

## **Formulation of Energy Bar with Desiccated Coconut Chips and Fruit Leathers**

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### **Introduction**

Food bars have been making noise in the market place recently, posting double digit growth rates. An energy bar is a convenient, fortified snack-food containing a blend of simple and complex carbohydrates, protein, fat, fiber, vitamins and minerals. Desiccated coconut with cereals, fruits and nuts stand out as energy bar is high in nutritional value. The study was aimed to develop of multi ingredient energy bar focusing international market with broken desiccated coconut at the retail packing and consumable fruit leather wastages of CBL Natural Foods (Pvt) Ltd. The objectives of this study were to determine ratios of ingredients to obtain required calorific value, sensory characters of each treatments, shelf life analysis, proximate analysis, packaging material, package design and cost of the final product.

### **Methodology**

Desiccated coconut chips and cashew were used as main sources of fat. Required level of protein obtained from green gram with soybean while fruit leather and sugar were used mainly as sources of carbohydrates. Wasted desiccated coconut chips disposed during the retail packing were collected. Cashew splits and rejected fruit leather were cut in to small pieces. Cleaned, washed green gram and soybean were blanched 3 minutes at 95 C - 100 C temperature. They were dried at 60 C and roasted. Finally they were ground separately. Sugar syrup (water 1: sugar 2) was used as a binding agent of the bar. When the sugar syrup was boiling, its thickness was increased. Then ingredient mixture was added and mixed well. After it was poured to stainless steel tray for levelled one centimetre height and cut into pieces with nearest 62g. Those were allowed to cool and packed separately in three ply aluminum coated laminated pouches.

In experiment 1, ratios of ingredients were determined as their nutritional value. Desiccated coconut, cashew and fruit leather were used at two different levels. Accordingly there were eight treatment combinations in a three factor factorial design. Those eight treatments were subjected to five point hedonic scale test and the acceptability of samples was judged by 11 trained tasters through sensory evaluation. The data were analyzed by MINITAB - 15 and the final treatment combination was selected through Friedman test at 95 % confidence level. In experiment 2, shelf-life was monitored for one month period. Changes of free fatty acid, pH level, moisture, total plate count, yeast and mould count were determined. Moisture, protein, fat, carbohydrates, ash and fiber were analyzed. Level of Ca, Mg, Fe, Cu, Zn and packaging material were determined. Package was designed considering the requirement of food act, No. 26 of 1980 regulation of Sri Lanka and finally, cost of the final product was calculated.

### **Result and Discussion**

There were significance difference ( $P = 0.05$ ) between the eight treatments regarding physical appearance, color, taste, texture, aroma and overall acceptability.

Table 1. Grand median of the sensory attributes of each treatments.

Attribute	212	323	434	545	656	767	878	989
Physical appearance	3	4	3.5	3.625	3.75	3.75	3.5	2.875
Color	2.6875	3.9375	3.1875	3.0625	3.1875	3.4375	3.0625	2.9375
Taste	3.938	4.813	4.063	2.813	3.938	3.938	3.938	2.063
Texture	3 3.75	3.75	3.125	2.875	4 3.25	3.375	4	2.875
Overall acceptability	2.688	3.75	3.25	3	3.563	3	3.125	2.875
		4.313	2.813	3.438		3.563	3.563	1.563



Figure 1. Sensory profile for the treatments on the sensory evaluation.

