



E-ISSN: 2278-4136  
P-ISSN: 2349-8234  
JPP 2020; 9(1): 1577-1580  
Received: 07-11-2019  
Accepted: 09-12-2019

**Mohammed Roohan Ansari**  
Department of Food Process  
Engineering, Sam Higginbottom  
University of Agricultural,  
Technology and Science  
Allahabad, Uttar Pradesh, India

**Er Chitra Sonkar**  
Department of Food Process  
Engineering, Sam Higginbottom  
University of Agricultural,  
Technology and Science  
Allahabad, Uttar Pradesh, India

**Er Dorcus masih**  
Department of Food Process  
Engineering, Sam Higginbottom  
University of Agricultural,  
Technology and Science  
Allahabad, Uttar Pradesh, India

**Corresponding Author:**  
**Mohammed Roohan Ansari**  
Department of Food Process  
Engineering, Sam Higginbottom  
University of Agricultural,  
Technology and Science  
Allahabad, Uttar Pradesh, India

## Development and quality evaluation of high protein energy bar

**Mohammed Roohan Ansari, Er Chitra Sonkar and Er Dorcus Masih**

### Abstract

The investigation was for high protein energy bar. In the present study four samples was prepared (T0, T1, T2 and T3) i.e. T0(Control)-(T0-50% Bengal Gram + 50% Jaggery), T1-(05 % Flax Seeds + 05% Watermelon seeds + 40% Bengal Gram + 50% Jaggery), T2-(10 % Flax Seeds + 10% Watermelon seeds + 30% Bengal Gram + 50% Jaggery) and T3-(15 % Flax Seeds + 15% Watermelon seeds + 20% Bengal Gram + 50% Jaggery). On this regard, in the present investigation, efforts have been made to develop the Energy bar from Bengal gram. The efforts were also made to develop technology for formation of Energy bar by utilizing Bengal gram as a novel ingredient in formulation of Energy bar by varying proportion of Watermelon seeds and flax seeds. The four samples were evaluated for the physico-chemical, sensory quality and overall acceptability. Comparison was done on the basis of statistical data and mean average score by 0-9-point hedonic scale and results of sample T3 was found (ash 2.40%) nutritional properties (moisture 11.47%, crude fibre 1.73%, crude fat 10.11%, total carbohydrate 60.02% and crude protein 22.71%) to be best in quality having more nutritional element and higher overall acceptability.

**Keywords:** Jaggery, Bengal gram, flax seed, watermelon seed, sensory

### Introduction

Snack bar, a convenient and healthy ready-to-eat food which supplies balance nutrients (protein, fat, minerals, vitamins, calories, and carbohydrate) and to abate hunger (King, 2006; Ryland *et al.*, 2010; Wyatt, 2011) <sup>[5]</sup> is continue to increase in sales. Snack bars initially marketed to athletes as a source of energy. However, the growing luxury groups and health-conscious consumers had increased the sales performance of snack bars (Euromonitor International, 2015). Data available on (Statista 2015) <sup>[6]</sup> reports recorded that retail sales of nutrition and energy bars in the United States are increasing year to year (from 2005 to 2014) from 0.57 billion U.S. dollars in year 2005 to 1.2 billion U.S. dollars in year 2014. In addition, according to (Williams *et al.*, 2006) <sup>[9]</sup>, 90% Australians regularly consume confectionary product (including food bars). Due to the growing consumer demand for natural, convenient, and nutritious food products, there is a need to modify, innovate and improve the nutritive composition of snack bars for health benefits (Williams *et al.*, 2006; Sun-Waterhouse *et al.*, 2010) <sup>[9, 7]</sup>.

Jaggery or 'Gur' is a pure, wholesome, traditional, unrefined, whole sugar made by the concentration of sugarcane juice without the use of any preservatives. Jaggery is one of the ancient sweetening agents known to man and is an integral part of the rural diet in many countries (Mandal *et al.*, 2006) <sup>[4]</sup>. The majority Indian population, being rural, suffers due to under nutrition and malnutrition as the common Indian diet is deficient in nutrition. Jaggery is an energy food that is said to purify blood, regulate liver function and keep the body healthy. (Veldhyyzen-van, 1999).

