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### Development and evaluation of energy bar incorporated with different varieties of watermelon seeds

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#### Abstract

The present study entitled 'Development and evaluation of energy bar incorporated with different varieties of watermelon seeds' was undertaken with the aim to develop an energy bar using selected cereals, and its variation with the incorporation of different varieties of watermelon seeds. Seeds of two varieties of watermelons (Sugar Lady Watermelon and Crimson Sweet Watermelon) were used to incorporate into energy bars. Rolled oats, rice flakes, sesame seeds, black raisins and jaggery were the basic ingredients of the energy bar. Both the watermelon seeds were boiled and roasted to analyze the effect of processing on organoleptic characters and on ant nutrient levels. Roasted basic ingredients and ground processed watermelon seeds were made into a bar with the help of binding agent jaggery. Nutrient content per 100 g of energy bar is energy-326.96 kcal, protein-5.59g, fat-0.91g, carbohydrate-76.25g and calcium-80.13 mg. In conclusion, the developed energy bar has good nutritional value and can be used as a supplement.

**Keywords:** Energy bar, watermelon seeds, rolled oats, sesame seeds, nutrient content, antinutrients

#### Introduction

Energy bars are emerging products in the Indian market and widely consumed by people of all age groups, but more popular among adolescents. People consume these bars not only to meet the requirement of immediate energy, but also for satiety. Demand of such bars is more among young generation specially those engaged in relatively high physical activities as compared to upper age groups. Energy bars can act as good carriers of healthy nutrients, bioactive compounds (such as phytochemicals and essential fatty acids), and dietary fiber. Thus, it is an edible food commodity potentially able to be classified under the category of functional foods. Such foods are known to provide additional health benefits apart from original nutrients. Such foods can be developed by fortification and enrichment with other bioactive components. Therefore, modifications in product formulations and the adoption of new technologies in processing have allowed a significant improvement in the nutritional quality of bars.

The seeds of watermelon are generally considered as agro-waste and are spitted out in spite of having its high nutritional value as well as therapeutic benefits. Watermelon seeds are a good source of low-molecular-weight polypeptides like globulin, glutenin and albumin. Seeds are also rich in aspartic acid, glutamic acid and serine. Nutritional or energy bars provide a convenient way to meet an individual's nutritional needs on an occasional basis. Besides energy, nutritional bars provide certain vitamins too. Although many energy bars contain more calories and sugar than the normal healthy adult needs in a snack or meal replacement, those low in sugar and fat provide a reasonable mix of nutrients. With this background, this study was undertaken with the objectives to develop an energy bar using selected cereals, and its variation with the incorporation of different varieties of watermelon seeds, to evaluate the nutrient content of the developed energy bar and to evaluate the organoleptic characteristics of the product.

#### Materials and Methods

**Collection of ingredients:** Basic ingredients for the preparation of nutribars was rolled oats, rice flakes, sesame seeds, black raisins, jaggery were purchased from local market.

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The main ingredient, the local varieties of watermelon seeds were collected from kitchen waste and also from fruit stalls and some were collected in bulk by buying watermelons and separating the seeds from them. Seeds were washed with water, air dried and kept in an airtight container.

### Formulations for basic energy bar

Considering the safe level of daily consumption of seeds, 20g of watermelon seeds were added in 100g of the basic energy bar. Thus, the remaining 80g of the formulation was the basic ingredients of the energy bar which are rolled oats, rice flakes, sesame seeds, black raisins, jaggery. So, six formulations for 80g of basic energy bar using varying proportions of rolled oats, rice flakes, sesame seeds and black raisins were worked out. Proportion of jaggery was kept same in all variations to get the consistency of energy bar proper. Nutrient content of these six variations were calculated. The variation with high calorie content was selected for incorporation. The selected variation contains 20 g oats (OT): 20 g sesame seeds (SS): 5 g black raisins (RS): 20 g jaggery (JG): 15 g rice flakes (RF).

Four variations of energy bar were made by incorporating heat treated two varieties of watermelon seeds (crimson sweet, sugar lady). In all the variations 20 g of watermelon seeds was added into 80g of the basic energy bar. The proportions of seed incorporated energy bars are given below:

- Roasted crimson sweet seed energy bar (RCSEB) - Roasted crimson sweet watermelon seeds: Rolled oats: Sesame seeds: Black raisins: Jaggery: Rice flakes (20:20:20:5:20:15).
- Boiled crimson sweet seed energy bar (BCSEB) - Boiled crimson sweet watermelon seeds: Rolled oats: Sesame seeds: Black raisins: Jaggery: Rice flakes (20:20:20:5:20:15).
- Roasted sugar lady seeds energy bar (RSLEB) - Roasted sugar lady watermelon seeds: Rolled oats: Sesame seeds: Black raisins: Jaggery: Rice flakes (20:20:20:5:20:15).
- Boiled sugar lady seed energy bar (BSLEB) - Boiled sugar lady watermelon seeds: Rolled oats: Sesame seeds: Black raisins: Jaggery: Rice flakes (20:20:20:5:20:15).

All the food components namely rolled oats, sesame seeds, black raisins and jaggery were purchased from local market. Watermelon seeds were heat treated for removing the ant nutrient content. Two methods of heat treatment were used such as boiling and roasting. Both crimson sweet and sugar lady watermelon seeds were both boiled and roasted to know which heating method is more effective. Roasted crimson sweet and sugar lady watermelon seeds were grinded into powder form. Boiled watermelon seeds were covered in a kitchen towel to remove moisture and ground into powder or paste.

