

# Development and Evaluation of Value-added Nutri bar using Popped Red Rice and Amaranth Seeds for Adolescents

Vinutha N A<sup>1</sup>, Navaneetha R<sup>2</sup>

<sup>1</sup>Department of Food and Nutrition, <sup>2</sup>Smt. V.H.D Central Institute of Home Science, School of Home Science, Maharani Cluster University, Seshadri Road, Bengaluru-560001

Corresponding Author: Vinutha N A

DOI: <https://doi.org/10.52403/ijhsr.20240620>

## ABSTRACT

The functioning of gut microbiome is strongly influenced by our diet. A balanced diet with additional requirement of Iron is necessary during adolescence. In India, value added popped rice is produced using a simple, low cost, iron-pan roasting technique. Value addition of indigenous sweets /snacks using popped red rice along with iron rich food sources can serve as a healthy snack for adolescents. This investigation was undertaken to develop value added Nutri bar for adolescents. The present study aimed at development, standardization, sensory evaluation and shelf life study of value added Nutri bar using popped red rice as the main ingredient along with other functional ingredients. The developed product (basic) and value added Nutri bar variations (V1, V2 and V3) were subjected to sensory evaluation, using 9point hedonic rating scale to 35 semi trained panelists. Sensory evaluation results indicated, value added Nutri bar (variation 2) developed using 20% popped rice, 10% Amaranth popped seeds, 40% jaggery, 5% almonds, 5% pumpkin seeds, 5% sesame seeds, 5% raisins, 5% ghee and 5% cardamom, was best accepted. Experimental results showed that the best accepted Value added Nutri bar (variation 2) has a shelf life of 21 days under normal storage conditions. Adolescents, gluten sensitive people and all age groups can enjoy this tasty, value added Nutri bar as an ideal, all time Nutri dense snack.

**Keywords:** Nutri bar, popped rice, Popped Amaranth seeds, Value addition, Sensory evaluation

## INTRODUCTION

Adolescence is an important period of nutritional vulnerability due to increased dietary requirements for growth and development. Iron needs of adolescents are elevated as a result of intensive growth and muscular development, which implies an increase in blood volume; thus, it is extremely important to meet their increased iron requirements. Currently, majority of adolescents consume unbalanced diet which may limit mineral intake and or

bioavailability, leading to iron deficiency. Iron deficiency not only leads to physiological changes, it can also adversely affect adolescents' cognitive ability and behavior (1). Appropriate nutrition during adolescents is important for the increased demands of growth and pubertal development and to decrease the risk of future chronic disease (2). Iron deficiency anemia occurs at all stages of the life cycle, but is more prevalent in pregnant women

and young children. Adolescents, especially girls, are particularly to iron deficiency (3). Numerous attractive snack foods that are high in calories but of low nutrient density are available in today's market. Value addition therefore important using nutri cereals is one way to meet the iron needs particularly through dessert foods. Nutri cereals are popped red rice and amaranth seeds. The objectives of this experimental study are:

- To develop puffed white rice bar (basic) and value added nutri bar (variations)
- To conduct sensory evaluation puffed white rice bar (basic) and value added nutri bar (variations)
- Proximate analysis of developed value added nutri bar of best sensory rated nutri bar.
- Shelf life study of developed, best rated value nutri bar

## REVIEW OF LITERATURE

Rice with a red bran layer is called red rices. Though the color is confined to the bran layer, a tinge of red remains even after a high degree of milling. The color of the bran ranges from light to dark red. The bran layer contains polyphenols and anthocyanin, and possesses antioxidant properties. The inner portion of red and white rices is alike and white. The zinc and iron content of red rices is 2-3 times higher than that of white rices(4).

India is renowned for its genetic wealth, including speciality cultivars such as black, red, and diverse white rice varieties, possessing unique aroma and texture. The Red and Black Pigmented rice varieties, contains diverse bioactives and nutrients including antioxidants, dietary fibre (DF), protein, fats, vitamins, and minerals, such as iron and zinc, in comparison to white rice varieties.

