

# Development and Organoleptic Evaluation of Foxtail and Proso Flakes Incorporated Energy Dense Snack Bar

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## Authors' contributions

This work was carried out in collaboration among all authors. Author SZS developed the product and performed the analysis. Author BAK designed the study and wrote the protocol. Author WJS wrote the first draft of the manuscript. Author BG managed the literature searches. All authors read and approved the final manuscript.

## Article Information

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## ABSTRACT

Nowadays, demand and aspiration for nutritionally balanced snacks that are palatable, portable, convenient is high. Increasing demand from consumers for nutritious snacks has provoked the researcher to develop food bars that are nutritious and convenient. The bar was developed with the flakes of millets like foxtail (*Setaria italica*) and proso (*Panicum miliaceum*) along with other ingredients like jaggery, liquid glucose, skimmed milk powder, cocoa powder, dates, flax seeds, sesame seeds, groundnuts and soya granules. With different incorporation, four combination millet snack bars prepared were 50%, 60%, 70% and 80% of foxtail and proso flakes. The most acceptable was 50% millet flakes bar by the semi - trained panellist.

**Keywords:** Foxtail flakes; proso flakes; snack bar; standardisation sensory evaluation.

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## 1. INTRODUCTION

Millets have been found to possess high nutritive value compared to major cereals such as wheat and rice. Millets are rich source of sulphur-containing amino acids, fiber, ash content, vitamin B and certain minerals like magnesium, manganese, iron, copper, phosphorous and zinc. Thus the presence of all the required nutrients in millet makes them suitable for large scale utilization in the manufacture of food products such as snack food and dietary foods [1].

Foxtail millet (*Setaria italica*) is one of the minor millets, containing high amounts of proteins and minerals. Simple processing methods like dehulling, soaking and cooking are reported to result in significant decreases in antinutrients and improved bioavailability of minerals like iron and zinc and also protein digestibility [2].

Proso millet (*Panicum miliaceum*) has high mineral content that includes calcium, iron, potassium, magnesium, phosphorous, zinc, dietary fiber, polyphenols and protein. It contains a high amount of lecithin which plays an important role in the neural health system by repairing and regenerating myelin fiber and intensifying brain cell metabolism and also contains a significantly high amount of vitamin B-complex, folic acid and niacin. The mineral content of this millet was much higher in comparison to major cereal grains. High content of fiber and antioxidants in proso millet was also valuable in prevention of CVD and cancer [3].

The products which were evaluated was made with refined proso flour consist of high protein (11.3 g/100 g) in extruded snacks and high fat (6.1 g/100 g) in muffins when compared to corn

based products. The refined proso flour based porridge had low glycemic index (GI) that is less than 55 [4].

There was an increased demand among the consumers for convenient foods for various reasons. Millets such as little, proso, barnyard and ragi were explored for processing into Ready-To-Cook (RTC) millet flakes to meet the needs of modern consumers [5].

Snacking between meals provides an important contribution to dietary intake of key nutrients. There was a need for snack bars that were nutrient dense and increase feelings of fullness and satiety [6].

The main aim of this work is to standardize energy dense millet flakes snack bar which can acquire the nutrients from the millets made in such way that is portable and ready to eat food product.

## 2. MATERIALS AND METHODS

### 2.1 Procurement of Raw Materials

All the raw material required for products were procured from the local markets of Hyderabad.

### 2.2 Preparation of Millet Snack Bar

Millet snack bar was prepared with different composition of foxtail and proso flakes with the other ingredients like groundnuts, flaxseeds, sesame seeds, soya granules, skimmed milk powder, cocoa powder, dates, liquid glucose and jaggery. First the ingredients were roasted in the non stick pan up to 110°C temperature. Then 100 g jaggery was melted and boiled to the