Flaxseed (*linum usitatissimum*) is popularly known Alsii, Jawas, Aksebija, etc. in Indian languages is blue flowering crop produces small flat seeds regarding in color from golden yellow to reddish brown. The texture of flaxseed is crisp and chewy possessing a pleasant nutty taste. The spherical fruit capsules contain two seeds in each of five compartments. The seed is flat and oval with a pointed tip. Flaxseed is mainly considered as oilseed crop. The use of flaxseed as a dietary supplement is increasing in parallel with the research on its multitudinous effects on human health (Tarpila *et al.*, 2005) <sup>[8]</sup> and designer foods for poultry feeding (Sujatha and Narahari, 2010). Hundred gram of flaxseed provides 100% of the recommended daily allowance (RDA) for manganese and potassium, 57– 65% of the RDA of phosphorus and iron, and 13–35% for zinc, calcium and copper while its recommended daily intake is 25–50 g (Anonymous 1994).

Watermelon (*Citrulluslanatus*) a fruit crop, is herbaceous creeping plant belonging to the family cucurbitaceae. It is mainly propagated by seeds and thrives best in warm areas. Watermelon seeds are known to be highly nutritional; they are rich sources of protein, vitamins B, minerals (such as magnesium, potassium, phosphorous, sodium, iron, zinc, manganese and copper) and fat among others as well as phytochemicals. The seeds of watermelons are known to have economic benefits especially in countries where cultivation is on the increase. The seeds are for instance used to prepare snacks, milled into flour and used for sauces.

Bengal gram is widely appreciated as health food. It is a protein-rich supplement to cereal-based diets, especially to the poor in developing countries, where people are vegetarians or cannot afford animal protein. The pulse proteins are rich in lysine and have low sulfur containing amino acids. It offers the most practical means of eradicating protein malnutrition among vegetarian children and nursing mothers. Bengal gram has a very important role in human diet in our country.

Bengal gram is called Chickpea or Gram (*Ciceraritinum L.*) in South Asia and Garbanzo bean in most of the developed world. Bengal gram is a major pulse crop in India, widely grown for centuries and accounts for nearly 40 percent of the total pulse production. India is the major growing country of the world, accounting for 61.65 percent of the total world area under Bengal gram during 2002 and 68.13 percent of the total world production. Bengal gram is known in this country since ancient times. It is said to be one of the oldest pulses known and cultivated in Asia and Europe. According to (Aykroid and Doughty, 1964).

In today's fast pace world, quick and healthy snack are a great need. For the athlete, they need to have instant energy in short time hence, thus work on energy bar. Similar products in the market are costlier so people hardly accept the product.

The objective of the present study is to study the physico-chemical properties of the developed product.

## Materials and Methods

### Material Requirement

Bengal Gram, Flax seed, Watermelon Seed, Jaggery.

**Table 1:** Proportion of different ingredients in different formulations of Energy bar

Sample No.	Flax Seeds (%)	Watermelon seeds (%)	Bengal gram (%)	Jaggery (%)
Control (T0)	0	0	50	50
T1	5	5	40	50
T2	10	10	30	50
T3	15	15	20	50

### Processing Equipment

Electronic weighing balance, Desiccator, Hot air oven, Muffle furnace, Soxhlet apparatus, micro Kjeldahl, Sealing Machine

### Evaluation of Properties

#### Physico-Chemical

Moisture content: (AACC 2000 <sup>[1]</sup> Method No.44-15A)

Ash content: (AACC 2000 <sup>[1]</sup> Method No. 08-01)

Crude Protein: (AOAC 2000) <sup>[2]</sup>

Total Carbohydrate: (AOAC 1990) <sup>[2]</sup>

Crude Fat: (AOAC 2000) <sup>[2]</sup>

Crude Fiber: (AACC 2000 <sup>[1]</sup> Method No.32-10)

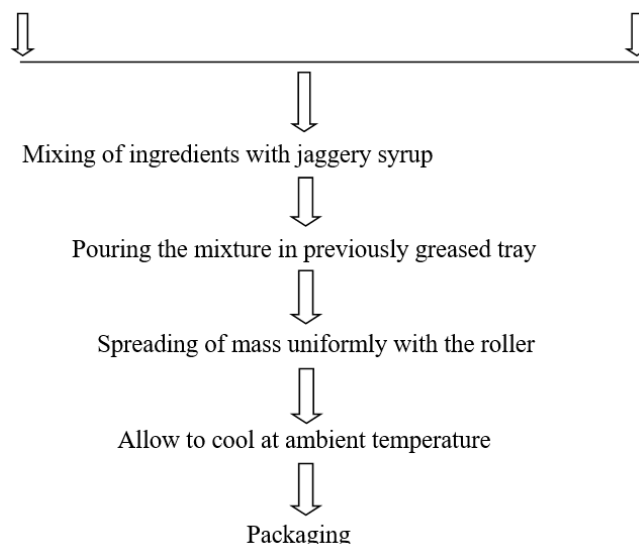
## Sensory Analysis

Color, Taste, Flavor, Texture, Appearance and Overall acceptability (Amerine *et al.*, 1980) <sup>[3]</sup>.

