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Development and sensory evaluation of multi millet crackers

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Abstract

Snack foods are being exploited over a longer time to improve the nutritional status of a person. India has over 1500 varieties of snack foods which are consumed by all age groups. Incorporating millets and whey protein isolates into snack foods can help to develop new products along with improved protein and other nutrients. Because of increased trend in the consumption of novel snack items, an attempt was made to develop crackers by incorporating multi millets, whey protein isolates and defatted soya flour using baking technology like 2.5%, 5.0% and 7.5% whey protein isolates proportions, finger millet, foxtail millet, pearl millets in (10%: 20%: 20%) proportions, defatted soya flour (5%) and refined wheat flour (22.5%, 20% and 17.5%). Sensory evaluation by 15 semi trained panel members revealed that 2.5% whey isolates incorporated formulation was more acceptable in terms of colour, flavour, taste, texture, bitterness and overall acceptability when compared to other formulations.

Keywords: Finger millet, foxtail millet, pearl millet, defatted soya flour, whey protein isolates, novel snacks, sensory evaluation

Introduction

Millets are the coarse grains broadly developed throughout the world while mostly grown are pearl millet (*Pennisetum glaucum*), proso millet (*Panicum miliaceum*), finger millet (*Panicum miliaceum*) and foxtail millet (*Setaria italica*) (Dayakar Rao *et al.* 2017)^[1]

As they are good sources of energy, proteins, vitamins, minerals, essential amino acids, phytochemicals and micronutrients called as nutraceuticals. (Singh *et al.* 2012)^[14] and may be considered as functional foods as they contain anthocyanin, tocopherols and carotenoids which are natural antioxidants that protect the membranes of heart, muscles and red blood cells from the attack of reactive oxygen species. (Banerjee and Maitra, 2020)^[2].

Whey protein isolates are produced from whey which is a milk protein as a by-product during cheddar making or dairy product processing by ultrafiltration and diafiltration which contains nearly 95% of protein. These can be utilized as functional ingredients in food items due to their good physical and functional properties and high protein content. (De castro *et al.* 2017)^[6].

Soya bean flours are being used widely in many countries as they contain good vegetable proteins with all nine essential amino acids and low fat and it plays an important role in health and hence can be used in developing many healthy food products. (Doxastakis *et al.* 2002)^[7]

Snacks are the convenience foods which are eaten between the meals can help to ensure the nutritional needs of a person. (Thakur and Sexena, 2000)^[16]. Since last 10 to 15 years, consumers have become more health conscious and are demanding nutritious snack products which satisfies their hunger requirements with balanced nutrient formulations. (Brennan *et al.*, 2013)^[4].

This is driving manufactures to look for ingredients which can provide functional and nutritional properties for formulation of various novel snacks, they have come to realize that milk proteins, particularly the whey proteins have potential to improve the quality of food products by increasing their protein content (Kumar *et al.* 2018)^[8] and also millets which are nutritionally superior to major cereals in terms of energy, protein, minerals, and vitamins can be used to develop various value added products. (Bansal and Kawatra, 2020)^[3]

Crackers are one of those novel snack items developed by baking technique which can be a versatile food due to their difference in taste, good shelf life, relatively low cost which are consumed by a wide group of population and it can meet their demand for convenient, nutritious and tasty snacks. (Ahmed and Abozed 2015)^[11].

Materials and Methods

Procurement of Raw materials

Finger millet, foxtail millet and pearl millets were procured from Millet processing incubation centre, PG&RC, Rajendranagar. Whey protein isolates of AS-IT-IS nutrition brand and defatted soya flour of veggio snacks brand were procured from amazon store, Hyderabad. Refined wheat flour, sugar, fat and other ingredients were procured from local markets of Hyderabad.

Preparation of Baked crackers

The baked crackers of control (BCC) were prepared using a standardized method by Ahmed and Abozed (2015) [1] using Refined wheat flour and other ingredients like fat, water and spices were mixed and formed into a dough, was rolled out and cut into rectangular shapes of 1-2 mm thickness and baked at temperature of 175 °C for 10-12 minutes.

