

Macromolecules and Sensory quality studies on millet based formulation in context to elite athletic performance

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Abstract: Sports nutrition plays an important role in keeping athletes healthy, preventing fatigues and illness associated with poor recovery. Nutrient rich bars can be used as dietary supplement by athletes and other physically active people to maintain their calorific and other nutrient requirements. These kind of bars are convenient and quick in providing energy and nutrients which helps in improving strength and endurance level of athletes during any endurance training or exercise events. Nutrient rich bar can be consumed as pre or post workout snack to improve the strength of an athlete. Hence present study was undertaken to develop nutrient rich bar and evaluate its acceptability. A ready to eat nutrient rich bar was developed using locally available and nutritionally superior ingredients, such as bajra flakes, jowar flakes, dates, dates syrup, grated coconut, pumpkin flesh, gum, almonds, and flax seeds. Two variations of nutrient rich bars were developed (S1 with Bajra flakes and S2 with Jowar flakes) keeping other ingredients common. The developed products were subjected to sensory evaluation by a panel of 50 semi trained members using 9 point hedonic scale. The study found that both the bars were accepted by the panel but the mean sensory score was highest for S1 (8.16, 7, 8.14, 7.82, 8.36, 8.4) when compared to S2 (8.02, 8.02, 8.12, 7.64, 8.2, 8.3) for appearance colour, flavour, texture, taste and overall acceptability respectively. The sensory evaluation showed significant difference between the variations and highly accepted product was chosen for nutrient analysis per 100g. The developed bars revealed it has 357g of Energy, 80g of carbohydrates, 8g of Fat, 10g of protein. Evidently investigation shows the presence of significant nutrient proportion in the millet based sports bar formulation. Formulation found to be a plant based nutraceutical meeting the special demands in sports endurance and performance

Keywords: Sports nutrition, endurance level, acceptability, millet bar and athletes.

INTRODUCTION

The term SPORT can be defined as “sport is influenced by different contexts and individual disposition. Sport is not just a demonstration of physical powers but also an avenue for employment, enjoyment or improving one's health and fitness”. One can alter his or her nutrition to match the body's demanding need if one is planning to ramping up levels of physical activity. At the most basic level, nutrition is important for athletes because it provides a source of energy required to perform the activity. The food we eat impacts on our strength, training, performance and recovery. Meals eaten before and after exercise are the most important in sports nutrition. After exercising one needs to replace the carbohydrates one has lost and need to ensure proper muscle recovery by including protein in post training meal. The areas of interest are: body's use of nutrients during athletic competition; the need, if any, for nutritional supplements among athletes; and the role of proper nutrition and dietary supplements in enhancing an athlete's performance. A nutritious diet is one that meets all of the body's macro and micronutrient demands on a daily basis. Nutrition for sport performance goes one step further. When the body is placed under excessive strain as a result of training at competitive levels, the demand for nutrients surpasses that of normal homeostasis. It's important to understand the differences in required nutrition for health, fitness, and athletic performance. Specifically, a healthy diet for the average individual is calorie controlled and composed primarily of a variety of fruits and vegetables, complex carbohydrates, and lean protein. At the same time, it also limits the consumption of unhealthy fats, processed carbohydrates, and simple sugars. These 4 Introduction to Sports Nutrition guidelines form the basis of the recommended daily allowances (DRI-RDAs), as provided by the United States Department of Agriculture. Macronutrients are nutrients that provide calories or energy to the body. The purpose of macronutrients is to promote healthy cellular growth, metabolism, and to maintain normal bodily function there are three types of macronutrients: carbohydrates, proteins, and fats. Carbohydrates can be found in most fruits, vegetables and grains and provide the body with 4 calories per gram. Proteins are nitrogenous organic compounds which are involved with many of the body's most crucial functions.