Popped red rice (*Oryza Savita*) is a classic, ready-to-eat wholegrain snack in India and a good dietary alternative for vegetarians,

anaemics, coeliacs, and gluten- sensitive and intolerant individuals. In India, this product is also called parched rice, Aralu, Pelaalu, Kheel, Nel Puri, and Khoi. It is mostly used during weddings, temple offerings, and other religious ceremonies and in several East Indian dishes due to its exceptional sensory qualities. In contemporary and commercialized processing, popped rice is used to produce ladoos (traditional Indian sweet) and morning cereals. Popping is a simple, cost-effective way to prepare wholegrain snacks (5).



Figure-1 Popped Red rice

Ready to eat expanded food grains are gaining popularity in modern days due to their ease to digest, lightness, crispiness and most importantly their ready to eat in nature. The demand for these products is increasing to develop products with enhanced quality more in product and taste. Heating methods for expansion, and the effect of these parameters on the quality of the final product. Quality characteristics such as texture, nutrition, and other organoleptic properties play an essential role in selecting puffing or popping methods and for enhancing consumer acceptability (6).

Amaranth (*Amaranthus cruentus*) grain is a pseudo-cereal which has better nutritional profile than the traditional cereals and is also gluten-free(7). Amaranth seeds are rich in energy, protein, calcium and iron and it is fast and easily grown in difficult weather and soil conditions. Amaranth is such a high nutrition profile pseudocereal that is very traditional to India. It is one of the ancient and most commonly produced crops in India. Amaranth, also known as Pigweed or

Rajgira or Ramdana. Although amaranth is categorized as a grain, it's really a seed, a dicot seed (just like quinoa), hence Amaranth is considered a "pseudocereal". Amaranth can be enjoyed in both sweet and savoury recipes. They have a sweet and nutty flavour and are a bit crunchy when cooked(8).



**Figure-2 Popped Amaranth seeds**

Jaggery (*Saccharum officinarum*) is prepared from sugarcane juice and is known by different name in the world such as Panela, Kokuto, and Muscovado. The nutrient value of jaggery is increased while preparing with different methods from sugarcane juice. The micronutrients which are present in Jaggery have many nutritional and medicinal aspects such as its anticarcinogenic and antitoxic activity. Jaggery has proved itself better when compared with white sugar. Jaggery is known to produce heat and give instant energy to a human body(9).

Almond (*Prunus dulcis*) are a nutrient-dense food, it reduces risk of chronic diseases such as coronary heart disease (CHD) and type 2 diabetes, as well as to weight maintenance and weight control. Almonds can be eaten whole (fresh or roasted) and in spreads like almond butter or they can be used in a wide range of food products and recipes. Almonds have complex food matrices containing diverse nutrients and other phytoprotective substances that favourably influence human physiology. All nuts are energy dense and contain high levels of fat, but much of this is unsaturated(10).

Pumpkin seeds (*Cucurbita pepo*) are rich in protein, fibers, minerals like iron, zinc,

calcium, magnesium, manganese, copper and sodium, PUFA (polyunsaturated fatty acids), phytosterol and vitamins, they might be considered important for the food industries. As the seeds are considered as by product of the pumpkin fruit, they are cheaper in cost and their utilization in different food products may lead to enhance their nutritional value at lower cost. Health promoting impacts of pumpkin seeds on the level of blood glucose, cholesterol, immunity, liver functioning, gallbladder, disabilities of leaning, prostate gland, depression, inflammation, cancer management and inhibition of parasites are established (11).

