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Development and Standardisation of Nutri Bar using Oats, Wheat Bran and Flax Seeds

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ABSTRACT

Cardiovascular diseases continue to be the major cause of morbidity and mortality in industrialized society. Various studies indicate the consumption of a vegetarian diet or a diet high in cereal fiber appears to be associated with reduced risk of cardiovascular diseases. Based on this, a product was developed which is not only high in fiber, low in saturated fats, high in PUFA and MUFA but also a good source of phytochemicals and antioxidant. The products were developed (basic with sugar-sample A, variations with jaggery-sample B and artificial sweetener-sample C) using bajra, oats, wheat bran, flax seeds, whole green gram, almonds and walnuts. The nutritive value per 100g of the basic recipe (energy – 389kcal, protein- 13g, fat – 12g, fiber – 6.5g) and variations were calculated. The pH and alcoholic acidity of the products were estimated using standard procedures. The products were subjected to sensory analysis through Hedonic rating test and the results revealed that sample B scored the highest. The cost of the products per 100g ranged from Rs. 9 to Rs. 14. From the results it is clear that the sample B prepared with jaggery was the most acceptable and hence, can be recommended for the patients suffering with cardiovascular diseases.

KEYWORDS: *Phytochemicals, antioxidants*

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INTRODUCTION

Cardiovascular disease remains the leading cause of mortality and morbidity worldwide. The inclusion of functional foods and natural health products in the diet are gaining increasing recognition as integral components of lifestyle changes in the fight against cardiovascular disease. Several preclinical and clinical studies have shown the beneficial cardiovascular effects of dietary supplementation with flaxseed. The cardiovascular effects of dietary flaxseed have included an antihypertensive action, antiatherogenic effects, a lowering of cholesterol, an anti-inflammatory action, and an inhibition of arrhythmias. Its enrichment in the ω-3 fatty acid α-linolenic acid and the antioxidant lignan secoisolariciresinol diglucoside as well as its high fiber content have been implicated primarily in these beneficial cardiovascular actions. Although not as well recognized, flaxseed is also composed of other potential bioactive compounds such as proteins, cyclolinopeptides, and cyanogenic glycosides, which may also produce biological actions. These compounds could also be responsible for the cardiovascular effects of flaxseed.

Flaxseed is a rich source of the omega-3 fatty acid, alpha linolenic acid, the lignan secoisolariciresinol diglucoside and fiber. These compounds provide bioactivity of value to the health of animals and humans through their anti-inflammatory action, anti-oxidative capacity and lipid modulating properties.

In nutrition, a new era is emerging that is characterized by the search of dietary constituents that have benefits beyond those ascribed to the macro and micro nutrients. Historically, in the area of cardiovascular disease (CVD), efforts have been directed towards identifying the type and, to some extent, amount of dietary fat that can achieve maximal risk reduction. It is now clear that although a fat modified diet can significantly affect CVD risk, other components in the diet, such as dietary fiber, plant protein and soya protein appear to confer additional protective effects that extend beyond the lipid lowering effects of the recommended diets. Identification of additional dietary constituents that elicit favourable effects will facilitate the development of diets that are even more effective for both prevention and treatment of CVD and other chronic diseases.

In the search for bio active components in foods that favorably affect CVD risk, nuts have begun to attract attention. Nuts are complex plant foods that are not only rich sources of unsaturated fat but also contain several non fat constituents such as plant protein, fiber, and micro nutrients (eg. Copper and magnesium), plant sterol and phytochemicals.

The positive nutritional advantages of walnuts in lowering blood cholesterol should not be over looked. These advantages come from the high level of mono and poly unsaturated fatty acids and possibly the tocopherol content. These experiments are unusual as they used specific foods,

walnuts and almonds to lower total plasma and low-density lipoprotein cholesterol, thus reducing the potential risk of coronary heart disease.

Nuts are important part of the Mediterranean diet. The Mediterranean diet is thought to be healthy because the mortality rates from coronary heart disease and cancer are low in traditional Mediterranean population.