Preparation of Multi millet Baked crackers

Different combinations of multi millet baked crackers were developed using multi millet flours (Finger millet, foxtail millet, pearl millet), defatted soya flour, whey protein isolates, refined wheat flour and other ingredients in the ratios of 50: 5: 2.5: 22.5, 50: 5: 5.0: 20, 50: 5: 7.5: 17.5. The proportion of ingredients used in the standardization of multi millet crackers and preparation of multi millet crackers are enumerated below in the Fig 1 and Table 1.

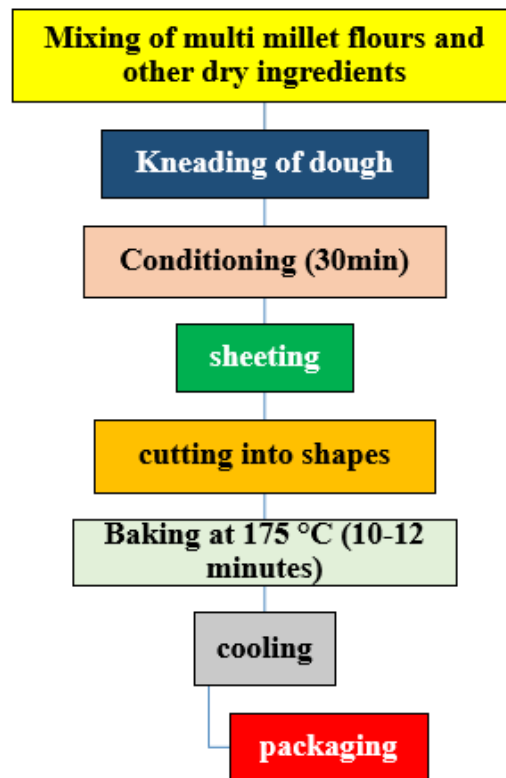


Fig 1: Preparation of multi millet crackers

Table 1: Proportions of ingredients used in the standardization of multi millet baked crackers:

Ingredients	BCC	MMBC1	MMBC2	MMBC3
Pearl millet: Foxtail millet: Finger millet (20:20:10) (g)	-	50	50	50
Refined wheat flour (g)	50	22.5	20	17.5
Defatted soya flour(g)	-	5	5	5
Whey protein isolates (g)	-	2.5	5	7.5
Other ingredients	20	20	20	20

Note: All samples were added with required amount of water and fat to get desired dough consistency

BCC: Baked Crackers of control

MMBC1: 2.5% whey isolates incorporated crackers

MMBC2: 5.0% whey isolates incorporated crackers

MMBC3: 7.5% whey isolates incorporated crackers

Sensory evaluation of baked crackers

A semi trained panel of 15 members from Post Graduate and Research Centre, PJTSAU evaluated the baked crackers of control (BCC) and standardized multi millet baked crackers (MMBC1, MMBC2 and MMBC3) for colour, flavour, texture, taste, bitterness and overall acceptability using the 9-point hedonic scale. Scores were based on the 1-9 of hedonic scale, where 1 indicates dislike extremely (very bad) and 9 indicates like extremely (excellent) (Meilgaard *et al.* 1999) [9]

Statistical analysis of data

All the results were analysed to test the significance of the results using means, standard deviation and analysis of

variance (ANOVA) technique. (Snedecor and Cochran, 1983) [15].

Results and Discussion

Sensory evaluation enables us to understand the Person’s reaction to the food products that are perceived by senses and to scientifically evaluate the product according to the attribute.

The standardized multi millet crackers (MMBC1, MMBC2 and MMBC3) with multi millet flours, refined wheat flour, defatted soya flour, whey protein isolates, compared to Baked crackers of control i.e., BCC were evaluated for sensory evaluation and their mean scores are presented in table 2.

Table 2: Mean sensory scores of multi millet crackers (MMBC)

Sample	Colour	Flavour	Texture	Taste	Bitterness	Overall acceptability
BCC	7.66 ^b ±0.72	7.94 ^a ±0.79	7.86 ^a ±0.83	7.74 ^a ±0.88	7.60 ^a ±0.98	8.00 ^a ±0.75
MMBC1	8.20 ^a ±0.56	7.93 ^a ±0.88	7.80 ^a ±0.77	7.73 ^a ±0.88	7.40 ^a ±0.91	7.66 ^a ±0.81
MMBC2	7.80 ^a ±0.67	7.53 ^b ±0.91	7.60 ^b ±0.82	7.06 ^b ±0.70	7.39 ^b ±0.82	7.60 ^b ±0.82
MMBC3	7.53 ^b ±0.91	7.26 ^b ±0.79	7.40 ^b ±0.91	7.20 ^b ±0.91	7.00 ^b ±0.75	7.33 ^b ±0.98
Mean	7.80	7.66	7.66	7.43	7.35	7.65
S.E of mean	0.09	0.11	0.10	0.11	0.11	0.11
C.D	0.53	0.62	0.57	0.67	0.65	0.64

Note: Values are expressed as mean ± standard deviation of fifteen determinations.