Sesame seeds (*Sesamum Indicum*) also known as gingelly seeds, til or benni seed is one of the oldest seeds known to humankind. It is an oilseed crop cultivated all the world. India, China and Myanmar are largest producers of sesame in the world. Sesame seeds are not only good source of carbohydrates, protein and fats (oil) but also rich in micronutrients and bioactive components. It is known as 'Queen of Oilseeds' as it is highly resistance to oxidation and rancidity. Sesame seeds are a reservoir of nutrients. Bioactive components like phytosterols, tocopherols and lignans such as sesamin and sesamolin provide numerous health benefits to humans. Sesamin and sesamolin exhibit antioxidant, anti-inflammatory, antihypertensive and anticarcinogenic properties . Sesame seeds are used in preparations of biscuits, crackers, sweets and desserts(12).

Raisins (*Vitis vinifera*) are dried grapes consumed world-wide that contain beneficial components for human health. They are rich in fiber and phytochemicals such as phenolic compounds(13).

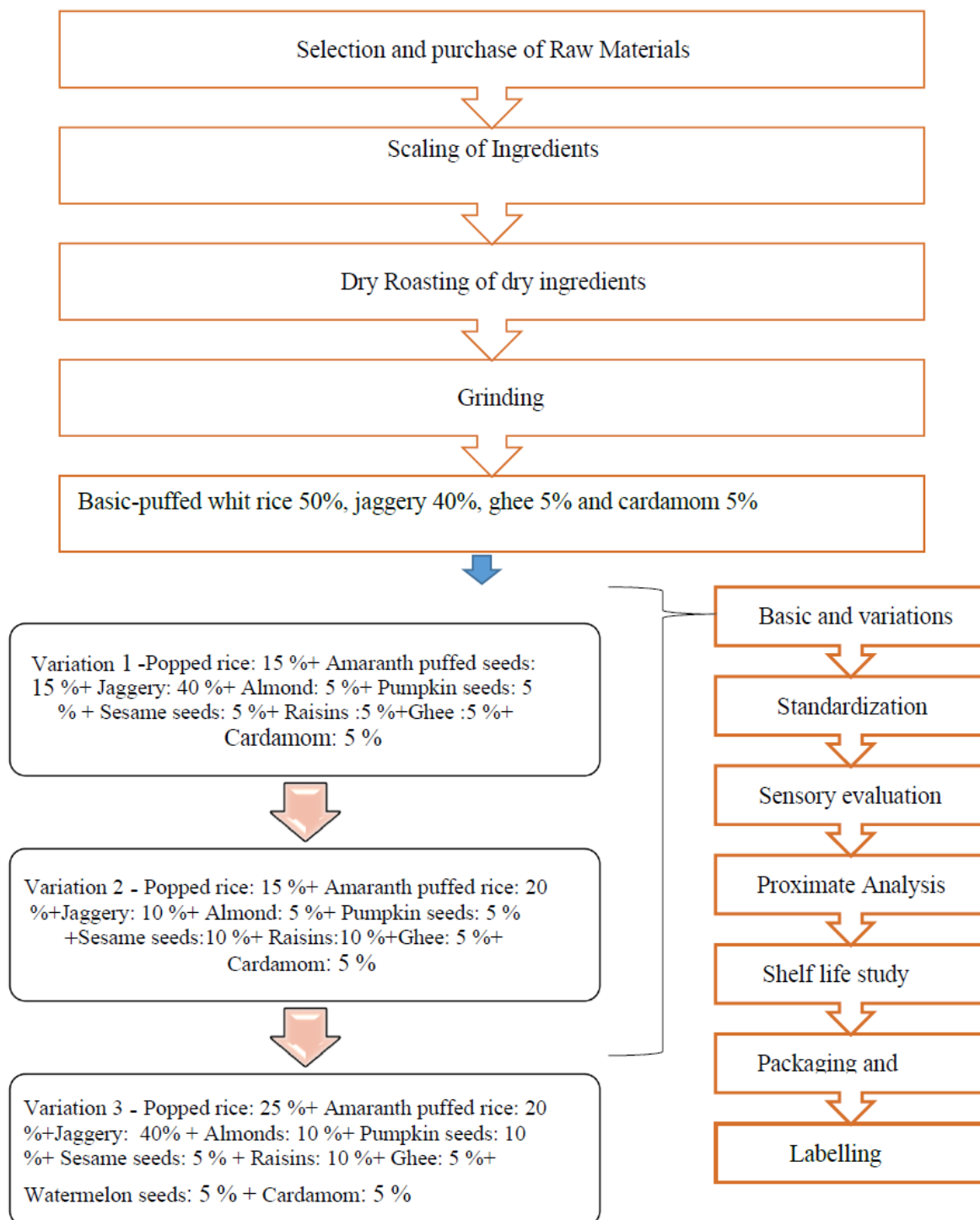
## **MATERIALS & METHODS**

### **Place of study**

The experiment was carried out at the Department of Food and Nutrition, Smt. VHD Central Institute of Home Science,

Maharani Cluster University, Bengaluru. laboratories.  
Sensory evaluations were performed in the

**Figure-3 Plan of work for development of protein rich value added NUTRI BAR**



**Raw materials used for the development of puffed white rice (basic) and Value added Nutri Bar (variations)**

Using locally available ingredients, Iron rich Nutri Bars were developed. The major raw materials used in the development of puffed white rice bar and Value added Nutri

Bar were puffed white rice, popped red rice (Oryza Savita), Popped Amaranth seeds (Amaranthus caudatus L., Amaranthus cruentus L., and Amaranthus hypochondriacus L), Jaggery (Saccharum officinarum L.), Almond (Prunus dulcis), Pumpkin seeds (Cucurbita pepo), Sesame seeds (Sesamum indicum), Raisins (vitis vinifera L.), Ghee (clarified butter), Cardamom (Elettaria cardamomum).