The bars currently in the market contain nutrition specification ranges: calories - 170 to 270, carbohydrate - 21 to 53g, fat - 3 to 11 g, protein - 4 to 17 g (Dairy Ingredients Fax, 1999), and fiber at least 3g (<http://www.consumersearch.com>, 09.09.2013). The selected energy bar one serving provides average 14.94 g (24.11 %) of protein, 7.13 g (11.51 %) of crude fat, 31.35 g (50.58 %) of carbohydrates, 251.88 calories and 3.134 g (5.055 %) of crude fiber which are in standard level of typical energy bars. Ash content of the biscuit made from rice bran and soybean was 1.7 % (Bunde *et al.*, 2010) and energy bar ash content was 0.328 % which is less than biscuit made from rice bran and soybean. The recommended daily intake of Ca, Mg, Zn, Cu, were respectively 1000 mg/day (Jensen, 2000), 400 mg/day (<http://ods.od.nih.gov/factsheets/Magnesium-HealthProfessional>, 09.09.2013), 6 mg/day (Smith *et al.*, 1983) and ranges from 1.5 - 2.0 mg/day (Sandstead, 1982) for adults. The final energy bar was contained RDA value of 7.944 % (79.440 mg/100 g) Ca, 20.295 % (81.834 mg/100 g) Mg, 39.003 % (2.340 mg/100 g) Zn and 54.74 % (0.958 mg/100 g) Cu for adults. RDA value of Fe is 18 mg/day for 19 – 50 age males and 8 mg/day for 19 – 50 age females (Institute of Medicine, 2001). One serving of energy bar contains 4.87 mg of Fe (8.55 mg/100 g). It was provides RDA value of 27.05 % for 19 - 50 age males and 60.87 % for 19 - 50 age females.

According to the Sri Lanka Coconut Development Authority, maximum FFA value of paring oil was 0.8 %. FFA content of the selected bar was determined three times and value of 0.7 % was retained constant. Hence energy bar was at consumable level of FFA value. Cereal bar development using exotic fruit (Torres *et al.*, 2011) moisture content was 10.71 %. The moisture percentage of the energy bar was 8.4 % and after four weeks, it was decreased up to 8.25 %. Therefore, the moisture percentage of the energy bar within one month period was in accepted level. Rather than water content, water activity may influence the shelf life of energy bars. Initial pH of the energy bar was 5.77. It was slightly variation within the storage time and each sample. Since there is no distinct variation, this study was in agreement with chemical degradation at minimal level for the period of one month. TPC, yeast and mould in the samples for one month was complied with the requirement of Sri Lankan standards (SLS) of desiccated coconut (See figure 2 (a) and (b)).

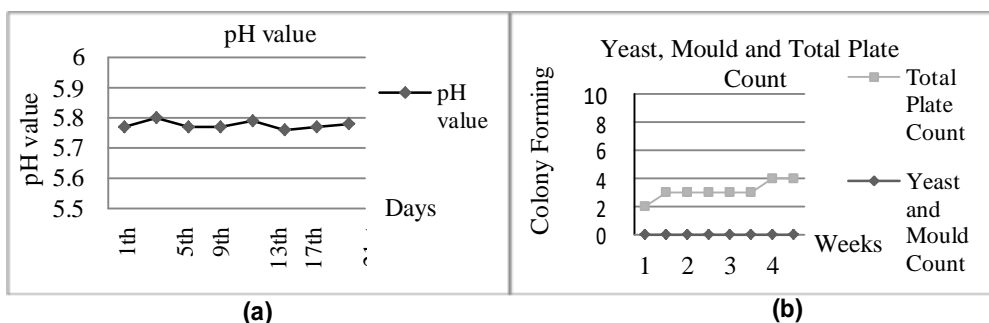


Figure 2. (a) Changes in pH value, (b) total plate count, yeast and mould count with storage time

Proposed package was a three ply aluminum coated laminated pouch with height and width respectively 11.0 cm and 7.2 cm. Metalized film package meets all the needs of the package of energy bar while well balanced between durability, flexibility with oxygen and moisture barrier properties. The total cost of manufacturing of the one bar was Rs. 43.39.

### Conclusions

Desiccated coconut is a good source of supplying fiber and cholesterol free fat for the energy bar. The formulated energy bar with 10.5 % desiccated coconut chips, 12.2 % fruit leather, 3.36 % cashew, 28 % sugar, 28.21 % green gram and 17.54 % soybean were the best formulation. Proximate analysis result of energy bar was at the typical energy bar recommendation level. Developed energy bar is safe for human consumption for a minimum of one month period.

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