## Methodology

### Preparation of Energy bar with Bengal gram, Flax Seeds, Watermelon seeds and Jaggery

Roasting of Ingredients at 150°C for 4 mins Heating of jaggery (Bengal Gram, flaxseeds, watermelon seed) (at 120°C for 10 min)



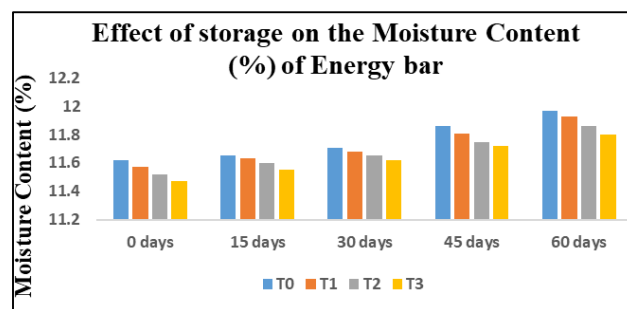
**Fig 1:** Experimental procedure for preparation of Energy bar

## Result and Discussion

### Moisture

The Moisture was estimated by using Hot air oven method. The given data shows that there is increasing in moisture content during storage period. The moisture content was maximum in treatment T0 on 60days i.e. 11.97% and minimum in T3 on 0day i.e. 11.47%.

Regarding the storage period, it was noticed that the moisture content of the energy bar increased significantly from 11.47 to % during storage period of 60 days. The moisture gain might be due to absorption of moisture to the atmosphere by the package during storage. The reason of increasing moisture content in energy bar might be i.e. temperature, relative humidity and packaging material. Moisture content bears a relation with the shelf stability of a food product in that the higher the moisture content, the lower shelf stability and vice versa. The result reported by (Ateequaddin *et al.*, 2015) found higher content of moisture ranging 14.61 to 16.58%.



**Fig 2:** Effect of storage on the Moisture Content (%) of Energy bar

### Crude Fat

The data given in fig 3 shows that the Crude fat content during storage time is increases day by day as the energy bar. It is clear from the data that the maximum mean (11.25) crude fat content was noticed in T3 and T2 followed by T1 and T0. The treatment T0 showed the mean minimum level of the crude fat content (10.90) on 60days.

The increase in crude fat content may be mainly from degradation products of hydro-peroxide, which is directly related with RH and moisture content of the products. Similar type of linearly increased crude fat content with increasing storage period. Similar type of linearly increased crude fat content with increasing storage period was also observed in the fortified Bengal gram sattu stored at 25°C (Mridula *et al.*, 2011).

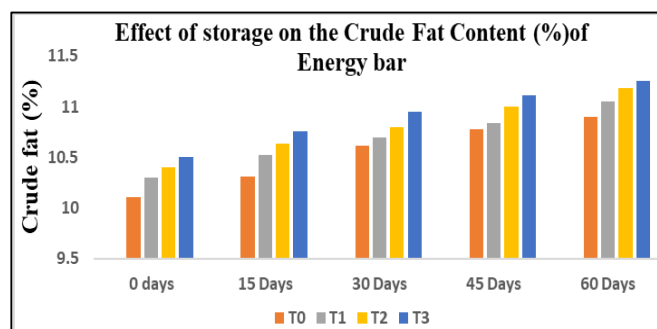


Fig 3: Effect of storage on the Crude Fat Content (%) of Energy bar

### Total Carbohydrates

The Total Carbohydrates content is affected during the storage time. It is clear from the data that the maximum mean (63.0) carbohydrates content was noticed in T0 and T1 followed by T3 and T2. The treatment T3 showed the mean minimum level of the carbohydrates content (60.02) on 0 day. The carbohydrate content decreases due to increases in the other contents day by day. On the 60 days in T3 the carbohydrate content was 59.04 was least in all observation. High temperature has influence in carbohydrate loss as it increases. Dehydration and direct radiation in storage degrades carbohydrate. The result reported by (Ateequddin *et al.*, 2015) was in similar range.

