

RESEARCH PAPER

Nutritional Properties and Organoleptic Evaluation of Formulated Granola Bar

Mansi Chaudhary, Ridhima Singh and Ekta Singh Chauhan*

Department of Food Science and Nutrition, Banasthali Vidyapith, Tonk, Rajasthan, India

*Corresponding author: eschauhan266@gmail.com

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ABSTRACT

The nutritious foods, which are also lightweight, and appropriate, are in tremendous supply for people. There are frequently few alternatives that are minimally processed, nutrient-dense, and delicious. The present investigation was to formulate a granola bar with a combination of different food ingredients in three different variants. Granola bar was formulated with cereals (quinoa, rolled oats), millets (sorghum flakes, bajra flakes), pulses (lentil), legumes (soy flour), nuts (dates, figs), seeds (pumpkin seeds, flax seeds), and sweeteners (jaggery, honey) in different proportions (Variant I- 5% rolled oats, 15% pumpkin seeds; Variant II- 10% rolled oats, 10% pumpkin seeds; Variant III- 15% rolled oats, 5% pumpkin seeds). The proximate composition, mineral analysis, antioxidant activity, phytochemical screening, and sensory evaluation of all three variants of a granola bar with the Control sample were analyzed. The data were analyzed by mean and standard deviation. The results revealed that proximate composition (100 g) like moisture (3.1%) and ash (0.2%) were found best in the Control sample; protein (25.2 g) was found best in Variant II; fat (3.0 g) was found best in variant III; and crude fiber (21.1 g) was found best in Variant I. The phytochemical analysis was present in all variants with the Control sample. In sensory evaluation, Variant III was more acceptable in overall acceptability as compared to the other variants. The study concluded that the recently created granola bar was satisfying to consume and had a good nutritional balance. It is less expensive, simpler to create, and far more economical.

Keywords: Granola bar, Healthy, Natural ingredients, Nutritious

These days, consumers place a greater emphasis on the value of a nutritious diet. This trend towards leading an active, healthy lifestyle and being "fit" also fuels consumer interest in foods that support well-being and fitness (Kosicka-Gębska *et al.* 2022; Sharma *et al.* 2021).

Due to its availability of macro as well as micronutrients, granola bars are regarded as a healthy meal. They may be consumed at any time of day, come in little sachets, are packed full of a variety of nutrients, and are easy to carry. The market for granola bars has been gradually expanding as a result of the variety of qualities and uses that each

type of bar has, which meet the trend towards the consumption of wholesome, novel, and useful foods (Samakradhamrongthai *et al.* 2021). Granola is a foodstuff that may be made with a variety of ingredients and is classified as a snack food. Cereal grains, millets, pulses, nuts, seeds, and other food groups are examples of some of these ingredients. It is a food that has been baked or cooked, and the mixture is constantly mixed to preserve a thin

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consistency throughout baking and cooking. It is transforming granola into a pressed bar shape for easy eating (Verma *et al.* 2022; Ahmad *et al.* 2017).

Cereal: Each cereal grain has significant, distinct nutraceutical value as a result of the existence of a certain component. Cereals are rich in beneficial nutrients that contribute to a spiritually healthy body. Rich dietary fiber, essential elements including vitamin E, several B-complex vitamins, omega-3 fatty acids, folate, phosphorus, magnesium, and zinc are all found in cereals. Despite this, they also contain phytochemical substances that provide antioxidant benefits and other important health advantages by lowering the chance of some malignancies, cardiovascular disease, diabetes, and other serious illnesses that individuals are known to suffer from (Baniwal *et al.* 2021; Sarwar *et al.* 2013).

Millets: Millets are useful for enhancing consumer health which are included in the main meals and supplying macronutrients and phytochemicals. Millets contain a reasonable mineral content, with the exception of vitamins such as vitamin B₁, riboflavin, niacin, vitamin E, and important amino acids. Millets are full of phytochemicals that reduce steroid alcohol and the risk of associated malignancies (Himaja and Meera, 2020).

Pulses and Legumes: Given their high protein content, low-calorie count, and low glycemic index, pulse, and legume consumption is on the rise on a global scale. In order to be employed as a key ingredient in food processing and the creation of novel food products, pulses, and legumes can be used in conjunction with other cereals. There are several health advantages to ingesting pulses and legumes (Kumar and Pandey, 2020; Atnaf *et al.* 2015).

Nuts and Seeds: A key element of the Mediterranean diet that has been demonstrated to have a preventative effect on the development of cardiovascular disease is nuts and seeds, a high-energy, nutrient-dense plant food category. In addition to providing vital fatty acids, phytosterols, fiber, and polyphenols, nuts, and seeds are significant dietary sources of mono- and polyunsaturated fatty acids. They also have a

favorable mineral composition and a low salt content (Dodevska *et al.* 2022).

Sweeteners: A supply of agglutinant (honey syrup) is frequently used to hold the dry components together. A granola bar may be enhanced with fruits, candies, nuts, and other components to enhance aroma. Additional coatings like chocolate syrup or caramel are dipped or coated on some granola bars (Chauhan *et al.* 2022).

