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Short Communication

# Development and optimization of sorghum-flakes based nutribar for physcio chemical and organoleptic evaluation

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Nutribars are supplemental bars composed of cereals and other high-energy foods designed for people who need quick energy but don't have time to eat a meal. Nutribars provide energy from ingredients used to prepare it. (Tiwari *et al*., 2016).

Nutribar or granola bar is a highly nutritious snack food that can be prepared with a variety of ingredients. Cereal grains, rolled or flaked oat and barley, cereal grain germ part, honey, nuts, raisins, and other ingredients may be included. It is a baked or cooked product, and the mixture is constantly stirred during cooking to maintain its consistency. Prepared mixture is being transformed into a pressed bar shape for easier consumption. Nutritional value of bar can be altered by changing the ingredients. Making granola bars or nutribars from cereal grains is a worldwide practice. This is owed because the increasing popularity of cereals, which has been used in the formulation of various products due to their functional and nutraceutical properties. Combining cereals with other ingredients is nutritionally beneficial because it provides a balanced amount of protein, particularly sulfur-containing amino acids and lysine, which are otherwise deficient in most cereal grains (Ahmad *et al*., 2017).

Nutritional bars are mostly made by using a base of grains, such as rice or oats proteins such as legumes. The bars can be fortified with a variety of vitamins, minerals, herbs, and other nutrients or energy sources. Nutritional bar gains the customer attention due to their nutritional quality and ease of availability to meet the energy requirements between meals. (Gonzales and Draganchuk, 2003).

Sorghum (*Sorghum bicolor* L.) is a major cereal crop grown in Africa and Asia's semi-arid tropics due to its drought tolerance. It is a staple food crop grown on a large scale by farmers in these areas for human nutrition (FAO, 2011).

It is obvious that using sorghum alone or in combination with other cereals, legumes, oilseeds, and so on in the development of value-added foods may result in their widespread use among non-traditional sorghum consumers. This will also improve the status of sorghum among cereals in the economic empowerment of millet growers and contribute to public health. (Verma *et al*., 2018).

Sorghum is usually recommended as a safe food for celiac patients, who cannot tolerate the protein sequences found in wheat gluten's gliadins and glutenins. Flaking, puffing, shredding and granule formation in wheat, corn and rice are the processes used in the preparation of ready-to-eat cereals. Cereal flakes are a popular breakfast item that is currently made primarily of corn. Sorghum flakes could be produced through appropriate processing. (Chavan *et al*., 2015).

Sorghum flakes could be toasted or expanded by hot air or sand to serve as a snack or supplementary food for obese and calorie-conscious individuals. After toasting, they can

be easily used as ingredients in muesli and other products (Divya *et al*., 2017).

Flaked or beaten rice is a traditional rice product popular in India and other rice consuming nations. This is consumed as a snack after roasting, frying, or seasoning, or as a breakfast item. Various rice-based, ready-to-eat food products are available at the market. Rice is a gluten-free diet that can be used as a good substitute for celiac patients (Kumar *et al*., 2016).

Sesame seeds are source of carbohydrates, proteins, fats, fibers and minerals. It is rich source of oil from its half of the chemical component. It gives same amount of the amino acids, monosaturated fatty acids, polyunsaturated fatty acids. It has antioxidant activity, which has a significant effect on lowering blood pressure, vessel degenerative changes, and preventing chronic diseases. (Aglave, 2018).

Sesame is a good source of iron, magnesium, manganese, copper, and calcium, as well as important vitamins B1 and E (Najeeb *et al*., 2012).

The groundnut or peanut is an important legume crop in tropical and semiarid tropical nations, where it is a key source of edible oil and protein. Groundnut kernels have 47-53% oil and a protein content of 25-36% (Prasad *et al*., 2011).

Peanuts are regarded as an important source of nutrition. Nutrition is essential to the growth and energy intake of living organisms. Peanuts are high in calories and abundant in nutrients, minerals, antioxidants, and vitamins, all of which are necessary for good health. All of these biomolecules are critical for delivering necessary nutrients to the human body and maintaining normal health (Settaluri *et al*., 2012).

The objective of this research was to develop and optimize nutribar using sorghum flakes with other easily available ingredients as rice flakes, sesame and peanut that would provide balanced nutrients, required for various body functions.

## Material and method

### *Procurement of selected ingredients*

Raw material like sorghum flakes, rice flakes, sesame seed, peanut, liquid glucose and butter etc.were purchased from local market of Parbhani.