Means within the same column followed by a common letter do not significantly differ at $p \leq 0.05$.

BCC: Crackers control

MMBC1: 2.5% whey isolates incorporated crackers

MMBC2: 5.0% whey isolates incorporated crackers

MMBC3: 7.5% whey isolates incorporated crackers

The results indicated that the colour of MMBC1 (8.20 ± 0.56) was significantly ($p < 0.05$) higher than MMBC2 (7.80 ± 0.67) and MMBC3 (7.53 ± 0.91) when compared to BCC (7.66 ± 0.72).

The flavour criteria of MMBC1, MMBC2 and MMBC3 was (7.93 ± 0.88), (7.53 ± 0.91) and (7.26 ± 0.79). MMBC1 had highest score for flavour followed by MMBC2 and MMBC3 with respect to BCC (7.94 ± 0.79) and there was a significant ($p < 0.05$) difference in between the developed multi millet crackers.

Multi millet baked crackers incorporated with 2.5% whey protein isolates i.e., MMBC1 (7.80 ± 0.77) had significantly ($p < 0.05$) higher scores for texture, followed by MMBC2

(7.60 ± 0.82) and MMBC3 (7.40 ± 0.91) when compared to BCC (7.74 ± 0.88).

There was a significant ($p < 0.05$) difference in between the standardized multi millet crackers in terms of bitterness. The bitterness of MMBC1 (7.40 ± 0.91) was lower than MMBC2 (7.39 ± 0.82) and MMBC3 (7.00 ± 0.75) with respect to BCC (7.60 ± 0.98).

It was observed the score of overall acceptability of multi millet crackers was significantly ($p < 0.05$) highest in MMBC1 (7.66 ± 0.81) than MMBC2 (7.60 ± 0.82) and MMBC3 (7.33 ± 0.98) when compared with BCC (8.00 ± 0.75).

The percentage change in the sensory scores of multi millet crackers when compared to control is shown in the figure 2.

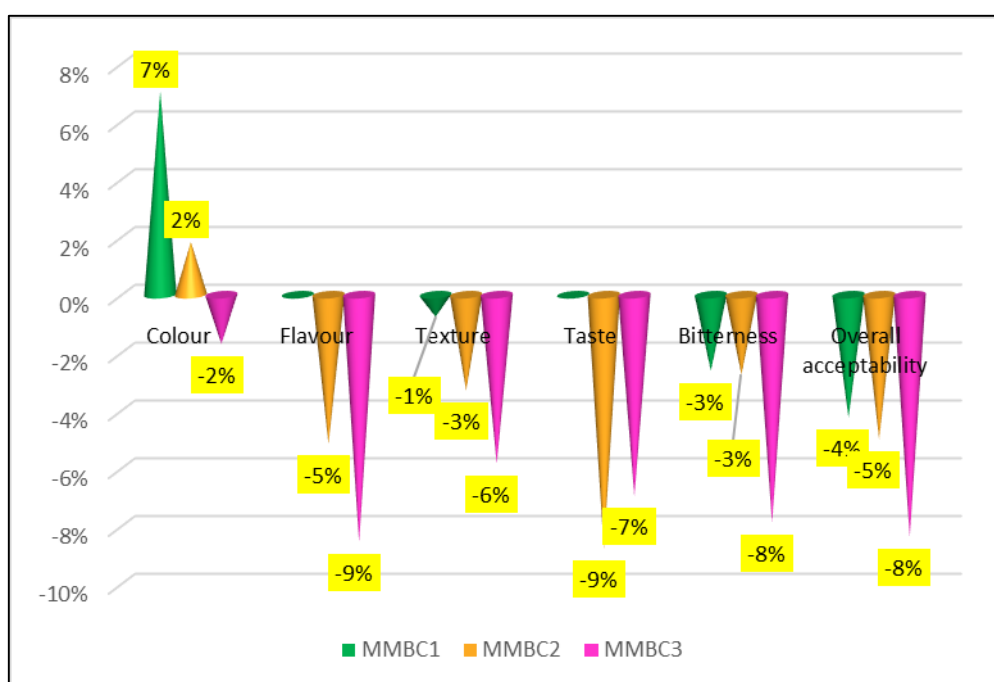


Fig 2: Percentage changes in the mean sensory scores of multi millet baked crackers

