



# DEVELOPMENT AND ORGANOLEPTIC EVALUATION OF NUTRIENT-DENSE SNACK BAR USING PROSO AND FOXTAIL MILLET

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## ABSTRACT:

Proso and foxtail millet are nutrient-dense cereals that grow sustainably in India's grey region areas. The consumption of nutrition bars has increased recently, and in light of this, the current study aimed to formulate nutrient-dense bars based on proso and foxtail millet to boost consumption and establish the grain as a trustworthy source of energy and other mineral. The bar was developed with the millets like proso (*panicum milliaceum*) and foxtail millet (*setaria italica*) along with other ingredients like oats, dates, raisins, almonds, pumpkin seeds, sunflower seeds and ghee. The nutrient-dense bars were prepared in two variations. Acceptability of the bars was assessed using the 5-point hedonic scale among fifty untrained panelists. The results show that sample A with equal proportion of proso and foxtail millet has better overall acceptance scores than sample B with 75% of foxtail millet and 25% proso millet, which suggests that sample A has better sensory qualities. In conclusion, this study offers a nutritious alternative to high-caloric snack items with the development of a mindful snack formulation using millet. By providing a convenient and wholesome option, it promotes healthier dietary habits and underscores the benefits of incorporating nutrient-rich ingredients into everyday food choices.

**Key words:** proso millet, foxtail millet, nutrient-dense bar, obesity, high-caloric snack

## INTRODUCTION:

The market for snacks, which includes items like crackers, cookies, bars, crisps, and biscuits, is growing phenomenally. As snacks become a bigger portion of people's daily diets, customers are now looking for snacks that provide more nutritional value. Food bars, often referred to as nutrition/snack/energy bars, are classified as handy foods. They are mostly made of cereals and other high-energy ingredients that include proteins, minerals, lipids, carbohydrates, and other nutrients that give them good sensory and nutritional qualities. Energy bars are a great option for a high-quality energy source because of the gradual changes in dietary patterns and lifestyle, growing awareness of good eating practices, and rising levels of physical activity (Doiphode S. S., et al (2019)).

In dry and semi-arid regions of the world, millets are a staple meal. Millets make excellent energy sources. They supply dietary fiber, polyphenols, minerals, vitamins, fatty acids, and protein. Normal protein from millet has a high concentration of important amino acids, particularly sulfur-containing amino acids like cysteine and methionine. Due to their ability to grow in unfavorable climatic circumstances, such as little rainfall, millets are a staple grain in many developing nations. For millions of people worldwide, especially those who reside in hot, arid regions, millet is an important source of nutrition. (Amadou, I., et al (2018)).

In terms of nutrition, millets have similar, if not higher, calorie values, protein levels, and macronutrient contents than regular cereals. Their high calories, calcium, iron, zinc, fats, and premium proteins make them an important addition to both human and animal diets. They are also excellent providers of vitamins and dietary fiber. Along with xylo-oligosaccharides, insoluble fibers, and peptides, millet grains also had phenolic acids, flavonoids, and tannins, which are naturally occurring phenolic components. (Hassan, Z. M., et al (2021)). The B-complex vitamins, with the exception of vitamin B12, and vitamin E are abundant in millets. 10.88 mg of niacin is found overall. (Chauhan, M., et al (2018)). Comparable to or better than major cereal grains in terms of nutrition are millets. Millets were a good choice for a health food because of their many advantages, which included richness in bioactive compounds, low glycemic index, high fiber content, and gluten-free proteins. (Kumar, A., et al (2018)). Frequent use of millet grains and their derivatives has been linked to a lower risk of all-cause mortality, diabetes, cardiovascular disease, and cancer, among other chronic disorders. Despite being one of the healthiest dietary options, millet is still relatively underutilized in affluent nations where the rate of chronic diseases linked to nutrition is concerning. (Chauhan, M., et al (2018))