The most important recommendation is that an athlete needs to track the amount of energy they are expending each day and make sure they are replacing this energy with a balanced diet of carbohydrates, protein, and fat. Sports or nutri bars are the healthiest snack for an athlete, convenient and nutritious way to fill our self and sustain energy. It is a blend of all nutrients in a right proportion, a combination of antioxidant rich bar will help in boosting immunity. These act as meal replacement. Bars are made up of assorted wholesome ingredients bajra flakes, makhanas, dates, dates syrup, flax seeds, pumpkin, almonds. These natural bars are good for all age groups that fulfil our nutritional needs. Bars can also be combined with eggs, fruit bowls and can be had as pre or post event meal. The developed bars are high in calories and protein which are perfect for athletes making them as an option for meal replacer. Athletes required more proteins as compared to others as it is important for optimal cellular-functions and also play the regulatory and developmental roles in the body. In the formulation of Nutri-bars, the different ingredients are being used in order to provide the plenty of supply of nutrients and functional

The primary concern of many athletes is to supplement the diet with protein, vitamins and minerals and a range of more exotic compounds, key dietary issues are often neglected. Research into antioxidant nutrition and athletic performance has been one of the most rapidly evolving areas of sports nutrition. Antioxidants significantly decrease the adverse effects of reactive oxygen and nitrogen species (free radicals) on normal physiological functioning and modify cell-signalling pathways. Free radicals are produced during normal cellular metabolism and are both beneficial and harmful to human health. Overproduction of free radicals, in conjunction with a deficiency in antioxidants, can lead to oxidative stress and, consequently, damage to cellular lipids, proteins and DNA. Nutri bars also provide easy censurability during training and post competition for athletes. Therefore, Nutri- bars could be a better option for supplementing antioxidant for the athlete's supriya *et al.*, (2012).

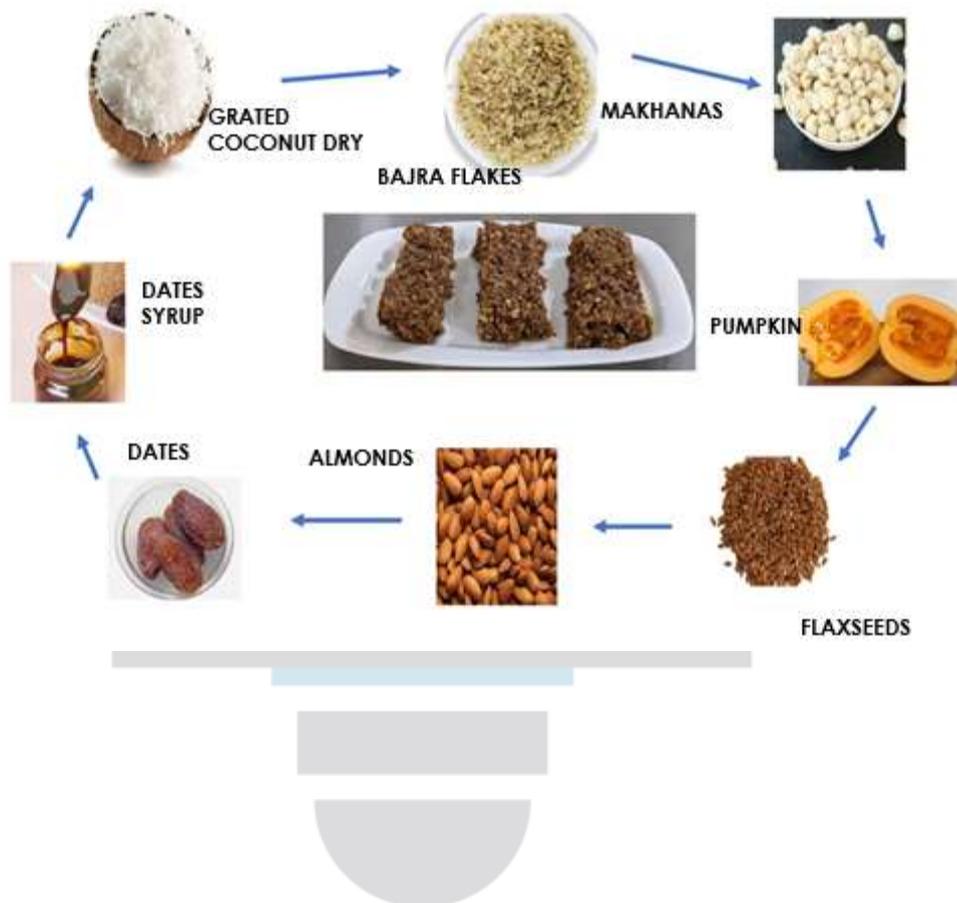
With this background the study was conducted on designing millet based sports bar and its effects on Athletic performance