### *Pre-processing of ingredients*

Sorghum flakes, rice flakes sesame seed were roasted separated in pan on low flame at 120°C. Peanut splits were prepared according to the procedure given below.

### Preparation of peanut splits

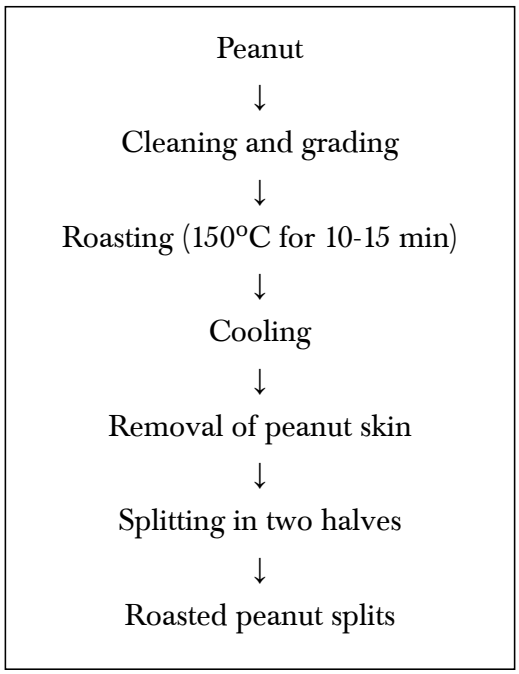



Fig 1: Preparation of roasted peanut splits

### *Preparation of binder syrup*

The binder syrup was prepared using jaggery, liquid glucose, butter and water. In sauce pan add butter, after melting of butter crushed jaggery and water added and heated. Simultaneously check and maintained 85$^0$Brix TSS of syrup. Add glucose syrup added in prepared syrup.

### *Preparation of nutribar*

Dry ingredients- roasted sorghum flakes, rice flakes, sesame seed and peanut splits were added in binder syrup and mixed properly, obtained mixture transferred to greased tray, hand pressed and cut in rectangular shape. The tray kept in oven for baking at 110°C for 15 min. After baking tray left for cooling at ambient temperature. The nutribars removed from tray then packed in aluminium foil pouches and kept at ambient temperature.

Sorghum flakes based nutribar was prepared with varying the composition of ingredients as rice flakes and sorghum flakes. The proportion of sesame seed, peanut, jaggery, liquid glucose, butter and water was kept constant. The formulation for samples is presented in Table 1.

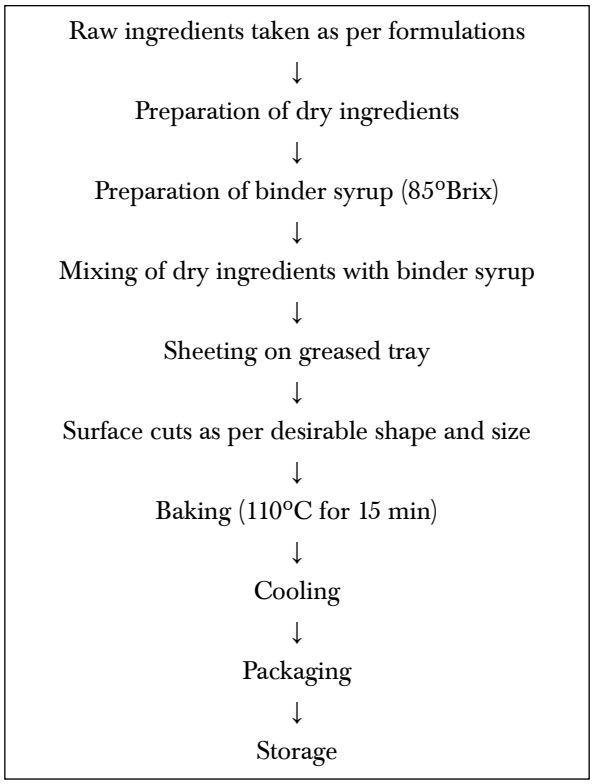



Fig 1. Preparation of nutribar

Table 1. Formulation for preparation of nutribar

| Ingredient(g) | Control (T0) | T1 | T2 | T3 |
|---|---|---|---|---|
| Sorghum flakes | 0 | 10 | 20 | 30 |
| Rice flakes | 30 | 20 | 10 | 0 |
| Sesame | 10 | 10 | 10 | 10 |
| Peanut | 10 | 10 | 10 | 10 |
| Jaggery | 30 | 30 | 30 | 30 |
| Liquid glucose | 10 | 10 | 10 | 10 |
| Butter | 2 | 2 | 2 | 2 |
| Water | 10 | 10 | 10 | 10 |

T0 – Without addition of sorghum flakes ; T1 – With addition of 10% sorghum flakes T2 – With addition of 20% sorghum flakes ; T3 - With addition of 10% sorghum flakes

### *Organoleptic evaluation of prepared nutribar*

Organoleptic evaluation of developed sorghum based nutribar carried out by using 9-point hedonic scale with 15 semi-trained panel members with respect to different quality attributes such as colour, taste, flavour, texture and overall acceptability.