All ingredients were procured from D-mart in Bengaluru. Popped red rice in local grocery store in Bengaluru, and Popped Amaranth seeds from online. Puffed white rice-Basic Bar (control) and Nutri Bar variations (experimental). The following table shows the composition of Nutri Bar.

**Sensory Evaluation of Puffed white rice Bar- Basic (Control) and Value added Nutri Bar variations (experimental)**

Sensory evaluation using 9 Point Hedonic scale was conducted by 35 semi trained panelists to study the acceptability of Nutri Bar variations (experimental) and Basic Bar (Control) which was made in the laboratory.

Characteristics like colour, appearance, taste, texture, flavour, odour and overall acceptability were rated and sensory evaluation results were tabulated and subjected to statistical analysis.

**Nutritional information of best accepted value added Nutri bar**

Nutritive value of best accepted value added nutri bar was calculated using IFCT- Indian Food Composition Tables Book 2017 NIN.

Proximate analysis of Iron content the best accepted value added nutri bar was carried out at using GA/0003 (Instrument:test method) at Vsix Analytical Labs Pvt. Ltd., Sunkadakatte, Bengaluru.

**Shelf Life Study of standardised best accepted value added Nutri Bar**

Shelf life studies was conducted at room temperature. The Nutri Bar was stored in a food grade air tight packaging containers. The shelf life was observed at the room temperature for 21 days.

**RESULT AND DISCUSSION**

**Table 1 – Quantity of ingredients used in the development of puffed white rice Basic Bar (control) and different variations of Nutri Bar (experimental)**

Ingredients	Variations of Nutri Bar			
	Bar (Basic) (Control) (%)	Variation 1 (%)	Variation 2 (%)	Variation 3 (%)
Puffed rice	50	-	-	-
Popped red rice	-	15	20	25
Amaranth puffed seeds	-	15	10	5
Jaggery	40	40	40	40
Almond	-	5	5	5
Pumpkin seeds	-	5	5	5
Sesame seeds	-	5	5	5
Raisins	-	5	5	5
Ghee	-	5	5	5
Cardamom seeds	-	5	5	5

