was the major problem expressed by farmers followed by marketing problem (26.00%), availability of High Yielding Varieties (25.00%), lower economic returns (24.00%) and lack of acceptance as regular food (76.66%).

Table 2: Problems identified in growing and utilization of millets by farmers N=100

Sl. No	Problems	No. of farmers
1.	Lack of millet processing techniques and industries	95 (95%)
2.	Problem in marketing of millets	100 (100%)
3.	Lack of nutritional knowledge and health benefits	60 (60%)
4.	Lack of acceptance as regular food	75 (75%)
5	Lower economic returns	55 (55%)

Table 3: Performance of the Technology

Technology option	No of trial	Keeping quality	Production/ Unit	Gross Cost Rs. / Unit	Returns Rs./ Unit		BC Ratio
					Gross	Net	
TO 1	5	60 days	10 kgs	1750	2900	1150	1.66
TO 2		60 days	12 kgs	1830	3600	1770	1.97
TO 3		55 days	11 kgs	1910	3600	1690	1.88

TO1: Millet flour bar, TO2: Millet bar (finger millet, bajra, sorghum), TO3: β -Carotene enriched millet bar

Table 3 shows that the keeping quality of millet flour bar, millet bar and beta-carotene enriched millet bar were acceptable up to 60, 60 and 55 days respectively. The gross returns, net returns and BC ratio of millet bar and β -Carotene enriched millet bar was high and low gross cost than millet flour bar. The quantity of output was high in millet bar (12kgs) than farmer practice (10kgs).

Table 4: Mean value for sensory evaluation of millet bar

Technology option	Storage Days	Sensory Characteristics				
		Colour and appearance	Flavor	Texture (consistency)	Taste	Overall acceptability
TO1	Initial	8.5	8.0	7.5	8.0	8.0
	Final	8.0	7.5	7.0	7.5	7.5
TO2	Initial	8.9	8.9	8.8	9.0	8.9
	Final	8.0	7.9	7.8	7.9	7.9
TO3	Initial	8.5	8.5	8.6	8.8	8.6
	Final	7.4	7.4	7.5	7.8	7.6

TO1: Millet flour bar, TO2: Millet bar (finger millet, bajra, sorghum), TO3: β -Carotene enriched millet bar

Table 4 shows that the sensory characteristics like colour and appearance, flavor, texture (consistency), taste and overall acceptability of the millet flour bar scored initial values were 8.5, 8.0, 7.5, 8.0 and 8.0 respectively and 8.0, 7.5, 7.0, 7.5 and 7.5 respectively at the end of the storage period. The millet bar scored initial values were 8.9, 8.9, 8.8, 9.0 and 8.9 respectively and 8.0, 7.9, 7.8, 7.9 and 7.9 respectively at the end of the storage period. The β -Carotene enriched millet bar scored initial values were 8.5, 8.5, 8.6, 8.8 and 8.6 respectively and 7.4, 7.4, 7.5, 7.8 and 7.6 respectively at the end of the storage period. The sensory analysis of the millet bars during storage a gradual depletion in all the sensory characteristics. The results indicated that the prepared millet

bar may be stored for a period of 60 days at room temperature.

Description of the results

The result of the trial indicated that the keeping quality and taste of the millet bar (TO2) was high among three combinations. The taste of the beta carotene enriched millet bar (TO3) was higher than the farmer practice but keeping quality is low. Net return is high in millet bar (TO2) than other combinations. Among the different technology option, Option-2 has higher BC ratio (1.97) than other technology option.

Feedback of the farmers involved

Value addition technology is a blessing to increase shelf life of the products and gives nutritious, sweetened, tasty, flavored and variety of millet products has doubled the income accruing to the farmers.

The variety of millets products making ensures assured market. Farmers are interested to do this assessment and gaining their income. This value added technology in millet is an eye opener for poor farmers to pursue a remunerative activity towards doubling farmer's income goal of the government of India.

Feed back to the scientists

According to these results, taste and shelf life of the millet bar is more than other products. It is very nutritious and energy yielding product. Based on sales millet bar gives more returns than millet flour bar. The interventions of KVK played a strategic role in increasing self-confidence among farmers in undertaking small scale food processing and value addition

unit at their village level and reaching the market in urban area.

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Summary and Conclusion

The millet based composite bar developed along with other nutritious ingredients showed that the bar is highly acceptable, easy to digest, contained high amount of energy and protein with a shelf life of 60 days at room temperature. The development of composite bar using low cost, locally available ingredients is nutritious and convenient snack for all age groups.

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