The basic ingredients of energy bar namely rolled oats, sesame seeds, rice flakes were weighed and roasted or pan broiled to get the crispy texture and put into four different bowls. To each bowl 20 g powder of heat-treated watermelon seeds (roasted crimson sweet watermelon seeds, boiled crimson sweet watermelon seeds, roasted sugar lady watermelon seeds, boiled sugar lady watermelon seeds) added respectively. Jaggery was melted in a pan. Then all ingredients were put together and mixed gently and transferred to a rectangular greased vessel. It was then allowed to cool and before it well cooled it was cut into pieces.

The acceptability of developed four variations of energy bar was evaluated using score card. The score card for sensory evaluation was prepared based on 9-point hedonic scale and the scores were given in such a way that 9 for like extremely, 8 for like very much, 7 for like moderately, 6 for like slightly, 5 for neither like nor dislike, 4 for dislike slightly, 3 for dislike moderately, 2 for dislike very much, 1 for dislike extremely. For that a panel of 10 judges were selected. The score obtained for organoleptic evaluation were evaluated using Kendall's Coefficient of Concordance.

### Results and Discussion

The results obtained from the analysis are presented and discussed here.

**Table 1:** Mean scores for organoleptic evaluation of watermelon seed incorporated energy bar

SL. No.	Sensory qualities	RCSEB	RSLEB	BCSEB	BSLEB	Kendall's (W) value
1	Appearance	7.9(2.85)	7.90(2.95)	7.00(2.00)	7.18(2.20)	0.168 <sup>NS</sup>
2	Colour	8.00(2.70)	7.90(2.75)	7.54(2.35)	7.36(2.20)	0.051 <sup>NS</sup>
3	Flavor	7.27(2.15)	7.45(2.35)	7.45(2.20)	8.09(3.30)	0.211 <sup>NS</sup>
4	Texture	6.54(2.00)	7.09(2.40)	7.36(3.00)	7.18(2.60)	0.124 <sup>NS</sup>
5	Taste	7.00(2.40)	7.09(1.95)	7.72(2.75)	7.81(2.90)	0.143 <sup>NS</sup>
6	Overall acceptability	7.63(2.40)	7.81(2.70)	7.63(2.50)	7.63(2.40)	0.016 <sup>NS</sup>

RCSEB: Roasted crimson sweet seed energy bar, BCSEB: Boiled crimson sweet seed energy bar, RSLEB: Roasted sugar lady seeds energy bar, BSLEB: Boiled sugar lady seed energy bar

**Table 2:** Nutrient contents of developed energy bar

SL. No.	Energy bar	Energy (kcal)	Protein (g)	Fat (g)	Carbohydrate (g)	Calcium (mg)
2	RSLEB	326.96	5.59	0.91	76.25	80.13

**Table 3:** Antinutritional factors present in developed energy bar

SL. No.	Anti- nutritional factors	Amount (mg/100g)
1	Oxalate	2.29
2	Phytate	4.5

All developed energy bars received good scores in organoleptic evaluation. Among the four variations RSLEB-roasted sugar lady watermelon seeds incorporated energy bar secured highest mean scores for overall acceptability (7.81) and a mean rank 2.70. Other three energy bars scored same

mean scores for overall acceptability (7.63). Based on Kendall's value, the agreement among judges in the evaluation overall acceptability of the energy bar was not found to be statistically significant.

The mean scores obtained for the taste of energy bars

RCSEB, RSLEB, BCSEB, BSLEB are 7.00, 7.09, 7.72, and 7.81 respectively. RCSEB scored lowest (7.00) mean score whereas highest (7.81) mean score was found to be BSLEB.

Energy bar RCSEB had scored highest mean score (8.00) for colour and lowest (7.36) was found in recipe BSLEB. The mean scores obtained for the texture of energy bars RCSEB, RSLEB, BCSEB, BSLEB are 6.54, 7.09, 7.36, and 7.18. Among these energy bars, boiled sugar lady water melon seed energy bar had better flavor (8.09) least flavored one was RCSEB (roasted crimson sweet watermelon seeds).

Based on sensory evaluation, the variation RSLEB [Roasted sugar lady water melon seeds: Rolled oats: Sesame seeds: Black raisins: Jaggery: Rice flakes (20:20:20: 5:20:15)] was the best selected and hence the nutritive value of selected water melon incorporated energy bar was analyzed and the calorie content of sugar lady watermelon seed incorporated energy bar (RSLEB) was observed to have the energy 326.96 kcal in 100g. RSLEB contain 76.25 g carbohydrate, 5.59 g protein, and fat 0.91 g and 80.13 mg calcium.

Ant nutrients were found to be relatively low and are safe to consume. Additionally processing methods like roasting and boiling can help reduce the levels of antinutritional factors in watermelon seeds and enhance their nutritional value.

During the first two, three weeks of storage, there was no observable change in the appearance, flavour, taste or texture of the supplements. After one month of storage, mild rancid odour was observed in the energy bar. Slight change in the colour was observed after one and half month of storage. Rancid odour was also increased after one and half month. Within two months of storage the energy bar's texture changed and rancid odour increased more than before. Thus, the keeping quality of energy bar was gradually decreasing after one month of storage at room temperature.

Microbial analysis of the energy bar was done based on yeast and moulds count initially and after 2 months. Initially no visible growth observed on the sample selected for analysis. This signifies that good hygienic condition was maintained. After 2-month yeast and mold growth (300 cfu/mg) was seen in the product.

## Conclusion

It can be concluded that the developed energy bar can be used as an energy supplement as it offers easy-to-consume nutritional grains and also have many health benefits. It had good acceptability and shelf life period for one month at room temperature. Energy bars can be manufactured economically. Moreover, it is also promising for improving nutritional availability to school-going and gym-going adolescents to meet RDA requirement specified by the National Institute of Nutrition.

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