

## **Formulation of Zinc Rich Coconut Nutribar Designed for Athletes**

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### **Abstract**

The main dietary goal for athletes is to obtain competent nutrition to improve health, fitness and sports performance. Athletes require nutritious convenient foods like nutribars to provide instant energy and other nutrients. Zinc supplementation has been shown to increase anabolic hormone status to meet catabolic activity in athletes which is profound during training. In the current study nutribar was formulated using zinc rich food sources namely dehydrated coconut meat, cashewnuts, pumpkin seeds and cocoa. Two variations of the nutribar were prepared variation I using dark chocolate and variation II with milk chocolate. The samples were subjected to organoleptic evaluation using a 9 point Hedonic scale by semi trained panel members. The nutribars were also analyzed for selected nutrients using standardized procedures. The mean score obtained for over all acceptability was  $8.0 \pm 0.632$ ,  $8.7 \pm 0.458$  and  $8.5 \pm 0.5$  by the control, variations I and II respectively. Variations I and II had obtained a mean score of more than 8.0 for flavour and taste, while the control sample had obtained lesser scores. The zinc content of variations I and II was 7.38 mg & 5.2 mg being greater than the control.

**Keywords:** Dehydrated coconut meat, Cashew nuts, Cocoa, Pumpkin seeds, Athletes, Zinc, Nutribar

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## Introduction

Sports nutrition is a part of nutrition science that relates to the interaction of nutrition and physical activity (Maughan, 2001). Nutrition plays a vital role in sports performance. Dawn Jackson, RD (2003) spokeswoman for the American Dietetic Association, concurs; nutribars are convenient, especially for physically active individuals. The coconut has been a traditional food in almost all the countries where it is grown. It enters the diet of the people many ways, the water from the tender coconut is drunk and the mature nuts are used in cooking in the preparation of sweetmeats and for house hold oil production (Grimwood, 1975). Increasingly, there is an emphasis on the synergistic relation between diet and exercise for well being and a growing awareness of the beneficial role that mineral element nutrition may play in achieving good health and enhanced physiologic function. In contrast with the role of macro nutrients in the body, micronutrients despite their relative paucity in the diet and the body, perform important roles in regulating whole body metabolism, including energy utilization and work performance. The importance of these micro nutrients is revealed by the diversity of metabolic process they help to regulate. Zinc is a ubiquitous element, that plays a fundamental role in many cellular reactions. It is also an intracellular cation, and is required to serve either a catalytic or structural role by 300 enzymes in mammals. (Ralf, 2003). Zinc containing enzymes participate in many components of macro nutrient metabolism and cell replication. In addition, some zinc containing enzymes, such as carbonic anhydrase and lactate dehydrogenase, are involved in intermediary metabolism during exercise (Henry, 2000). Zinc is essential in keeping the immune system strong. For athletes, this is especially important, since being side lined with a viral infection, or other illness, can force one to miss valuable workout time. Zinc deficiency is problematic as plasma testosterone is regulated in part by zinc. Therefore, zinc deficiency may adversely affect this hormone, causing muscular mass and strength to suffer. Exercise increases losses from the human body, and severe zinc

deficiency can compromise muscle function (Lukaski HC, 2000). Dietary zinc intake and plasma zinc each have a positive association with BMD in men leading to osteoporosis (Tiasun H Hyun, 2004). Therefore in order to augment zinc deficiency in athletes and to enhance their endurance activity level, this nutribar was designed. The objective of the study is to formulate zinc rich coconut nutribar for athletes and finding out its organoleptic acceptability and nutrient content.

## Materials and methods

### Selection of ingredients

There are several zinc rich food sources like pumpkin seeds, sesame seeds, squash seeds, watermelon seeds, dark chocolate, wheat germ (Edward, 2013). The researcher selected dehydrated coconut meat, cashew nut and pumpkin seeds as zinc sources as they have 5mg, 6mg and 6.6mg/100gm respectively. These three ingredients were also found to blend well in the final product after a pilot study. The chocolate coating given to the product also enhanced the zinc content dehydrated coconut meat is dried coconut flesh which is widely used for extracting coconut oil and the remaining coconut meal is used for cattle feeding. In India, dehydrated coconut meat is used for cooking food, apart from using coconut oil. Dehydrated coconut meat meets 42% of daily requirement of Zinc for an adult. The recommended dietary allowance of Zinc for an adult per day is 12 mg (Sesikeran, 2010). The nutrient content of dehydrated coconut meat is presented in Table 1.