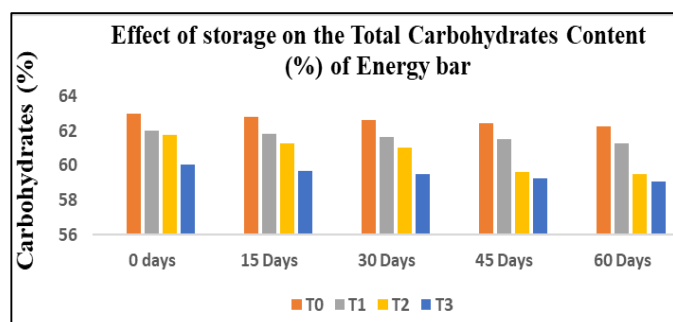


Fig 4: Effect of storage on the Total Carbohydrates Content (%) of Energy bar

### Crude Protein

The Crude protein content is affected during the storage time. It is clear from the data that the maximum mean (22.71) crude protein content was noticed in T2 and T2 followed by T1 and T0. The treatment T0 showed the mean minimum level of the crude protein content (22.00) on 0 day.

The protein gets denatured during storage life, hence there is

decrease in the protein content. The processing also effected as the protein denaturation. The protein content decreased as the storage period was increased. But it was in fewer amount so no deterioration in the quality of the product during storage period. Similar range of results were reported by (Ateequddin *et al.*, 2015).

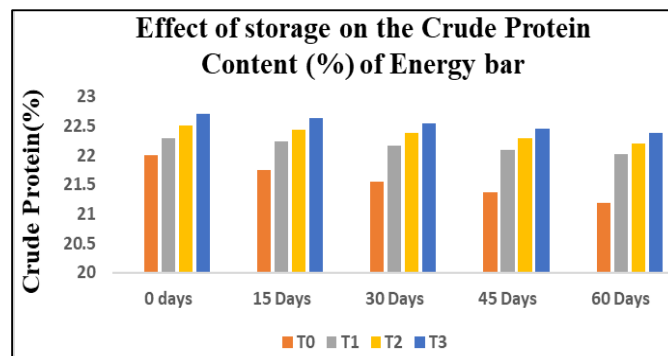


Fig 5: Effect of storage on the Crude Protein Content (%) of Energy bar

### Ash Content

The Ash content is affected during the storage time. It is clear from the data that the maximum mean (2.40) ash content was noticed in T2 and T2 followed by T1 and T0. The treatment T0 showed the mean minimum level of the Ash content (2.00) on 0 day.

Ash also decreases day by day due to loss in minerals in storage study. The tabulated study shows the decrease in ash content in gram as the replicating days' increases. The ash content in food stuff not necessarily accounts for exactly the same composition as the mineral matter present in the original food, there may be some losses due to volatilization or some interaction between the constituent. Similar range of results was reported by (Ateequddin *et al.*, 2015).

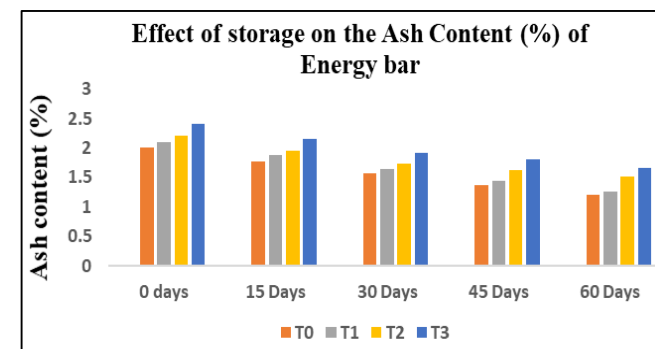


Fig 6: Effect of storage on the Ash Content (%) of Energy bar

### Crude Fibre

The Crude Fibre content is affected during the storage time. It is clear from the data that the maximum mean (1.43) crude fibre content was noticed in T3 and T2 followed by T1 and T0. The treatment T0 showed the mean minimum level of the crude fibre content (1.02) on 0 day.

Due to thermally processing the dietary fibre get decreased as the solubilization of the polysaccharide resulting into decrease in the fibre content. The value of crude fiber decreased non-significantly with the increase in number of days of storage period. But there was opposite result by (Ateequddin *et al.*, 2015) who reported crude fiber content ranging from 7.00 to 9.89%.