**Table 2– Sensory evaluation (Mean sensory evaluation score of Nutri Bar)**

Samples	Appearance (Mean±SD)	Colour (Mean±SD)	Texture (Mean±SD)	Taste (Mean±SD)	Odour (Mean±SD)	Over all acceptability (Mean ± SD)
Basic	8.26± 0.86	8.1 ± 0.92	8.06 ± 0.90	7.93 ± 1.08	8.16 ± 0.87	8.16 ± 0.83
Variation 1 V-1	8.25 ± 0.75	8.11 ± 0.78	7.91 ± 0.87	7.88 ± 0.96	8.11 ± 0.78	8.11 ± 0.82
Variation 2 V-2	8.48 ± 0.62	8.31 ± 0.74	8.18 ± 0.79	8.38 ± 0.80	8.58 ± 0.67	8.35 ± 0.70
Variation 3 V-3	8.41 ± 0.61	8.28 ± 0.69	7.95 ± 1.02	8.11 ± 0.80	±0.72	8.15 ± 0.68



### Mean sensory scores of puffed white rice bar (basic) and value added nutri bar (variations)

Basic Bars were prepared using Puffed rice 50 %, jaggery 40 %, ghee 5% and cardamom 5%, This was evaluated using 9 Point Hedonic Scale (Swaminathan 1987) by twenty-five semi trained panelists. The average overall acceptability of the product was best among others. The mean value for Appearance was 8.26, Color was 8.1, Texture was 8.06, Taste was 7.93, odor was 8.16 and the overall acceptability had a mean score of 8.16.

Variation I was prepared using 15 % Popped rice, 15 % Amaranth puffed seeds, 40 % Jaggery, 5% Almonds, 5 % Pumpkin seeds, 5 % sesame seeds, 5% Raisins, and 5% Ghee and 5% Cardamom. This was evaluated using 9 Point Hedonic Scale (Swaminathan 1987) by twenty five semi trained panelists. The average overall acceptability of the product was best among others. The mean value for Appearance was 8.25, Color was 8.11 , Texture was 7.91 , Taste was 7.88 , odor was 8.11 and the overall acceptability had a mean score of 8.11.

Variation II was prepared 20% Popped rice, 10 % Amaranth puffed seeds, 40 % Jaggery ,5 % Almonds, 5% Pumpkin seeds, 5 % sesame seeds, 5% Raisins, and 5% Ghee

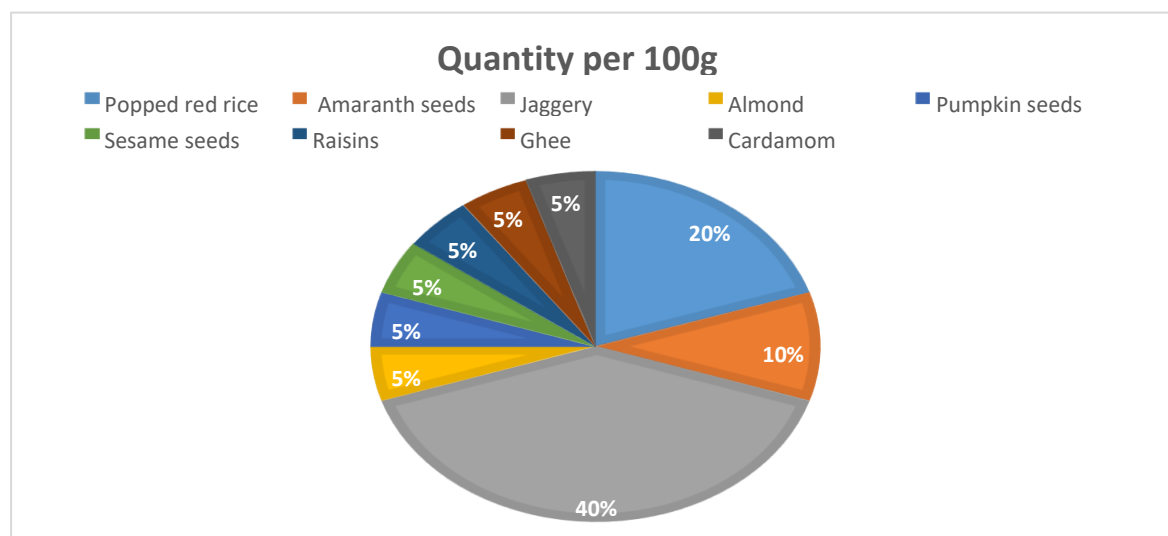
and 5% Cardamom. This was evaluated using 9 Point Hedonic Scale (Swaminathan 1987) by twenty five semi trained panelists. The average overall acceptability of the product was best among others. The mean value for Appearance was 8.48 , Color was 8.31 , Texture was 8.18 , Taste was 8.38 , odor was 8.58 and the overall acceptability had a mean score of 8.35.