Epidemiological studies suggest that frequent nut consumption may be protective against coronary heart disease because of beneficial effects on blood lipids.

In clinical studies, diets supplemented with walnuts or almonds decreased serum concentration of low density lipoprotein and cholesterol.

Nuts are both an important component of the Mediterranean diet and a source of small to moderate amounts of α-linolenic acid if calorie intake remains constant. On the basis of experimental and observational data, all of these potential effects would be expected to reduce sudden cardiac death.

Diet is the cornerstone of the prevention and treatment of cardiovascular disease (CVD). The National Cholesterol Education Program / American Heart Association step I or step II diets are typically recommended for lowering blood cholesterol concentrations. The primary objective of these diets is to lower saturated fat (8- 10% and <>% of energy respectively), cholesterol (300 or 200 mg/d) and total fat (< 30% of energy). Typically, a step I diet lowers total cholesterol and LDL cholesterol by ≈ 5 – 7%.

A step II diet can lower total cholesterol and LDL cholesterol an additional 3-7%. In these diets, saturated fat energy is replaced by carbohydrate, resulting in a low fat, high carbohydrate diet. Although these diets have beneficial effects on total cholesterol and LDL cholesterol, they increase plasma triacylglycerol concentration and decrease HDL- cholesterol concentrations, thereby potentially adversely affecting CVD risk. This has caused some to question whether a step I or step II diet is the ideal diet for maximally reducing the CVD risk. The alternative diet that has attracted much attention is a high- monosaturated fatty acid (MUFA), cholesterol-lowering diet, in which saturated fat energy is replaced by MUFAs resulting in a diet higher in total fat (i.e >30% of energy) than a step I or step II diet in contrast with a step I or step II diet, a high MUFA diet does not raise triacyl glycerol nor lowers HDL- cholesterol concentrations. A study was conducted to compare the step II diet and 3 high MUFA diets in which MUFA source was olive oil, peanut oil or peanuts and peanut butter with an average American diet.

In the last half of this century, a variety of recommendations have been made concerning the optimal diet to lower cardiovascular disease (CVD) risk. The primary focus in the early year was on decreasing the intake of total fat, especially of saturated fat, in the diet. Hypothesis evolved from the epidemiologic studies of keys which correlate these fats with the risk of mortality from coronary heart disease (CHD). Equations were proposed that weighted saturated (SFA) and polyunsaturated (PUFA) fatty acid and cholesterol intakes to predict effects on circulating lipids and lipoproteins, and thereby risk of CVD or CHD. Monounsaturated fatty acids (MUFAs) and stearate were considered neutral without effect on serum lipid measures.

Effect of the concentration or composition of dietary fats and the intake of cholesterol on CHD development are the basis of the lipid hypothesis of atherosclerosis. Elevated blood concentrations of total cholesterol or LDL cholesterol increase the risk of CVD or CHD, whereas higher concentrations of HDL cholesterol decrease risk. Investigators proposed using the ratio of total to HDL cholesterol or of LDL to HDL cholesterol, to assess risk. Elevated concentrations of circulating triacyl glycerol have also been considered independent risk factors for CVD. Thus the composition of the diet relates not only to the concentration of circulating lipids and lipoproteins but also to CVD incidence or prevalence in the population or in individuals. The size and density of LDL, influenced by genetics and diet, may play a role in an individual's risk of CHD. An inherited variant of LDL, lipoprotein (a), markedly enhances CVD risk, although we have little knowledge about the effects of diet.

The National Cholesterol Education Programme[1] delineated the desirable concentrations of lipids and lipoproteins to minimize CVD, set guidelines for dietary and drug interventions, and recommended dietary interventions at 2 levels – the familiar step I and stepII diets. The diets reduce total fat to < 30% of energy, SFAs to < 10% of energy, and cholesterol to < 300mg/d (step I) or SFAs to <> % of energy and cholesterol to <200mg/d (step II). A lowering of LDL cholesterol by 1 % reduces CVD risk by 15%. A 2.5% increase in risk occurs with each 1mg decrease in HDL cholesterol, and risk increases by 25% for each 89mg (1mmol) increase in triacylglycerol concentration.