Around the world, especially in Asia and Europe, proso millet is widely grown in the dry and semiarid tropics. Proso millet, a cereal native to northern China, was among the first cultivated crops ever used to produce alcohol and a variety of desserts. Proso millet has a high concentration of amylose and resistant starch is free of gluten and loaded with nutrients. (Xiao, J., et al (2023)). Compared to other millet varieties, proso millet has a higher protein content and is a more nutritious option than main grains like wheat, rice, and corn. Because the particular prolamin fraction in Proso is below the allowable limit, it is a suitable food item for patients following a gluten-free diet. (Karakannavar, S., et al (2022)) 12.5 grams of protein per 100 grams of grains is a significant protein level for proso millet. This protein acts as the basic building block for muscles, skin, and bones, making it essential to maintaining a healthy body. Additionally, the development and maintenance of bodily tissues depend heavily on protein. Additionally, calcium, which is necessary for strengthening bones, may be found in proso millet. Children whose bones are still developing can use it as a calcium source, and elderly people who need to consume enough calcium to maintain overall bone health can also benefit from it. Magnesium, another mineral abundant in proso millet, is important for controlling blood sugar and fostering appropriate insulin levels. This helps reduce the risk of developing Type-II diabetes. (Singh, N., et al)

The sixth-highest yielding grain, foxtail millet (*Setaria italica* (L.) P. Beauv.), has been recognized as a significant millet in terms of global output. It is a cereal grain that is easily grown and a member of the *Setaria* genus in the Poaceae family, specifically the Subfamily Panicoideae. (Niranjan, K., and Sharma, N. (2018)). Foxtail millet is being grown on a small plot of land primarily for rural residents' household purposes. Children, the unwell, and expectant and nursing mothers still use it as an energy source. Nutritionally, it is low in fat (4%), high in protein (11–12%), and rich in dietary fiber (6.7%). Since foxtail millet releases glucose steadily and doesn't alter the body's metabolism, it is recognized as a diabetic food. Diabetes is reported to be uncommon in the population that consumes a diet high in foxtail millet. (Hariprasanna, K. (2016)). The antioxidants, variety of vitamins, minerals, phytochemicals, and other bioactive components found in foxtail millet are primarily responsible for these health advantages, making it a potentially useful functional diet. ((Sharma, N., & Niranjan, K. (2018)).

The nutrient-dense foxtail millet is rich in protein, fiber, zinc, and magnesium. Its glycemic index (GI), which is 59, is moderate. Compared to wheat and rice, eating foxtail millet causes a slower release of sugar into the bloodstream. B-glucans, which make up 42.6% of the fiber, stimulate the metabolism of sugar and cholesterol, lowering blood sugar and cholesterol levels. This can help avoid diabetes and cardiovascular diseases. Low GI foods—especially those for type 2 diabetes—are made using foxtail millet to help treat cardiovascular illnesses and diabetes. Foxtail millet consumption lowers blood pressure, lipid profiles, fasting blood sugar levels, and body weight effectively. The high fiber content of foxtail millet reduces the risk of heart disease, hypertension, and stroke while also easing constipation and improving digestion. It has a good supply of B vitamins, including folate (B9), thiamin (B1), riboflavin (B2), and niacin (B3). The nervous system and the brain depend on these B vitamins for proper operation. Additionally rich in antioxidants, foxtail millet contains flavonoids that shield neurons from inflammation and may enhance memory. (Hariprasanna, K. (2016)).

In areas where dates are grown, especially in the Middle East, date fruit is significant. Numerous reports exist regarding the chemical makeup of date fruit. Date fruit's primary chemical components are carbohydrates, specifically sucrose, glucose, and fructose. (Tang, Z. X., Shi, et al, (2013)).