There was decrease in percentage for colour in MMBC3 (2%) and was increased in MMBC1 (7%) and MMBC2 (2%). The flavour scores showed no change of percentage in MMBC1, but decreased in MMBC2 (5%) and MMBC3 (9%). In terms of texture, it was decreased in all the multi millet baked crackers i.e., MMBC1, MMBC2 and MMBC3 by 1%, 3% and 6%.

The taste of multi millet crackers showed no percentage change in MMBC1, but was decreased in MMBC2 (9%) and MMBC3 (7%). For bitterness, Percentage change was decreased by (3%) in MMBC2 and MMBC1, (5%) in MMBC3. The percentage change was low in MMBC1 (4%), MMBC2 (5%) and MMBC3 (8%) for overall acceptability when compared to BCC.

The sensory evaluation was conducted by a semi trained panel of 15 members and the results of their evaluation revealed that all the attributes i.e., colour, flavour, texture, taste, bitterness and overall acceptability had highest scores for MMBC1 (2.5% Whey isolates incorporated crackers) followed by MMBC2 (5% whey isolates) and MMBC3 (7.5% Whey

isolates) when compared to BCC, hence it was the most commonly accepted standardized formulation.

Shogren *et al.* (2006) [12] prepared spaghetti from durum wheat supplemented with soya flour at 25%, 35% and 50% levels, while spaghetti added with soya flour at 50% level had bitter taste, that was associated with different chemicals produced by the lipoxygenase catalysed oxidation of native lipids in soy beans.

Shogren *et al.* (2003) [13] conducted sensory analysis of whole wheat/Soy flour breads and observed bitter aftertaste associated with soy flour was higher for 40% soy flour incorporated and 60% whole wheat flour. The bitterness of soya flour incorporated food products depends on the type of technology used for product development.

Pearl millet based extruded snacks prepared with whey protein concentrate at (0%, 2.5%, 5.0% and 7.5%) levels had significant effect on sensory properties like texture., whereas 5% incorporation was more acceptable with high protein content (12.4%) (Yadav *et al.* 2014) [12].

Saponjac *et al.* (2016) [10] prepared cookies from bioactive

compounds extracted from cherry pomace, encapsulated in whey and soy proteins, replaced 10% and 15% flour had good sensory acceptance, colour and storage properties.

Sensory analysis of millet based composite sports bar was conducted by Shobana, (2017) ^[11] using little millet, sorghum, pearl millet, foxtail millet, oats, wheat and red rice showed that the bars were highly acceptable with a shelf life of 45 days.

Conclusion

The final most accepted multi millet baked crackers was selected based on the sensory scores given by the panel members which showed that the crackers with 2.5% whey protein isolates was more acceptable in terms of overall acceptability. The least accepted one was 7.5% incorporated especially due to its colour and flavour. The acceptability order of multi millet crackers when compared to BCC was 2.5% whey isolates incorporated > 5% whey isolates incorporated > 7.5% whey isolates incorporated.

Because of the high preference of bakery products and their availability, crackers can be used as a novel nutritious product and also a therapeutic food by incorporating whey protein isolates, millets and defatted soya flour which is expected to supplement more protein, fiber and energy with good physical and functional properties, especially for adolescents as they require more protein during that age for their growth and development.

The incorporation of whey protein isolates in the present study was at 2.5%, 5.0% and 7.5% levels, multi millet flours at 50% level and also defatted soya flour at 5% level was acceptable by the panellists. Further processing methods can help to increase whey protein isolates, multi millets and soya flour percentage incorporation leading to noticeable increase of their usage in the future. Through this, protein content may be improved which is good for adolescents and can be accepted by all the consumers.

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