Newer proposals about dietary fats include the concept that MUFAs are not neutral but lower total and LDL cholesterol, similar to PUFAs, with the added benefit that replacing SFAs with MUFAs will not decrease HDL cholesterol. [32] propose that diets high in MUFAs from olive oil, peanut oil or peanuts and peanut butter also lower concentration of circulating triacylglycerol. This may enhance their salutary effect on CVD risk in contrast with either the step II diet or the average American diets (AAD), which is high in SFAs. MUFAs may also reduce CVD risk with their antioxidant, antithrombotic, and antihypertensive properties. Measure of vascular and coagulation activity extends the original lipid hypothesis and is a current focus of atherogenesis research. Growth factor, cytokines and other inflammatory components, and genetic abnormalities that predispose individual to CHD are new area for examining potential effects of diet on biomarkers of CVD.

MATERIALS AND METHODS

The ingredients used in the preparation were procured from the local market. Oats is available in super markets in different brand names and "white oats" were used in the preparation.

FORMULATION

The method of preparation is the same for both the basic and variations.

Table 1: Proportion of Ingredients

Ingredients	Basic (g) (A)	Variation I (g)(B)	Variation III (g)(C)
Bajra	25	25	25
Oats	25	25	25
Green gram	15	15	20
Flax Seeds	5	5	10
Almonds	5	5	5
Walnuts	5	5	5
Wheat bran	5	5	5
Sugar	15	-	-
Jaggery	-	15	-
Sweetener	-	-	15

METHOD

1. Green gram was soaked in water for 1 hour and the water was drained.
2. Bajra, oats, green gram were roasted on a low flame at 70^0c for 3 – 5 minutes.
3. All the roasted ingredients were finally ground into a powder.
4. To this powder, wheat bran, flax seeds and powdered sugar/ jaggery/ sweetener were added.
5. Dough was prepared with the powdered ingredients using 100ml water.
6. The dough was spread out on a plate and garnished with almonds and walnuts and cut into bars.

STANDARDISATION

The standardization is the process where a recipe is tested a number of times and found satisfactory in quality and yield. It is a gradual trial and error process. The recipe was standardized using different variations after carrying out two trials in the laboratory.

SENSORY EVALUATION

Once the standardization was completed for Bars, 24 panelists were selected for both the trials of evaluation of the sensory attributes using Hedonic rating test. The panelists in each trial did sensory evaluation of the preparations.

Same procedure, temperature and cooking time were followed for both the trials for both the products, as to minimize any kind of change in the preparation that might bring about difference in taste, texture and odour. The taste panels were conducted in a calm place. The time selected for conducting sensory evaluation was 11a.m. when the panel members are neither too hungry nor well fed and 3 p.m that is 2hrs after lunch.

Three samples of Bars were placed, in front of each member with a score card (sample score cards is given in the Annexure), to rate the bars. A glass of water was also provided, to drink in between the assessment of the samples, so that it becomes easier for the panelists to get the exact taste of all the bars. Two minutes of minimum was given to each sample to assess the sensory attributes. The sensory evaluation of Bars were done on different days.

COST

The total cost of the products prepared was determined by taking into account the cost of the ingredients used.

RESULTS AND DISCUSSION

Three types of bars were prepared using bajra, oats, green gram, flax seeds, walnuts and almonds. Sample A was prepared using sugar whereas sample B and sample C were prepared from jaggery and artificial sweetener respectively.

Panel of 24 judges for Bars evaluated the palatability and acceptability of the products using 5 point Hedonic scale. The palatability of the basic and the variations were accepted in terms of appearance, colour, texture, taste and acceptability. The results of sensory evaluation are given in Table 3 and 4 respectively.