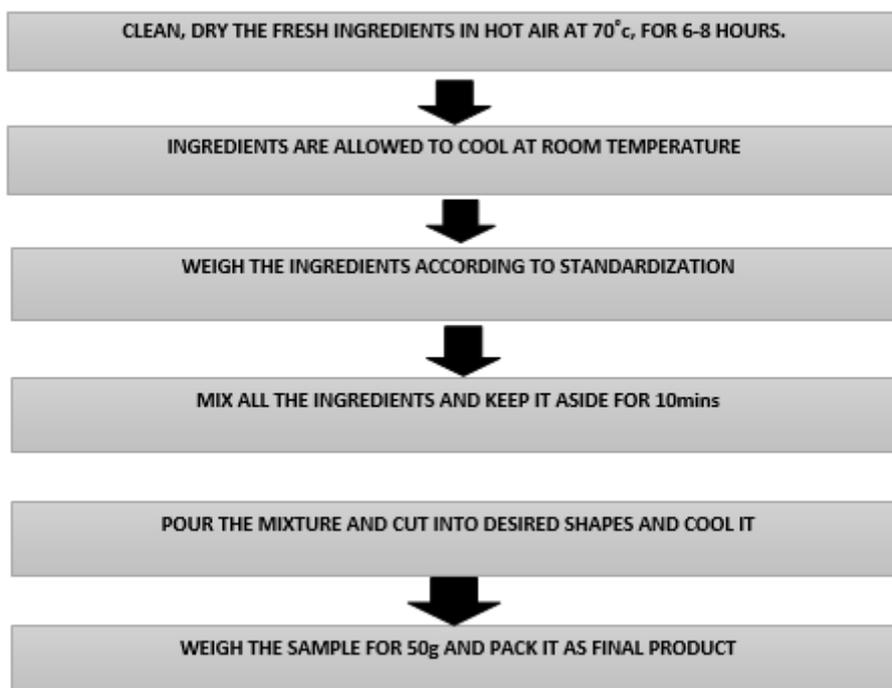
Objectives of the study:

1. Standardization and formulation of millet based sports bar
2. Sensory quality evaluation of the sports bar formulation
3. Proximate analysis of the sports bar formulation

MATERIALS AND METHODS

Raw material procurement: Raw materials required for the development of sports bar for product for an athlete were procured from local markets of Mysore city based on the requirement. All the ingredients were collected, cleaned, stored in air tight container. The ingredients are as follows: bajra flakes, dates, dates syrup, almonds, flax seeds, pumpkin flesh, and grated coconut. They have been developed with variations and the best accepted were analysed for nutritive value.





FLOW CHART REPRESENTING FORMULATION OF MILLET BASED SPORTS BAR

SENSORY ACCEPTABILITY OF MILLET BASED SPORTS BAR

Developed sports bar were subjected to sensory evaluation to assess the best acceptability of product. 9 point hedonic scale was used for organoleptic evaluation of developed products which had attributes like appearance, color, taste, texture, aroma and overall acceptability of products as presented in annexure 50 Semi trained panels were participated in sensory evaluation from the department of nutrition and dietetics Mysore. After briefing about the product, panels were asked to evaluate the product.

Developed sports bar were subjected to sensory evaluation by semi trained panel members (n=50). The products were evaluated for Appearance, Texture, Aroma, Taste and Overall acceptability on a nine point hedonic scale.

Sensory Evaluation
Instructions:

Product name	Appearance	Consistency	Colour	Aroma	Taste	Overall acceptability
MSB 1						
MSB 2						

Evaluate each of the following samples using scoring system given below. Write the preferred number score in the column as per evaluation. Rinse your mouth in between evaluating each sample.