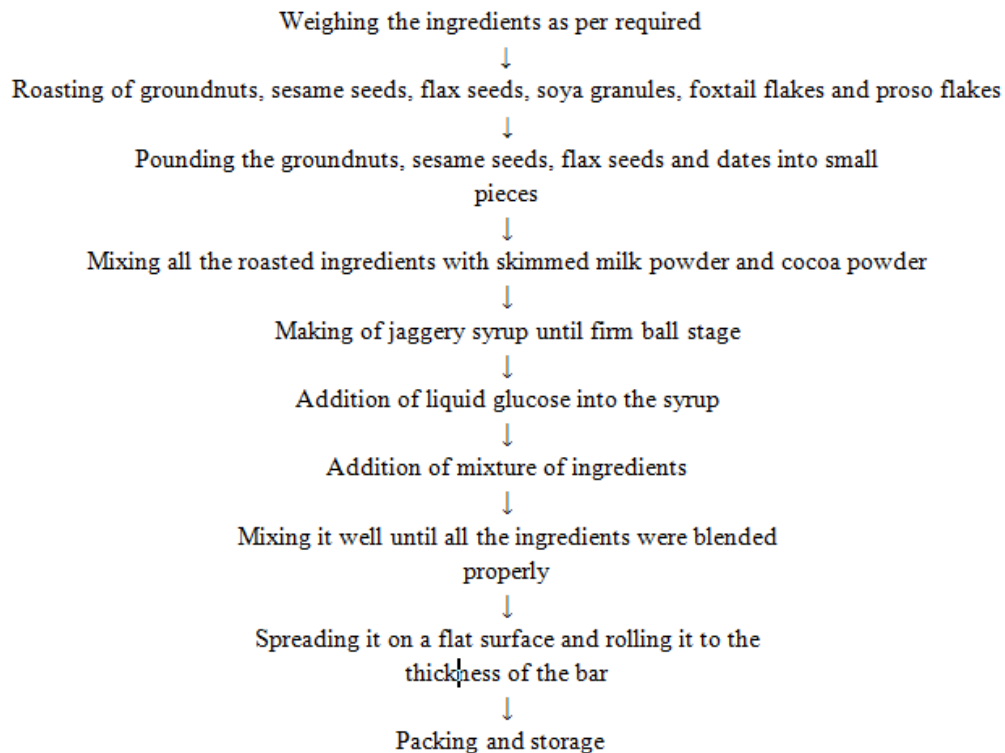
**Table 1. Formulations of millet bars based on different combination of foxtail flakes, proso flakes and jaggery**

S. no	Ingredients	C1	C2	C3	C4
1	Groundnuts	25	25	25	25
2	Sesame seeds	4	4	4	4
3	Flax seeds	4	4	4	4
4	Soya granules	7	7	7	7
5	Dates	15	15	15	15
6	Cocoa powder	1.5	1.5	1.5	1.5
7	Skimmed milk powder	4	4	4	4
8	Liquid glucose	20	20	20	20
9	Jaggery	75	85	95	105
10	Foxtail flakes	25	30	35	40
11	Proso flakes	25	30	35	40

Note: 1. All ingredients are measured in gram, 2. C: Combination

**Table 2. Development of control bar**

S. no	Ingredients	Amount (g)
1	Groundnuts	100
2	Jaggery	100
3	Flax seeds	4
4	Sesame seeds	4
5	Soya granules	7
6	Dates	15
7	Liquid glucose	20
8	Skimmed milk powder	4
9	Cocoa powder	1.5



**Flowchart 1. Flowchart for development of bars**

temperature 90°C, while boiling about 20 g of liquid glucose was added and made into thick syrup. Then all the roasted ingredients along with the cocoa, skimmed milk powder and dates were added into the thick syrup. On the greased pan the mixture was kept and shaped in to rectangular bars.

