

Development and Nutritional Assessment of Protein and Fibre Rich Snack bar

Author- Shere P.D., Dukare R.B., Gaikwad K.B., Gaikwad S.S.

Abstract:

The objective of present investigation was to explore the possibility of nutritionally enhancing snack bar with protein and fibre content. Snack bars are 'on the go snack' and nutritional improvement provides an option for healthy snacking for all age group consumers. The high protein and fibre content help boost energy levels giving sense of satiety and fullness of stomach after eating. The formulations were developed with protein and fibre rich ingredients such as soy flour, amaranth, oats, rice flakes, peanuts, and flax and chia seeds. The developed formulations were evaluated for sensory and nutritional quality parameters. The sensory evaluation by semi-trained panellists indicated preference for formulation containing peanut (15%), amaranth (10%), soybean (7%), oats (5%), flax seed (1.5%) and chia seeds (1.5%). The nutritional composition showed improved protein (13.96%), fibres (2.36%), iron (25.77 mg/100g), and calcium (150 mg/100g) compared to control sample of snack bar. The study concluded for protein and fibre improvement in snack bar and thus delivering a healthy snacking option for all consumer age groups.

Keywords: snack bar, protein, fibre, nutrition.

Introduction:

Snack foods are very popular and very well known throughout the world. 'Snack foods' term is used for energy- dense, nutrient poor foods. By contrast, the term 'snacking' refers to eating between meals, irrespective of whether the food consumed was a 'snack food' or any other food item (Hess *et al.*, 2016). In 2016, the sales volume of snack bars in the Indian packaged foods market amounted to about 1.83 million metric tons, an increase of 31 % from 2011. The Indian snack bar market is expected to reach USD 185 million by 2023, witnessing a double-digit CAGR, during the forecast period. The Indian snack bar sale has recorded a historic CAGR of 20.1 %, during the past 5 years. Snack bar is still a niche category in India, which accounts for less than 1 % of the global snack bar market [Mordor intelligence Report].

The recent pattern for consumption of healthy, innovative and practical food, which occurred recently, has led the market of snack bars to a gradual growth [Michelle *et al.*, 2011] The development of gluten free bars with combination of healthier breakfast cereals such as oats, rice flakes, amaranth in addition to soy flour and peanuts, flax seed, chia seeds to increase the level of proteins and dietary fibres.

The purpose of this study was to develop a gluten free, nutritionally enhancing snack bar with enhanced levels of protein and fibre. The study also aims to evaluate the influence of breakfast cereals and other components on sensory properties as well as nutritional improvement on bars. It also delivers a RTE

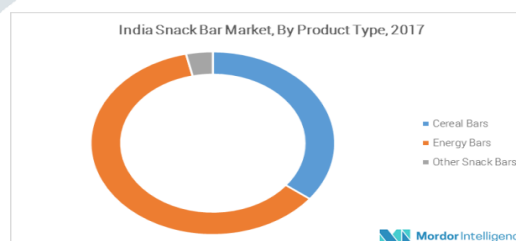


Fig 1. [reference: Mordor intelligence]

food category with a focus on convenience and as 'portable nutrition' [Isadora *et al*, 2017]. Proteins is a macronutrient that we need in relatively large amounts of it to stay healthy. Protein bars are a great way to supplement your diet to ensure we are getting the right amount of protein. According to Harvard school of Public Health, dietary fibres is beneficial for digestive health, and a high-fibre diet is linked to the lower risk of heart disease.

The protein rich sources used for snack bars includes soybean flour, amaranth, oats, peanuts, etc. Soybean comprises approximately 37-42 % protein [Sean *et al*, 2015]. Amaranth, a pseudo-cereal contains on average 13.1-21.0 % protein and popping of amaranth grains affects the protein digestibility. [Muyonga *et al*, 2014]. Cowpea protein content also found to be higher i.e. 20.57% -24.95 % [Waltram *et al*, 2016].

Flax seeds emerges as nutritionally rich source of dietary fibers (35 %), high quality protein (28-30%) and alpha linoleic acid [Kajlia *et al*, 2014]. Chia seeds characterized for 25 % fiber content, which helps to keep final product stay fresh longer [Rahman *et al*, 2015].

Incorporation of protein and fibre rich sources in diet will provide the fullness and fulfill the hunger as well deliver the essential nutrients as per recommended daily intake.