Variation III was prepared 25% Popped rice, 5 % Amaranth puffed seeds , 5% Jaggery , 5% Almonds, 5% Pumpkin seeds, 5% sesame seeds, 5% Raisins, and 5% Ghee and 5% Cardamom. This was evaluated using 9 Point Hedonic Scale (Swaminathan 1987) by twenty five semi trained panelists. The average overall acceptability of the product was best among others. The mean value for Appearance was 8.41, Color was 8.28, Texture was 7.95, Taste was 8.11 , odor was 8.05 and the overall acceptability had a mean score of 8.15.

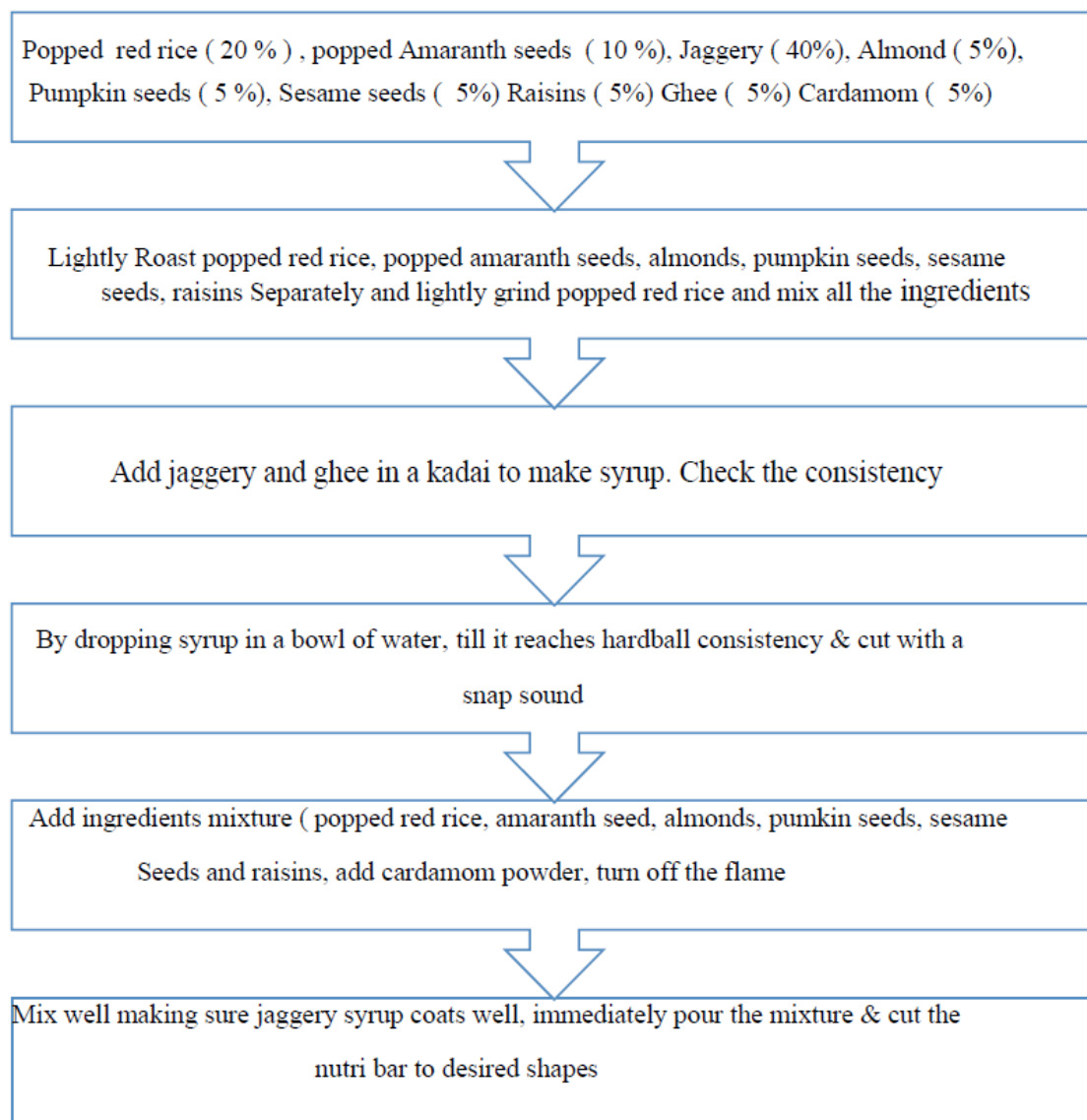
Nutri Bar (variation 2) was found to be highly acceptable based on the mean score of overall acceptability compared to all other variations (V-1, V-2, V-3).