The creation of granola bars with a variety of components and a basis of grains, seeds, or fruits together with sugars or binding agents has been the subject of several research. However, no research has been done on how to best formulate granola bars using a mixture of cereals, pulses, millets, seeds, nuts, and sweeteners. This study set out to create granola bars and assess their nutritional value, phytochemical profile, and sensory quality.

MATERIALS AND METHODS

Collection of Raw Materials

The raw materials like quinoa, rolled oats, sorghum flakes, bajra flakes, lentil, soy flour, dates, figs, pumpkin seeds, flax seeds, jaggery, and honey were collected from the market of Banasthali Vidyapith, Tonk, Rajasthan, and from online Amazon application.

Formulated Food Product

The granola bar was made by using different ingredients in three different proportions of rolled oats, and pumpkin seeds. The granola bar was prepared in the Cooking Laboratory of Banasthali Vidyapith, Rajasthan.

Determination of Proximate Analysis

Moisture by air oven technique, ash by muffle furnace technique, protein by micro-kjeldahl technique, fat by soxhlet technique, and crude fiber by acid and alkali treatment technique. And by subtracting the total contents of the moisture, ash, protein, fat, and crude fiber from 100, the quantity of carbohydrates was

determined to analyze the proximate composition of the formulated granola bar (Sharma, 2007; Raghuramulu, 2003).

Determination of Mineral Analysis

According to Wong’s technique for iron and the titrimetric technique for calcium, the mineral composition of the formulated granola bar was assessed (Sharma, 2007; Raghuramulu, 2003).

Determination of Antioxidant Activity

By using the titrimetric technique, vitamin C was performed on the formulated granola bar (Raghuramulu, 2003).

Spectrophotometric evaluation of the nitric oxide scavenging activity was performed on the formulated granola bar (Govindarajan *et al.* 2003).

Determination of Phytochemical Screening

The aqueous extract was prepared before analysis.

Alkaloids (Mayer’s Test), flavonoids (Shinoda Test), phenolic compounds, saponins (Froth Test), tannins, and terpenoids (Salkowski test) were used for the qualitative analysis of formulated granola bar (Edeoga *et al.* 2005; Raghuramulu, 2003; Harborne, 1973).

Sensory Evaluation

The sensory assessment entails a panel of judges rating the food’s quality. Measuring, examining, and interpreting the characteristics of food as they are experienced by the senses of smell, touch, taste, and hearing are all part of the assessment process. The 9-point hedonic scale performance determines whether or not the food will be accepted. With the use of a triangle test, it was done formally by the semi-trained panel members (Singh *et al.* 2022).

RESULTS AND DISCUSSION

Formulated Food Product

The granola bar was prepared by using different ingredients like quinoa, rolled oats, sorghum flakes, bajra flakes, lentil, soy flour, dates, figs, pumpkin

seeds, flax seeds, jaggery, and honey in three variants (I, II, III) with Control sample as shown in Table 1.

The different concentration has occurred between the rolled oats, and pumpkin seeds in three variants.

Variant I - 5% rolled oats, 15% pumpkin seeds

Variant II - 10% rolled oats, 10% pumpkin seeds

Variant III - 15% rolled oats, 5% pumpkin seeds

Table 1: Ingredients of Granola Bar with Different Variants

Ingredients (100 g)	Sample			
	Control	Variant I	Variant II	Variant III
Quinoa (g)	10	5	5	5
Rolled Oats (g)	—	5	10	15
Sorghum Flakes (g)	10	5	5	5
Bajra Flakes (g)	—	5	5	5
Lentil (g)	10	5	5	5
Soy Flour (g)	—	5	5	5
Dates (g)	20	15	15	15
Figs (g)	—	5	5	5
Pumpkin Seeds (g)	20	15	10	5
Flax Seeds (g)	—	5	5	5
Jaggery (g)	15	15	15	15
Honey (ml)	15	15	15	15

Variant I (5% rolled oats, 15% pumpkin seeds); Variant II (10% rolled oats, 10% pumpkin seeds); Variant III (15% rolled oats, 5% pumpkin seeds).

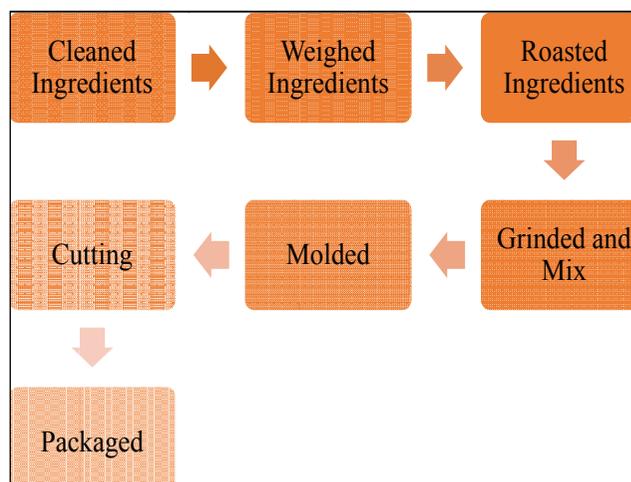


Fig. 1: Flow Chart of Granola Bar

Proximate Composition

The proximate composition of the granola bar is shown in Table 2. In the control sample, fat and carbohydrate content were high as compared to variants of granola bars. In Variant I, crude fiber content was highest; in Variant II, protein content was highest; in Variant III, moisture and ash were highest as compared to variants of granola bars and the control sample. Therefore, according to the analysis, Variant I and Variant II were found best in proximate composition.