Scoring system:
 9-like extremely: 6-like slightly: 3-dislike moderately:
 8-like very much: 5-neither like nor dislike: 2-dislike very much:
 7-like moderately: 4-dislike slightly: 1-dislike extremely:

Remarks:

NUTRITIONAL ANALYSIS OF MILLET BASED SPORTS BAR

Food samples were allowed for chemical analysis by standard methods. The nutrients analysed were moisture, protein, fat, crude fiber, ash, carbohydrates and energy were derived. The results are found in triplication for the samples.

Determination of Moisture - Weight of the ash 100 Weight of the sample taken Moisture %= *weight of the ash* × 100 *weight of the sample taken*
 Determination of Ash Method: Ash was determined by drying the food samples for about 3-5hrs in the oven (600°C) to give 1 dry weight of 5gm, charring on hot plate for 1 hr and then ashing in a muffle furnace at 550e for 4-5h. The weight

was recorded after cooling. The difference in weight gives an estimation of ash content Ash content (g/100g sample) = $\frac{\text{weight of ash} \times 100}{\text{weight of the sample taken}}$ Preparation of ash solution Ash+ 1 ml double distilled water+ 5ml HCL Ash evaporation 5ml HCL Evaporation 4ml HCL+ 1 ml distilled water 42 Make the volume up to 100ml using distilled water.

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DETERMINATION OF FAT: Fat is estimated as crude ether extract concentrate of the dry material. The dry sample (5-10 gm) is weighed accurately into a thimble and plugged with cotton. Thimble is placed in a Soxhlet apparatus and extracted with anhydrous ether for about 16 hrs. The flask containing ether extract is washed 4 to 5 times with small quantities of ether and the washings are also transferred. The ether is then removed by evaporation and the flask with the residue dried in an oven at 80 to 100 C, cool in desiccators and weighed.

Fat content (gm.100g sample) = $\frac{\text{weight of ether extract} \times 100}{\text{weight of sample}}$

ESTIMATION OF PROTEIN: Processing of the sample: 1 g of sample was taken in a 50 ml long necked kjeldahl flask. Add 10ml of concentrated sulphuric acid and catalyst mixture (1 spatula) digest on a heated bath or on protein digester, until the solution become colourless and clear. After cooling the volume was made up to a known volume with distilled water. Few drops of per chloric acid were added to test for completion of digestion. Distillation: Introduce known amounts of standard ammonium sulphate solution into flask C through the funnel. Then add 10 ml of 40% NaOH through the funnel, a flask containing 10 ml of boric acid solution, at the delivery end of the condenser in such a way that the tip is just beneath the surface of the liquid. Now, heat the flask A with water to produce steam.

This steam is passed through the contents of flask C and the ammonia formed by the alkaline treatment of ammonium sulphate is carried along with it through the condenser outlet. 40 Ammonium is trapped by boric acid as ammonium borate. Steams distil till about 30 ml distillate collected in the receiver flask. Remove the receiver flask after rinsing out the tip of the condenser. Stop heating the flask A. On cooling, this will create a back suction so that the contents in flask C will be sucked into the trap B. Add about 10 ml of water through the funnel quickly, so that it will be back sucked. The apparatus is ready for use. The content in the received flask is titrated against 0.01N HCl, till the colour changes from bluish green to pink. Note the volume of acid used and calculate the strength of ammonia in the distillate Process aliquots of the digested sample and blank as above to obtain the ammonia content. Run the blank preparation through all the steps by taking water in place in place of the sample calculation: $N\% \text{ (in mg)} = \frac{\text{total volume of sample} - \text{blank total volume of factor} - \text{blank}}{\text{total volume volume taken for estimation}} \times 100 \text{ weight of the sample for estimation} \times 100$

Calculation of carbohydrate (AOAC, 1980) The differential method was used to calculate the carbohydrate content. Carbohydrate (g/100g) = $100 - [\text{protein(g)} + \text{Fat(g)} + \text{Fiber(g)} + \text{ASH(g)} + \text{Moisture(g)}]$

Calculation of energy For all of the samples, the energy was calculated as follows Energy (kcal) = $[\text{protein(g)} \times 4] + [\text{carbohydrate(g)} \times 4] + [\text{fat(g)} \times 9]$