According to the sensory evaluation results, Nutri bar variation -2 received highest sensory scores with respect to its organoleptic properties.

**Figure 4- Ingredient composition (%) of value added Nutri Bar V-2**



**Figure 5, the method of preparation of the most accepted value added Nutri bar variation -2 ,**



1)Roasted Popped red rice & amaranth seeds

2) Roasted seeds and nuts

3) Jaggery syrup 4) Testing syrup consistency



**Table 3- Nutritional Composition of standardized Nutri Bar V-2 (IFCT- Indian food composition tables book 2017 NIN)**

Nutrient	Value per 100g
Energy (Kcal)	668
Iron (mg)	9.5
Fat (g)	14
Carbohydrates (g)	63
Total Fibre (g)	5
Moisture %	15
Ash %	9

### Proximate analysis

The results of nutrient analysis of Nutri bar showed that the Iron content of Nutri bar is 8.37mg/100g. Analyzed at Vsix Analytical Labs Pvt.Ltd, Bengaluru, accredited.

**Table 4- Shelf life study (Physical Examination) of Value added Nutri Bar V-2, at room temperature**

Physical Examination	At Room Temperature			
	1 <sup>st</sup> day	7 days	14 days	21 days
Appearance	White and Brown	White and light Brown	White and light Brown	White and light brown
Odour	No off odour	No off odour	No off odour	No off odour
Presence of any visible infestation	Absent	Absent	Absent	Absent
Overall acceptability	Good, acceptable	Good, acceptable	Good, acceptable	Good, acceptable

The shelf life of a product can be defined as the time phase in which the product is safe with acceptable qualities to be purchased and consumed. The developed Value added Nutri Bar (V-2) was kept in a food grade air tight packaging containers and stored at room temperature. The stored product kept well for 21 days without change in colour; had a good acceptable flavour, texture and over all acceptability. The product remained free from any visible infestations at room temperature storage.