Material: The basic raw ingredients obtained for this work are locally available oats, rice flakes, amaranth, soy flour, peanuts, flax and chia seeds as well as the ingredients used for binder solution such as sugar, confectioner's glucose syrup, butter obtained from Pune local market.

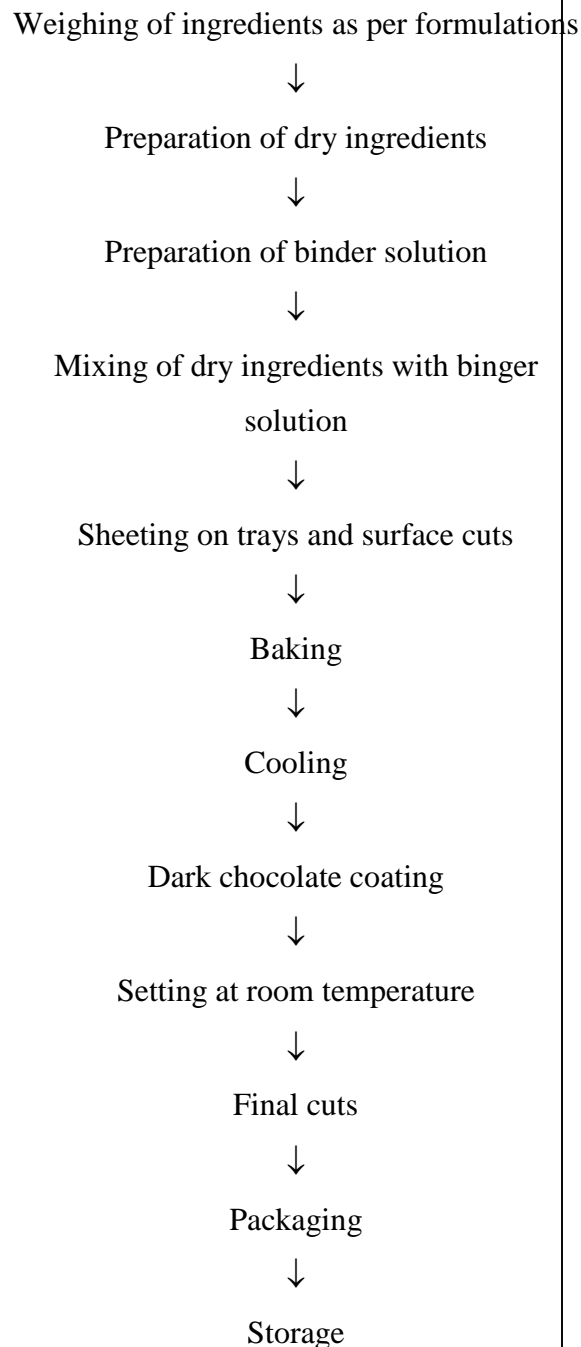
Methodology:

All the dry ingredients (oats, rice flakes, amaranth, soy flour, peanuts, flax and chia seeds) were roasted separately for 5-7 minutes; amaranth being puffed at high temperature (120⁰C). Simultaneously, the preparation of binder syrup (glucose syrup, sugar, water, butter) was carried out, until the TSS reaches 85-90⁰ brix and temperature 105⁰ C. Further, the dry ingredients were added to the binder syrup and stirred to homogenize the mixture. The mixture was poured on trays lined with butter paper and sheeted giving surface cuts. The bars were baked for 120⁰ C - 20 min, until there was slight brown colour. Then further cooling was carried out. Chocolate coating was applied on single side of bars and allowed it to set. Each bar of weight 45 g was cut into rectangular piece and packed into PP (Polypropylene) and stored at cool place [Michelle *et al*, 2011].

Table1. Formulation of snack bars with four different components.

Ingredients	Formulations (g/ 100 g)				
	Cont rol	A	B	C	D
Dry ingredients	60%	60%	55%	55%	55%
Rice flakes	30	20	20	20	20
Amaranth	-	10	10	10	10
Oats	30	05	10	10	10
Peanuts	-	15	-	-	-
Soy flour	-	07	-	-	-
Cow pea flour	-	-	10	-	-
Green gram flour	-	-	-	10	-
Ragi flour	-	-	-	-	10
Flax seeds	-	1.5	2.5	2.5	2.5
Chia seeds	-	1.5	2.5	2.5	2.5
Binder solution	40%	40%	45%	45%	45%
Sugar	13	13	15	15	15
Glucose syrup	17	17	20	20	20
Butter	02	02	02	02	02
Water	08	08	08	08	08

Process flow-sheet:



Sensory evaluation:

Sensory evaluation of five samples was carried out by 10 semi-trained panellist on 9 point hedonic scale. The developed bars were evaluated for sensory evaluation on the basis of appearance, taste, colour, flavour, texture and overall acceptability. Scores were given on hedonic scale ranging from 9 to 1 representing like extremely to dislike extremely respectively.