Table 2: Proximate Composition of Granola Bar

Proximate (100 g)	Control	Variant I	Variant II	Variant III
Moisture (%)	3.1±0.02	6.1±0.01	7.0±0.08	7.7±0.08
Ash (%)	0.2±0.01	3.1±0.04	3.8±0.01	3.9±0.04
Protein (g)	10.0±0.44	21.0±0.42	25.2±0.54	23.0±0.52
Fat (g)	7.0±0.24	5.0±0.15	4.1±0.12	3.0±0.18
Crude Fibre (g)	6.9±0.19	21.1±0.23	20.0±0.33	19.0±0.18
Carbohydrate (g)	72.8±0.45	43.7±0.59	39.9±0.37	43.4±0.34

Values are expressed as Mean±SD, n=3.

Minerals Analysis

The mineral analysis of the granola bar is shown in Table 3. The calcium and iron content were highest in Variant I; and the lowest content were found in the Control sample.

Table 3: Mineral Analysis of Granola Bar

Minerals (100 g)	Control	Variant I	Variant II	Variant III
Calcium (mg)	43.0±1.01	60.8±1.24	59.9±0.10	58.1±0.09
Iron (mg)	10.2±0.03	15.5±0.43	15.3±0.08	15.1±0.23

Values are expressed as Mean±SD, n=3.

Antioxidant Activity

The antioxidant activity of the granola bar is shown in Table 4. The vitamin C and nitric oxide scavenging activity were highest in Variant I; and the lowest activity were found in the Control sample.

Table 4: Antioxidant Activity of Granola Bar

Antioxidant (100 g)	Control	Variant I	Variant II	Variant III
Vitamin C (mg)	0.2±0.00	4.9±0.25	4.5±0.23	4.0±0.01
Nitric oxide scavenging activity	0.1±0.00	1.8±0.05	1.5±0.01	1.2±0.03

Values are expressed as Mean±SD, n=3

Phytochemical Screening

The phytochemical screening of the granola bar is shown in Table 5. All phytochemicals like alkaloids, flavonoids, phenolic compounds, saponins, tannins, and terpenoids were present in all variants of the granola bar as well as the Control sample.

Table 5: Phytochemical Screening of Granola Bar

Phytochemical Screening	Control	Variant I	Variant II	Variant III
Alkaloids	+	+	+	+
Flavonoids	+	+	+	+
Phenolic Compounds	+	+	+	+
Saponins	+	+	+	+
Tannins	+	+	+	+
Terpenoids	+	+	+	+

+ is present, - is absent.

Sensory Evaluation

The sensory evaluation of the granola bar is shown in Table 6. According to the 9-point hedonic scale performa, the overall acceptability was highest in Variant III due to less incorporation of pumpkin seeds (5%); and lowest in Variant I due to more incorporation of pumpkin seeds (15%). The other attributes like appearance, color, texture, flavor, and taste were highest in Variant III and lowest in Variant I.

Table 6: Sensory Evaluation of Granola Bar

Attributes	Control	Variant I	Variant II	Variant III
Appearance	7.1±0.01	7.3±0.12	7.9±0.07	8.0±0.15
Color	7.3±0.03	7.5±0.35	8.0±0.19	8.6±0.13

Texture	7.6±0.54	7.1±0.01	8.0±0.22	8.5±0.22
Flavor	7.2±0.43	8.0±0.15	8.2±0.24	8.0±1.01
Taste	7.0±0.23	7.8±0.21	7.9±0.12	8.0±0.13
Overall Acceptability	7.5±0.01	8.0±0.15	8.5±0.14	8.9±0.19

Values are expressed as Mean±SD, n=3.

CONCLUSION

Granola bars are made by combining several components to improve their nutritional value. Cereals, millets, pulses, legumes, nuts, seeds, and sweeteners are excellent sources of carbohydrates and proteins, and a good source of other macro and micro-nutrients like fiber, iron, magnesium, calcium, zinc, and B group vitamins. These components satisfy a normal person's needs as well as a sports person's needs. In proximate composition, Variant I and Variant II were highest; in mineral and antioxidant activity, Variant I was the highest as of other variants. The phytochemical screening was present in all variants with the Control sample. And in the sensory evaluation, Variant III was more acceptable in overall acceptability as of other variants. With the right blend of natural ingredients and ease of consumption, granola bars are regarded as the ideal and comfortable snack for people to satisfy their energy as well as other nutrients.

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