RESULTS AND DISCUSSION

The results of the study on the formulation MILLET BASED SPORTS BAR is presented in the following headings below:

1. Standardization of the millet based sports bar
2. Sensory Analysis of the millet based sports bar
3. Proximate Analysis of the millet based sports bar

Standardization of the Millet Based Sports Bar

Ingredients	Standard	MSB1	MSB2
Bajra flakes	25g	25g	-
Jowar flakes	25g	-	25g
Makhaanas	15g	15g	15g
Pumpkin flesh	5g	5g	5g
Flax seeds	5g	5g	5g
Almonds	5g	5g	5g
Dates	10g	10g	10g
Dates syrup	15g	15g	15g
Grated coconut	1g	1g	1g
Gum	1g	1g	1g

MSB1: Millet based Sports bar 1

MSB2: Millet based Sports bar

SENSORY ANALYSIS OF THE MILLET BASED SPORTS BAR

Mean sensory scores of the Millet based sports bar

Sports bar	Appearance	Texture	Color	Aroma	Taste	Overall acceptability
MSB1	8.16±1.17	7±0	8.14±1.02	7.82±1.38	8.36±0.99	8.4±0.8
MSB2	8.02±1.06	8.02±0.9	8.12±0.9	7.64±1.3	8.22±0.78	8.3±0.72

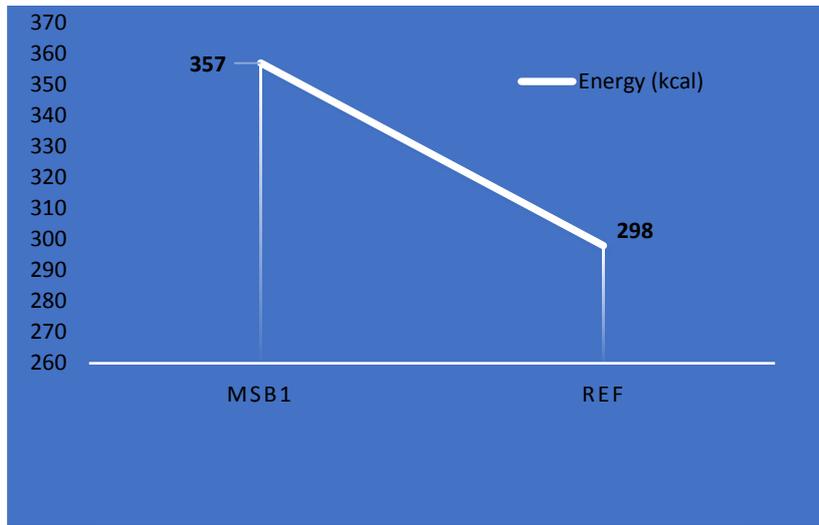
(Note: MSB1 Bajra flakes; MSB2 Jowar flakes)

Significant difference was observed among all the variations in each of the sensory parameter . It is clearly observed that S1 variation bar is best acceptable among other one with the highest mean of 8.4.

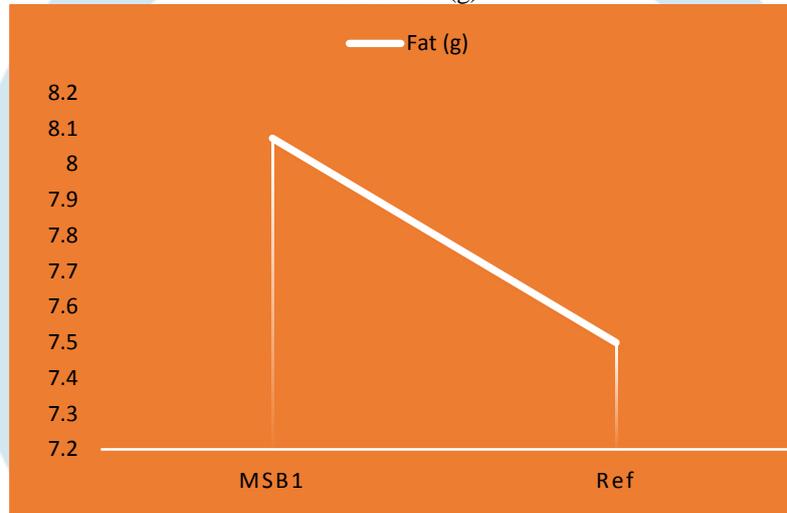
NUTRITIONAL PROPERTY OF THE MILLET BASED SPORTS BAR