The chance of developing chronic illnesses, including depression, type 2 diabetes, cardiovascular disease, several malignancies, and death, is significantly raised by obesity. A number of dietary modifications, such as larger serving sizes and increased frequency of snacking (SF), have been linked to the rise in obesity. Additionally, snacking

contributes to a greater daily calorie consumption. Snacking can add 152–302 calories per snacking occasion to daily energy intake, therefore having multiple snacks throughout the day can add a significant amount of energy. (Skoczek-Rubińska, A., et al (2021)). An essential way to increase dietary intake of critical nutrients is through snacking in between meals. It was necessary to have snack bars that were rich in nutrients and enhance satiety and feelings of fullness. (Sohan, S.Z., et al).

Consumer interest in ready-to-eat items has increased since they are handy and cater to most palates. This trend is met by nutrition bars, which are made primarily of cereal grains, dried fruits, and nuts and have a wonderful flavor and sweetness that make them more enticing. These nutrition bars are an excellent source of vitamins, minerals, fiber, protein, and complex carbohydrates.

In light of this, the current work aims to produce a nutrient-dense bar made from underutilized but nutrient-dense sources, proso and foxtail millet, which is economical as well as nutritious. The addition of dates and other commonly consumed nutrient-dense sources enhances its nutritional qualities.

## 2. MATERIALS AND METHODS

### 2.1 Materials

#### 2.1.1 Raw material:

Raw materials such as foxtail millet, proso millet, oats, dates, raisins, pumpkin seeds, sunflower seeds and ghee were purchased from local market at Chennai.

### 2.2 Methodology

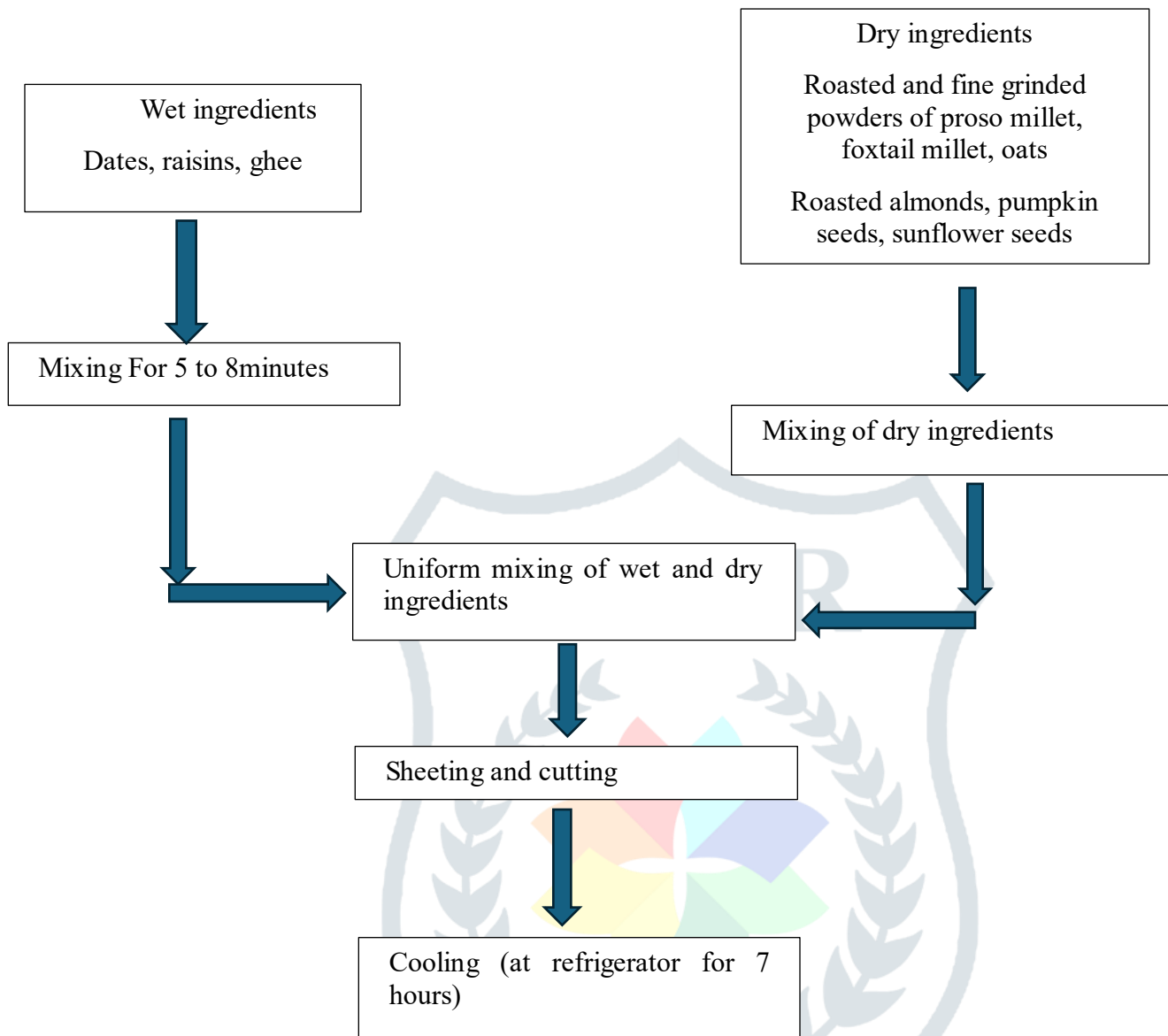
#### 2.2.1: Standardization of energy dense bar:

The foxtail millet and proso millet are roasted in pan separately and grinded it into fine powder. The binding ingredients for the formulation of bar are oats (50g/100g), dates (25g/100g) and raisins (10g/100g), ghee(15ml/100ml). The binding ingredients was prepared by grinding dates and raisins into paste and grinding of oats into fine powder separately. The dry ingredients such as almonds, sunflower seeds, pumpkin seeds were weighed as per the formulation tabulated in table (table1) and roasted. All the grinded powder, binding ingredients and dry ingredients are mixed together. The mixer poured in tray which is greased by ghee. The bar weighing approximately 30g± 3g were cut with the help of mould and refrigerated for 7 hours. The sample was done in two variation, sample A is done in equal proportions of foxtail and proso millet and sample B is done in 75% of foxtail millet and 25% proso millet and the other ingredients are added in same proportion for each sample.

Table 1: Formulation of nutrient dense bar

Ingredients	Sample A	Sample B
Foxtail millet (g)	50	75
Proso millet (g)	50	25
Oats(g)	50	50
Almonds	10	10
Sunflower seeds(g)	10	10
Pumpkin seeds (g)	10	10
Dates(g)	25	25
Raisins (g)	10	10
Ghee (ml)	15	15

### 2.2.2. Flow of work:



### 2.2.3. Sensory analysis

The sensory analysis of three variations of bar samples was conducted using a 5-point hedonic scale with fifty untrained participants. This method aimed to evaluate the overall liking of each bar variant based on taste, texture, aroma, and appearance.

### 2.2.4. Statistical analysis:

All data were analyzed using mean and standard deviation using Excel.

## 3. RESULT AND DISSCUSION

### 3.1 Organoleptic characteristics of snack bar:

The organoleptic characteristics, including color and appearance, flavor/taste, aroma, texture, mouthfeel, and overall acceptability, were evaluated for nutrient-dense bar. The scores received for sample A and sample B is given below in Table 2. The analysis indicates that sample A exhibited the highest overall acceptance among the two samples, suggesting that it was preferred by the evaluators in terms of sensory attributes.