### CONCLUSION

Value added Nutri Bar was developed and standardized using popped red rice, popped Amaranth seeds, Jaggery, Almond, pumpkin seeds, sesame seeds, raisins, ghee and cardamom. Sensory evaluation results showed that Variation-2 Nutri Bar (V-2) showed best organoleptic acceptability (8.35 ± 0.70). The developed product (Nutri Bar) is rich in Iron, nutri dense and serves as an ideal snack for adolescents and all age groups. The value added Nutri Bar is developed using locally available

ingredients free from any added preservatives, flavours and colours.

**Acknowledgments:** This project was conducted in-house in the Department of Food and Nutrition Laboratory, Smt VHD Central Institute of Home Science, Maharani Cluster University, Bengaluru, without any external financial support.

### REFERENCES

- Mesías, M., Seiquer, I., & Navarro, M. P. (2013). Iron nutrition in adolescence. Critical reviews in food science and nutrition, 53(11), 1226-1237.
- Lifshitz, F., Tarim, O., & Smith, M. M. (1993). Nutrition in adolescence. Endocrinology and metabolism clinics of North America, 22(3), 673-683.
- World Health Organization. (2011). Prevention of iron deficiency anaemia in adolescents (No. SEA-CAH-02). WHO Regional Office for South-East Asia.
- Ahuja, U., Ahuja, S. C., Chaudhary, N., & Thakrar, R. (2007). Red rices—past, present and future. Asian Agri-History, 11(4), 291-304.



5. Itagi, H., Sartagoda, K. J. D., Pratap, V., Roy, P., Tiozon, R. N., Regina, A., & Sreenivasulu, N. (2023). Popped rice with distinct nutraceutical properties. *LWT*, 173, 114346.
6. [6] Swarnakar, A. K., Mohapatra, M., & Das, S. K. (2022). A review on processes, mechanisms, and quality influencing parameters for puffing and popping of grains. *Journal of Food Processing and Preservation*, 46(10), e16891.
7. Raghuvanshi, R. S., & Bhati, D. A. S. H. R. A. T. H. (2019). Development of breakfast recipes from amaranth grains for preschoolers, celiac and osteoporotic subjects. *Pantnagar J Res*, 17(3), 267-272.
8. Guha, S. Development of Value Added Amaranth Seed Laddus. *IJFMR-International Journal For Multidisciplinary Research*, 4(6).
9. Kumar, A., & Singh, S. (2020). The benefit of Indian jaggery over sugar on human health. In *Dietary sugar, salt and fat in human health* (pp. 347-359). Academic Press.
10. Richardson, D. P., Astrup, A., Cocaul, A., & Ellis, P. (2009). The nutritional and health benefits of almonds: a healthy food choice. *Food Sci. Technol. Bull. Funct. Foods*, 6, 41-50.
11. Syed, Q. A., Akram, M., & Shukat, R. (2019). Nutritional and therapeutic importance of the pumpkin seeds. *Seed*, 21(2), 15798-15803.
12. Mohammed, S. (2022). An overview on nutritional composition and therapeutic benefits of sesame seeds (*Sesamum indicum*). *Int. J. Res. Appl. Sci. Eng. Technol*, 10, 1119-1127.
13. Olmo-Cunillera, A., Escobar-Avello, D., Pérez, A. J., Marhuenda-Muñoz, M., Lamuela-Raventós, R. M., & Vallverdú-Queralt, A. (2019). Is eating raisins healthy?. *Nutrients*, 12(1), 54.
14. Longvah, T., Anantan, I., Bhaskarachary, K., Venkaiah, K., & Longvah, T. (2017). *Indian food composition tables* (pp. 2-58). Hyderabad: National Institute of Nutrition, Indian Council of Medical Research.

How to cite this article: Vinutha N A, Navaneetha R. Development and Evaluation of Value added Nutri bar using Popped Red rice and Amaranth seeds for Adolescents. *Int J Health Sci Res*. 2024; 14(6):133-141. DOI: <https://doi.org/10.52403/ijhsr.20240620>

\*\*\*\*\*