### *Proximate analysis of nutribar*

Proximate analysis of selected sample on basis of organoleptic evaluation were carried out for determination of moisture, protein, fat, carbohydrate, crude fiber and ash (AOAC 2005).

## Result and Discussion

### *Physical parameters of nutribar*

Physical properties of prepared nutribar were characterized by their shape, length, width and weight. The physical properties of sorghum-jaggery nutribar were studied and results obtained are presented in Table 2.

Table 2. Physical parameters of nutribar

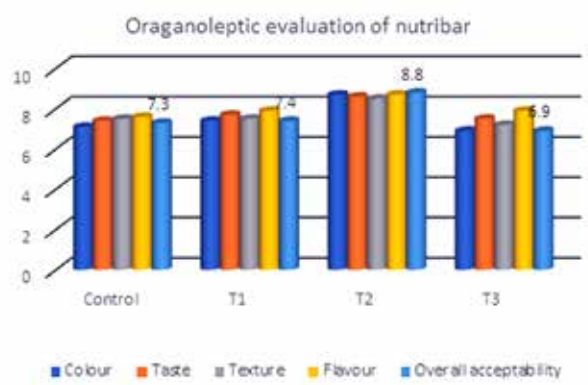
| Formulation | Length | Width | Weight | Shape |
|---|---|---|---|---|
| **Control (T0)** | 6.1 | 2.5 | 28.3 | Rectangular |
| **T1** | 6.2 | 2.6 | 28.6 | Rectangular |
| **T2** | 6.2 | 2.6 | 28.7 | Rectangular |
| **T3** | 6.0 | 2.5 | 29.0 | Rectangular |

*Each value is average of three determinations

It can be observed from the above table that weights of different formulations of nutribar were slightly varied. The weight of the sample T0, T1, T2 and T3 were observed in the range 28-29 g. The length of sample T0, T1, T2 and T3 were found as 6.1, 6.2, 6.2 and 6.0 cm respectively. The width of sample T0, T1, T2 and T3 were found as 2.5, 2.6, 2.6 and 2.5 cm respectively. The shape of all samples of nutribar were found to be similar i.e., rectangular. A slight difference was observed in weight and length of prepared sorghum based nutribar. The physical parameters analysed for developed nutribar was in line with (Ghatge, 2016).

### *Organoleptic evaluation of nutribar*

Organoleptic evaluation of prepared product was carried out and selected highest scored sample on basis of 9-point hedonic scale.




Graph 1. Oraganoleptic evaluation of nutribar

Various parameters as colour, taste, texture, flavour and overall acceptability. The colour serves as a preliminary attribute for food acceptance and signifies the suitability for consumption. Control sample scored 7.1 whereas T2 obtained highest score 8.7 for colour. Different samples obtained various scores for colour due to ingredient variance.

It is revealed from graph 1 that the taste of T2 secured the highest score (8.5) followed by T1 (7.7) and T3 (7.5), whereas control (T0) secured minimum score (7.4) for taste.

Sample T2 obtained highest score for texture followed by control and T1, whereas T3 sample scored minimum for textural parameters. Addition of sorghum flakes significantly effects on texture of nutribar. T2 sample scored highest for flavour and overall acceptability (8.8). On the basis of sensory evaluation sample T2 was selected and further analysis was carried out. Organoleptic quality evaluation of optimized nutrient bar was carried out by (Srivastava and Mishra, 2016) and selected best formulation.

### *Proximate composition of nutribar*

The moisture content in prepared nutribar found to be 9.40 % in control sample, it is observed that incorporating sorghum flakes reduces moisture content in final product. Table 3 revealed that highest protein content found in T3 14.42% followed by T2 and T1. Increasing protein

Table 3. Proximate composition of nutribar

| Formulation | Proximate composition (%) | | | | | |
|---|---|---|---|---|---|---|
| | **Moisture** | **Protein** | **Fat** | **Carbohydrate** | **Crude fiber** | **Ash** |
| Control | 9.40 | 13.51 | 8.71 | 62.51 | 5.61 | 1.81 |
| T1 | 9.12 | 13.64 | 8.69 | 62.83 | 5.66 | 1.83 |
| T2 | 8.43 | 14.33 | 8.55 | 63.04 | 6.23 | 2.21 |
| T3 | 8.22 | 14.42 | 8.51 | 63.59 | 6.34 | 2.26 |

*Each value is average of three determinations

content level found in sorghum based cereal bar by Verma *et al*., (2018). Fat content of different formulations found to be almost similar, whereas control sample having highest fat 8.71%. Developed nutribar is good source of carbohydrates, T3 having highest 63.59% carbohydrates followed by T2 and T1.