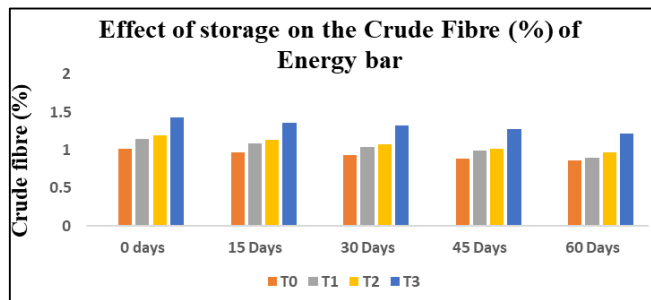


Fig 7: Effect of storage on the crude Fibre (%) of Energy bar

### Sensory Characteristics of Energy Bar

It may be seen from the results that many variations observed in overall acceptability score. The samples T2, T1 and T3 valued in between like very much to like extremely. Lowest score was observed in treatment T0. The overall acceptability of energy bar could be attributed to the different characters of flavor, color appearance, texture and taste of the final product. It is revealed from the scores of the overall acceptability 8.5 was highest of sample T3 (15% Flax Seeds, 15% Watermelon seeds, 20% Bengal Gram, 50% Jaggery) was successful. Similar observation with respect to attributes color, flavor, texture, taste and overall acceptability of cereal bar was reported by (Gutkoski *et al.*, 2007).

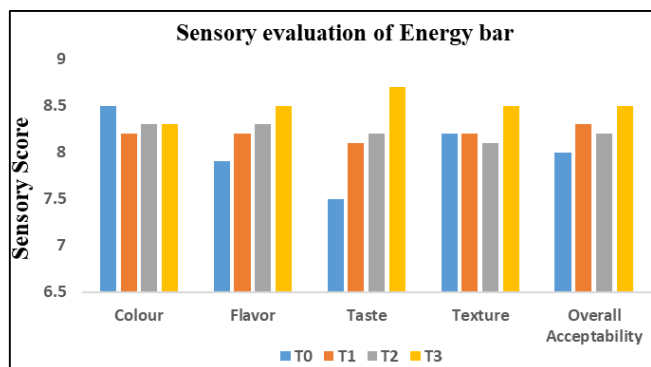


Fig 8: Sensory evaluation of Energy bar

### Conclusion

From the present investigation it can be concluded that the Energy bar containing Bengal gram, flax seed, watermelon seed and jaggery 50:30:15:15 was acceptable by the panel members. The storage studies suggest that the shelf life of energy bar is 60 days at room temperature without significant qualitative deterioration. Thus, Bengal gram, flax seed, watermelon seed and jaggery are rich in nutrients and has many health benefits, so, they can be incorporated in energy bar which can be consumed by different age groups to provide required amount of nutrients in the form of snack.

### References

1. AACC. Approved Methods of the American Association of Cereal Chemists, 10th Ed. AACC, St. Paul, MN, USA, 2000.
2. AOAC. Official Methods of Analysis. Trends Food Science Technology. Association of Official Analytical Chemists, Washington, DC, USA, 2000.
3. Amerine MA, Pangborn RM, Rossler EB. Principles of sensory evaluation of food. Academic press. New York, 1980.
4. Mandal D, Tudu S, Mitra SR, De GC. Effect of common packaging materials on keeping quality of sugarcane

jaggery during monsoon season. Sugar Technology. 2006; 8(2-3):137-142.

5. Ryland D, Vaisey-Genser Ma, Arntfield SD, Malcolmson LJ. Development of a nutritious acceptable snack bar using micronized flaked lentils. Food Research International. 2010; 43:642-649.
6. Statista. Retail sales of nutrition and energy bars in the U.S. from 2005 to 2015 (in million U.S. dollars), 2015.
7. Sun-Waterhouse D, Teoh A, Massarotto C, Wibisono R, Wadhwa S. Comparative analysis of fruit-based functional snack bars. Food Chemistry. 2010; 119:1369-1379.
8. Tarpila A, Wennberg T, Tarpila S. Flaxseed as a functional food. Current Topics in Nutraceutical Research. 2005; 3(3):167-188.
9. Williams G, Noakes M, Keogh J, Foster P, Clifton P. High protein high fibre snack bars reduce food intake and improve short term glucose and insulin profiles compared with high fat snack bars. Asia Pacific. Journal of Clinical Nutrition. 2006; 15(4):443-450.