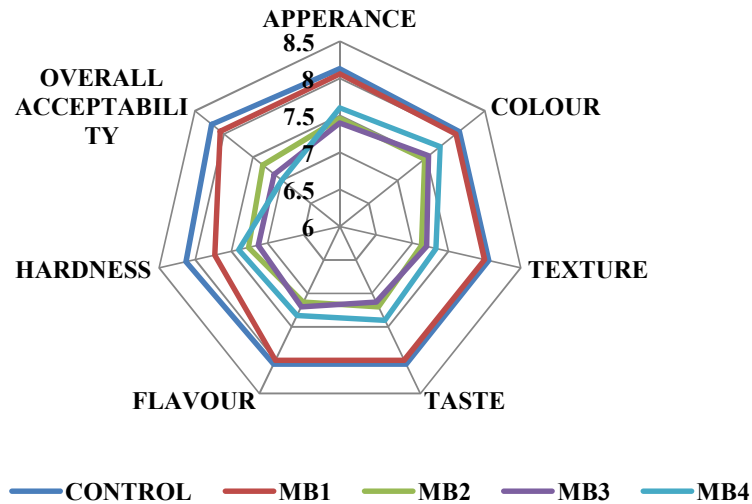
### 2.3 Sensory Evaluation

Sensory analysis of millet snack bar and control bar were evaluated by fifteen semi-trained panelists between 18-30 years of aged students by simple random sampling method was used at

Post Graduate & Research Centre, PJTSAU, Rajendranagar, Hyderabad using 9-point hedonic scale and snack bars were scored for appearance, colour, texture, flavor, taste and overall acceptability. Scores were based on a hedonic rating of 1 to 9 where: 1 is “I dislike extremely” (very bad) and 9 is “I like extremely” (excellent) [7].

### 3. RESULTS AND DISCUSSION

Foxtail and proso flakes were standardized by tempering the grains for 10 hrs then grains were autoclaved at 121°C for 20 minutes at a pressure



**Fig. 1. Sensory evaluation of millet snack bar**

Note: CMB: Control bar. MB1: Millet bar with 50% of foxtail and proso flakes, MB2: Millet bar with 60% of foxtail and proso flakes, MB3: Millet bar with 70% of foxtail and proso flakes, MB4: Millet bar with 80% of foxtail and proso flakes

of 15 lbs/psi. Then it was cooled for 10 minutes and roasted it. The roasted grains were passed through flakes machine.

The energy dense bars prepared in different combination of Foxtail and proso flakes were evaluated for sensory qualities like appearance, colour, texture, taste, flavor, hardness and overall acceptability. The sensory scores for appearance ranged from 8.13 (CMB) to 7.40 (MB3) colour ranged from 8.06 (CMB) to 7.46 (MB3), texture 8.06 (CMB) to 7.13 (MB2), taste 8.06 (CMB) to 7.13 (MB3), flavor 8.06 (CMB) to 7.12 (MB2), hardness 8.13 (CMB) to 7.16 (MB3), and overall acceptability from 8.21 (CMB) to 7.13 (MB3), for the five incorporated bars as shown in Fig. 1. MB4: Millet bar with 80% of foxtail and proso flakes. The hedonic scale is ranged between 1-9 points from extremely disliked to extremely liked parameter.

The results showed significant difference ( $p < 0.05$ ) in the appearance and hardness when snack bar was added with 50% of foxtail and proso flakes (MB1). The appearance and hardness of 50% snack bar (MB1) was rated high in comparison among other formulations. The least score was rated to 70% foxtail and proso flaked bar (MB3).

Colour, textural and flavour properties also showed significant difference among the four millet snack bars. The millet snack bar with 50%

(MB1) had better colour (8.00), texture (8.00) and flavour (8.00) properties when compared with other three millet snack bar. The least score was rated to 60% millet snack bar (MB2).

Similarly, overall acceptability of millet snack bar made with 50% foxtail and proso flakes (MB1) had the highest rating than the remaining three millet snack bar samples in the hedonic scoring and they differed significantly ( $p < 0.05$ ). Of the four millet snack bar the one with 50% millet snack bar (MB1) followed by 60% (MB2) was rated the best.

#### 4. CONCLUSION

From the present studies, it is therefore concluded that incorporation of foxtail and proso flakes at 50% to snack bar (MB1) improved the colour, texture, hardness, taste, flavour and overall acceptability.

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#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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