**Table 1. Nutrient Content of Dehydrated coconut meat per 100gm**

S. No	Nutrients	Values
1	Energy	662 kcal
2	Carbohydrate	18.4 gm
3	Protein	6.8 gm
4	Fat	62.3gm
5	Crude fibre	6.6 gm
6	Calcium	400 mg
7	Phosphorus	210 mg
8	Iron	7.8 mg
9	Zinc	5.0 mg

Source: Nutritional value of Indian Foods, National Institute of Nutrition

### Preparation of nutribar

Dehydrated coconut meat, cashew nut and pumpkin seeds were purchased in a pure form from a reputed shop known for selling these products. Other ingredients namely cocoa powder, sugar and honey were purchased from a reputed departmental store. 100gm of the dehydrated coconut meat is taken and the brown outer skin was peeled and discarded as it was found to interfere with the organoleptic characteristics. The pulp was flaked and toasted in a frying pan till a fine aroma emanated from it. 20 gm of pumpkin seeds and 10 gm of cashew nuts were also dry roasted separately. All the ingredients were coarsely powdered and kept aside. Sugar syrup was prepared up to the thread stage in 1:1 ratio. The other ingredients were added to the syrup and cooked in a low flame with constant stirring till the thick mass did not stick to the sides of the pan. The mass was then allowed to set on a greased plate and cut into uniform sized pieces each in the shape of a bar weighing approximately 50gm each and allowed to cool. One half (variation I) was coated with dark chocolate and other half (variation II) with milk chocolate as the preference for the dark and milk chocolate varies between individual. (Figure 1 shows a display of the formulated products). A control sample was also prepared replacing dehydrated coconut meat, cashew nut, pumpkin seeds and chocolate with oats and the same method of preparation was followed.

**Figure 1.** Formulated Coconut nutribar



### Nutrient analysis

The nutribars were analyzed for their fiber, protein, zinc calcium and iron. These nutrients were selected for analysis as they affect the bioavailability of zinc. Protein was estimated by Kjeldahl method, fiber by AOAC method, zinc by atomic absorption spectrophotometer, iron by Wongs method and calcium was estimated by precipitating it as calcium oxalate. The estimations were carried out in triplicates.

### Sensory evaluation

Sensory evaluation is defined as a scientific discipline used to evoke, measure, analyze, and interpret those responses to products that are perceived by the senses of sight, smell, touch, taste, and hearing (Stone and Sidel,1993). The nutribars thus prepared were evaluated for the sensory attributes. Each of the qualities namely appearance, texture, flavour, taste and over all acceptability was assessed using a 9 point Hedonic scale by a team of 10 semi trained panel members. The scores given by the panelists were statistically analyzed by ANOVA.

### Results and discussion

#### Nutritional composition of Nutribar

The nutrient content of the prepared nutribar is presented in Table 2. The nutribar had a protein content of 13.86, 15.60 and 15.82g% for the control, variations I and variation II respectively. The protein is essential for muscle building, and wear and tear of the athletes and it also enhances the absorption of zinc. The Zinc content of the nutribar was higher in variation I (7.38 mg %) due to the addition of dark chocolate, as it has more cocoa in it. Cocoa is one of the zinc sources. In dark chocolate, the amount of cocoa added being greater has enhanced the zinc content. The amount of zinc in variation II was 5.32mg of which was nearly 2mg lesser than the variation I while that of control was even lesser (3.08 mg %), as there was no zinc food source added to it. The fiber content of the both the variations was almost same (7.10g and 7.14g% for variations I and II respectively) and was higher than the control

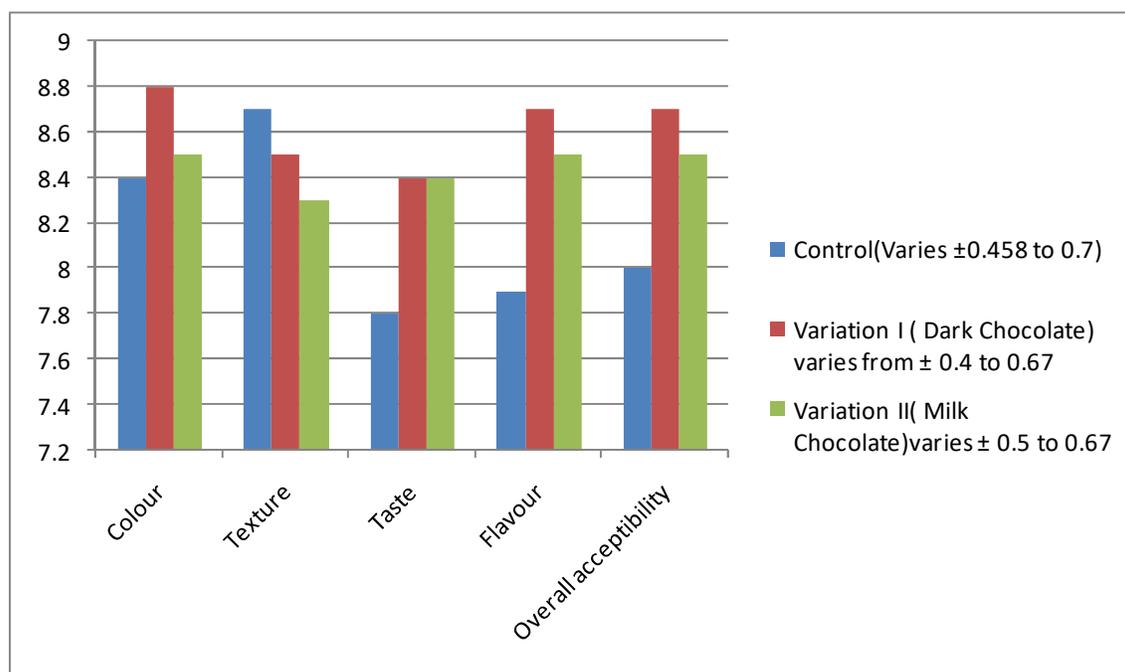
**Table 2.** Nutrient composition of Nutribar per 100gm