The best accepted bajra flakes bar was exposed to proximate analysis by standard methods to evaluate its nutritional value The macronutrients like moisture, protein, fat, crude fibre and ash were examined . Carbohydrate and energy were determined.

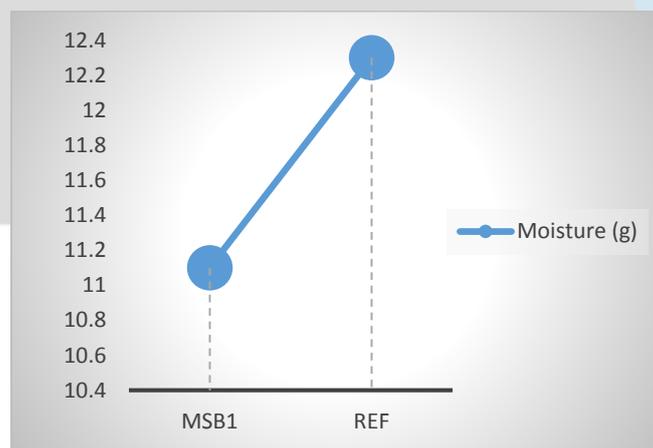
MACRONUTRIENT COMPOSITION OF MILLET BASED SPORTS BAR (PER 100G)



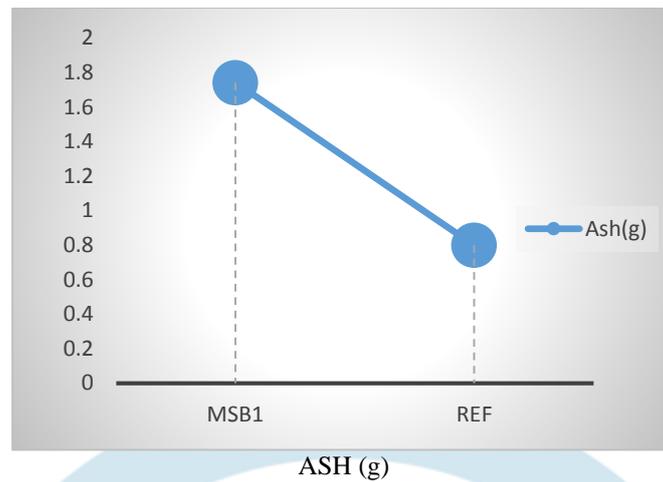
ENERGY (g)



FAT (g)



MOISTURE (g)



The bar was formulated per 100g. The formulation contained remarkable amount of nutri dense product. From the above results we can substantiate the bar is energy dense and rich in protein which has 357kcal per 100g and 10g of protein per 100g High calorie and protein makes this formulation as a superior supplement for an athlete

SUMMARY:

Sports bars are the healthiest snack for an athlete, convenient and nutritious way to fill our self and sustain energy. It is a blend of all nutrients in a right proportion, a combination of antioxidant rich bar will help in boosting immunity. These can be used as meal replacements.

Sports bar was developed in two different variations using bajra flakes and jowar flakes respectively, in which variation developed with bajra flakes was best accepted panel members of sensory analysis.

The best accepted product was subjected to proximate analysis to know the nutritional value of the product .The results showed that the product contained 10g of protein, 8g of fat, 80g of carbohydrates and provided 357kcal of energy.

CONCLUSION:

The present study was carried to increase the endurance levels in the sports person or an athlete. Proving the role of nutrition in athletes and the formulation of bars, which often helps in an athlete's performance. Nutri bars also provide easy consumability during training and post competition for athletes. Therefore, nutri- bars could be a better option as a vital supplementation for an athletes.

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