Table 2: Organoleptic characteristics of Nutrient-Dense Bar

SAMPLE	APPEARAN CE	TASTE	TEXTURE	AROMA	FLAVOUR	OVER ALL ACCEP TABILI TY
<b>SAMPLE A</b>	4.8±0.40	4.58±0.60	4.72±0.49	4.62±0.63	4.54±0.78	4.76±0 .43
<b>SAMPLE B</b>	4.8±0.40	4.5±0.61	4.68±0.51	4.58±0.64	4.54±0.70	4.64±0 .52

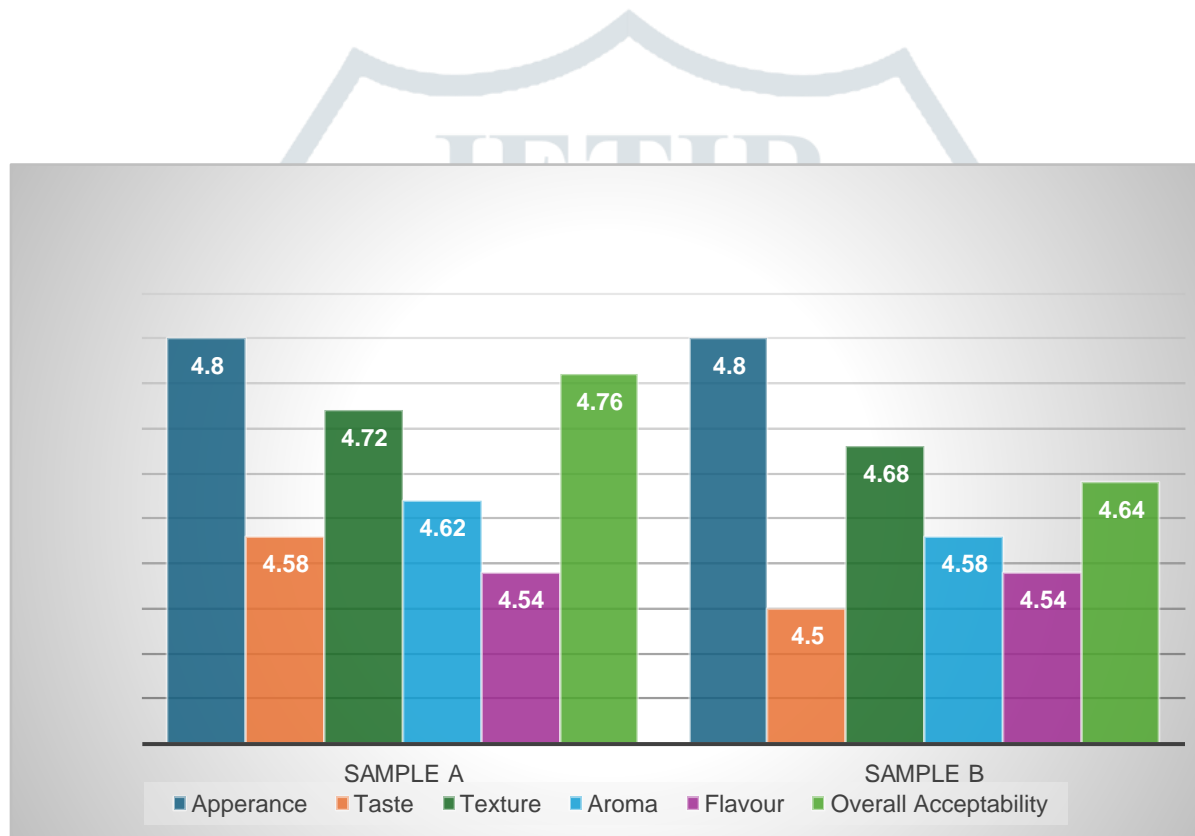


Figure 1: Result of Sensory Analysis of Nutrient-Dense Bar

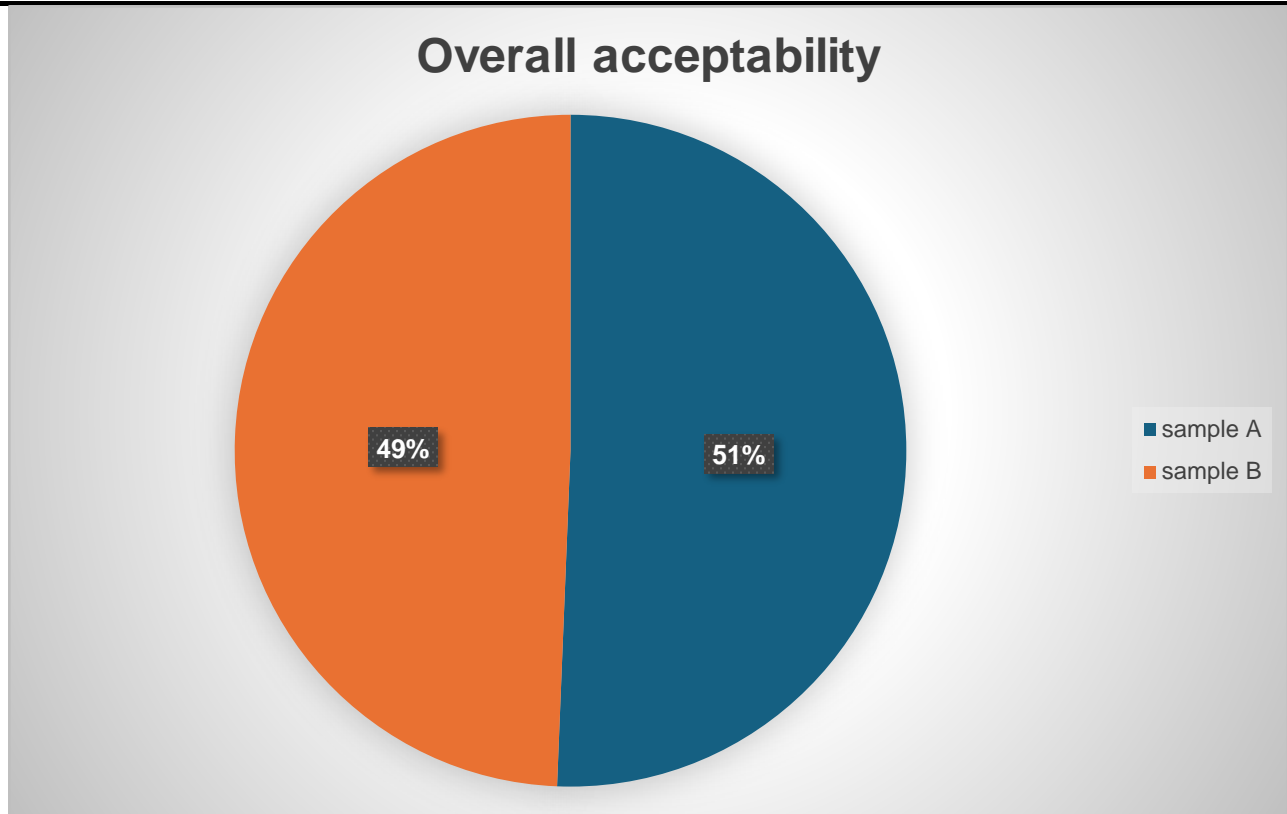


figure 2: overall acceptability of Nutrient-Dense Bar

#### 4. CONCLUSION:

This study aimed to highlight the nutritional potential of proso and foxtail millet, which are minor millets that are not widely recognized by consumers due to processing challenges. Our findings indicate that Sample A (50% proso and 50% foxtail) was highly preferred over Sample B in terms of appearance, taste, aroma, flavor, and texture. This suggests that incorporating both proso and foxtail millet in equal proportions yields a more appealing and palatable product. This supports the utilization of both millets as nutritious ingredients in food products. In conclusion, considering the prevailing consumption of high-caloric snack items, this snack formulation presents a mindful and nutritious alternative. By offering a convenient and wholesome snack option, this study contributes to promoting healthier dietary habits, emphasizing the potential benefits of incorporating nutrient-rich ingredients like millet into everyday food choices.

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