Table 3: Results of Sensory Evaluation

Sensory attributes	Sample A	Sample B	Sample C
Appearance	4.05	4.6	4.2
Colour	4.2	4.3	4.3
Texture	3.6	4.4	4.3
Taste	4.3	4.6	4.4
Acceptability	4.4	4.7	4.4

Table-4: Mean Values of the Sensory Attributes of Basic and Variations

Sensory Attributes	Basic	Variation - I	Variation - II	Variation - III
Appearance	4.3	4.17	4.37	.12
Flavor	4.00	3.35	4.00	4.07
Taste	4.15	3.97	4.25	4.22
Texture	4.17	4.02	4.40	4.25
Acceptability	4.3	4.1	4.28	4.13

STATISTICAL ANALYSIS

When the overall mean scores of palatability of basic and variation-1 and variation-2 were subjected to statistical analysis the 't' values obtained were found to be insignificant. The't' values were given in the tables – 5 ,6, 7,8 and 9.

Table 5:'t' test for variation I in comparison with basic

Serial no	Sensory attributes	Mean values Of basic	Mean values of Variation I	't' value	Result
1	Appearance	4.35	4.15	0.357	Insignificant
2	Colour	4.10	4.05		
3	Texture	3.90	4.10		
4	Taste	4.40	4.15		
5	Acceptability	4.30	4.40		

Table 6: t' test for variation II in comparison with basic

Serial no	Sensory attributes	Mean values Of basic	Mean values of Variation I	't' value	Result
1	Appearance	4.35	4.50	0.536	Insignificant
2	Colour	4.10	4.20		
3	Texture	3.90	4.20		
4	Taste	4.40	4.15		
5	Acceptability	4.30	4.30		

NUTRITIVE VALUE

The nutritive value of all the bars (Sample A, B and C) were calculated and is given in Table 7. It is evident that the bars contain appreciable amounts of nutrients.

Table 7: Nutritive Value of Sample A, Sample B and Sample C.

BARS	Energy (Kcals)	Protein (g)	Fat (g)	Fiber (g)
Sample A	389	13	12	6.5
Sample B	393	13	12	6.5
Sample C	329	17	14	7.1

COST

The total cost of the bars were calculated for all the samples, the cost of sample A and B was Rs. 9/- while that of Sample C was Rs. 14/-. The product was thus economical and is thus suitable for people of lower socio economic status to enhance the nutrient content of the diet.

SUMMARY AND CONCLUSION

In nutrition, a new era is emerging that is characterized by the search of dietary constituents that have benefits beyond those ascribed to the macro and micro nutrients. Historically, in the area of cardiovascular disease (CVD), efforts have been directed towards identifying the type and, to some extent, amount of dietary fat that can achieve maximal risk reduction. It is now clear that although a fat modified diet can significantly affect CVD risk, other components in the diet, such as dietary fiber, plant protein and soya protein appear to confer additional protective effects that extend beyond the lipid lowering effects of the recommended diets. So this study was an effort in the direction of developing nutritious Bars. Three types of bars were prepared using bajra, oats, green gram, flax seeds, walnuts and almonds. Sample A was prepared using sugar whereas sample B and sample C were prepared from jaggery and artificial sweetener respectively.

The same method of preparation was followed for all the samples. All the samples were formulated and standardized by conducting repeated trials.

The palatability of the basic and the variations were accepted in terms of appearance, colour, texture, taste and acceptability. The Ph was found to be acidic for all the samples. The total cost of the bars were calculated for all the samples, the cost of sample A and B was Rs. 9/- while that of Sample C was Rs. 14/-. The product was thus economical and is thus suitable for people of lower socio economic status to enhance the nutrient content of the diet.

From the findings of the present investigation it is concluded that the bars developed from millet, oats, green gram, flax seeds, walnuts and almonds contained appreciable amounts of nutrients. If these bars are incorporated instead of other bars the quality and quantity of the nutrients can be improved and the health status of the vulnerable group can be improved.

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