Crude fiber content increased significantly wit increasing sorghum flakes percentage and found to be highest in T3 sample 6.34%. The results for crude fiber content are in similar agreement with findings revealed by Verma *et al*., (2018) who prepared iron rich sorghum based cereal bar.

## Conclusion

The study concluded that different formulations of sorghum flakes based nutribar were organoleptically acceptable, in which T2 sample scored highest for overall acceptability. The developed nutribar was found to be high in carbohydrates, protein and fiber with good amount of fat. Hence, it is recommended that sorghum flakes based nutribars are better in terms of sensory attributes, rich in nutrients and techno-economically feasible which can be explored on commercial level.

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## Author Contributions

PTJ, SKS and VSP prepared the manuscript and preparing the final version of the manuscript and correspond to the journal.

## Ethical Approval

This article does not contain any studies involving human or animal participants performed by any of the authors.

## Conflicts of Interest:

The authors declare no conflict of interest.

## References

1. A.O.A.C. 2005. Official Methods of Analysis of A.O.A.C International. 18th Edition.
2. Aglave HR. 2018. Physiochemical characteristics of sesame seeds. *Journal of Medicine Plants Studies 6*(1), 64-66.
3. Ahmad A, U Irfan, RM Amir and KS Abbasi. 2017. Development of high energy cereal and nut granola bar. *International Journal of Agricultural and Biological Sciences*, 13-20.
4. Chavan UD, SS Patil, BD Rao and JV Patil. 2015. Processing of Sorghum for Flakes and their Products. *European Journal of Molecular Biology and Biochemistry*, *2*(1), 49-58.
5. Divya K, D Barmavath and B Dayakar. 2017. Health mix product development by incorporating the bi-product of sorghum flakes powder & pulses and its organoleptic evaluation. *Journal of Pharmacognosy and Phytochemistry*, *6*(5), 1434-14.
6. FAO. 2011. Food and Agriculture Organization of United Nations. FAOSTAT Statistics database-agriculture. FAO, Rome, Italy.
7. Gonzalez E and M Draganchuk. 2003. Flavoring nutrition bars. *Cereal Foods World*, *48*(5), 250.
8. Kumar S, RU Haq and K Prasad. 2018. Studies on physico-chemical, functional, pasting and morphological characteristics of developed extra thin flaked rice. *Journal of the Saudi Society of Agricultural Sciences*, 17(3), 259-267.
9. Najeeb U, MY Mirza, G Jilani, AK Mubashir and WJ Zhou. 2012. Sesame. In *Technological Innovations in Major World Oil Crops, Volume 1* (pp. 131-145). Springer, New York, NY.
10. Prasad PV, VG Kakani and HD Upadhyaya. 2010. Growth and production of groundnut. *UNESCO Encyclopedia*, 1-26.
11. Settaluri VS, CVK Kandala, N Puppala and J Sundaram. 2012. Peanuts and their nutritional aspects–a review.
12. Srivastava Ananya and Sunita Mishra. 2016. Development of the Nutrient Optimised Bar for the Sport Person. *International Journal of Science and Research (IJSR)*. Volume 7 Issue 11.
13. Tiwari P, K Agrahari, M Jaiswal and A Singh. 2017. Standardization and development of different types of energy bars. *International Journal of Home Science*, *3*(1), 370-372.
14. Verma S, N Khetrapaul and V Verma. 2018. Development and standardisation of protein rich

sorghum based cereal bars. *International Journal of Current Microbiology and Applied Sciences,* 7(5), 2842-2849.

15. Verma S, N Khetrapaul and V Verma. 2018. Development and standardisation of iron rich sorghum based cereal bars and their nutrient composition. *Journal of Pharmacognosy and Phytochemistry*, 7(3), 1189-1192.

16. Ghatge PU, PY Solankar, RR Andhale and HM Syed. 2016. Physicochemical and organoleptic evaluation of nutri bar supplemented with millet and legume flours. *Multilogic In Science,* Volume V, Issue XV.