S. No	Nutrients	Control	Variation I (Dark chocolate)	Variation II (Milk Chocolate)
1	Protein	13.86gm	15.60gm	15.82mg
2	Zinc	3.08mg	7.38mg	5.32mg
3	Fibre	6.70gm	7.10gm	7.14gm
4	Calcium	310.0mg	330.0mg	342.0mg
5	Iron	4.80mg	6.0mg	6.20mg

**Table 3.** Mean Scores of the organoleptic evaluation of nutribars

Sensory attributes	Control	Variation I (Dark Chocolate)	Variation II (Milk Chocolate)	P value
Colour	8.4±0.663	8.0± 0.4	8.5± 0.670	0.342774
Texture	8.7 ± 0.458	8.5 ±0.670	8.3± 0.640	0.377798
Taste	7.8 ± 0.6	8.4± 0.663	8.4± 0.663	0.091761
Flavour	7.9 ± 0.7	8.7± 0.458	8.5± 0.670	0.028525
Over all acceptability	8.0 ± 0.632	8.7 ±0.458	8.5± 0.670	0.0282674

**Figure 2.** Mean Scores of the organoleptic evaluation of nutribars



(6.7g %). Addition of dehydrated coconut meat added to the variation may be the reason for this. The fiber concentration is high in dehydrated coconut meat and palm kernel products (Stephaine, 2013). Calcium in the control group was found to be 310mg whereas in variations I and II it was 330.0mg and 342.0mg respectively. The iron content was found to be 4.80mg in the control and comparatively high in variations I and II (6.0mg and 6.20mg respectively).

### Sensory evaluation of nutribar

The sensory attributes and the mean scores of the nutribar are indicated in Table 3. The mean scores obtained for over all acceptability was  $8.0 \pm 0.632$ ,  $8.7 \pm 0.458$  and  $8.5 \pm 0.5$  respectively by the control, variation I and II respectively. Variations I and II had obtained a mean score of more than 8.0 for flavour and taste, while the control sample had obtained lesser scores. Results of ANOVA indicate no significant difference ( $p \geq 0.05$ ) in colour, texture and taste between the three samples, while it was significant ( $p \leq 0.05$ ) for flavour and over all acceptability. This is due to the addition of chocolate and dehydrated coconut meat as it has good flavour (Gohl, 1982) in the variations which have mutually enhanced the acceptability of the nutribar. Graphical representation of organoleptic scores are shown in figure 2.

### Conclusion

The control sample had obtained highest mean score in the texture criteria compared to the variations I and II. This is because the texture of the oats being crispy and crunchy, whereas the variations I and II had obtained higher mean scores in over all acceptability compared to the control sample. Statistically it was found out that there was no significant difference ( $p \geq 0.05$ ) in the colour, texture and taste between the three samples, while it was significant ( $p \leq 0.05$ ) for flavor and over all acceptability. The addition of dehydrated coconut meat, pumpkin seeds, cashew nuts and chocolate in the variations are not only nutritious, but also highly acceptable. The nutribar provide almost one half of the daily zinc requirement of athletes.

Consumption of the formulated nutribar (100 gm) will help in contributing to the zinc requirement, thereby enhancing the muscle power and endurance capacity of athletes. The designed nutribar is organoleptically accepted and nutritious in terms of protein, zinc, iron, calcium and fiber. The formulated nutribar can be recommended as healthy nurturing snack for athletes to increase their endurance performance.

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