Analysis of Physico-chemical parameters:

The following physico-chemical parameters were analysed: moisture (dried at 105 C), fat (soxhlet apparatus), total protein (kjeldahl method, N x 6.25), ash and crude fibres, in accordance with AOAC methods of analysis, carbohydrates by anthrone method. To estimate total energy value of each bar formula, the conversion used was 4 kcal g⁻¹ protein, 4 kcal g⁻¹ carbohydrates, 9 kcal g⁻¹ fat [Appelt *et al*,2015].

Statistical analysis:

The data obtained for sensory evaluation is the average obtained from 10 observations. The physico-chemical analysis values are the mean values of 3 replicates performed.

Results and discussions:

The results for physico-chemical parameters regarding moisture, ash, carbohydrates, proteins, fats, carbohydrates and micro-nutrients such as calcium and iron are presented in Table 2 [Leilane *et al*, 2015].

Table 2. Chemical composition of Protein and fibre rich Snack bar

Nutrients	Formulations				
	Contro l	A	B	C	D
Moisture (%)	7.4	7.03	6.83	6.54	7.52
Ash (%)	1.2	1.5	1.2	1.3	1.3
Carbohydrate (g)	65.3	53.99	64.3	63.89	66.89
Protein (g)	3.88	13.96	7.7	8.93	6.77
Fat (g)	17.2	29.2	24.7	23.8	24.56
Fibres (g)	2	2.56	1.97	2.08	2.24
Calcium (mg/100g)	84	150	97.03	92.8	127
Iron (mg/100 g)	21.59	25.77	24.23	26.72	29.03

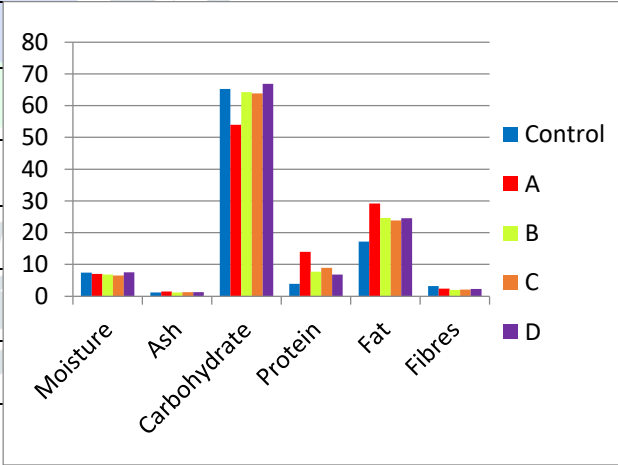


Fig 2. Graph representing proximate analysis of all samples along with control.

Table 2 shows the comparative result of the nutritional composition of formulations using different flours in each sample. The results indicated that the bars with soy flour (7 %) contain good amount of protein (13.96%) and fibres (2.56 %) as compared to control and rest of the formulation

[Cadiolia *et al*, 2011]. The levels of fat content in the sample A found be higher due to peanuts and flax seeds.

Table 3 represents the average sensory scores for all the five formulations of snack bar. The results showed higher acceptance for formulation A compared to control and other formulations (B, C, and D).

Table 3. Average score awarded by panelist for sensory acceptance of bars formulations.

Formulation	Sensory parameters					
	Colour	Appearance	Texture	Taste	Flavour	Overall acceptability
Control	7.5	7.4	7.0	7.4	7.35	7.5
A	8.2	8.0	8.05	8.25	8.1	8.2
B	7.9	7.5	7.5	7.1	7.55	7.7
C	7.8	7.5	7.7	7.2	7.6	7.7
D	7.9	7.9	8.0	8.0	7.9	8.0

The overall acceptance of formulation A found to be the highest score as compared with others. Hence, all formulations scored between 7 ‘liked moderately’ to 8.5 ‘liked very much’. The addition of soy flour and peanuts to the bars resulted in change in texture and flavour which was preferred by sensory panellist [Yadav and Bhatnagar, 2016].

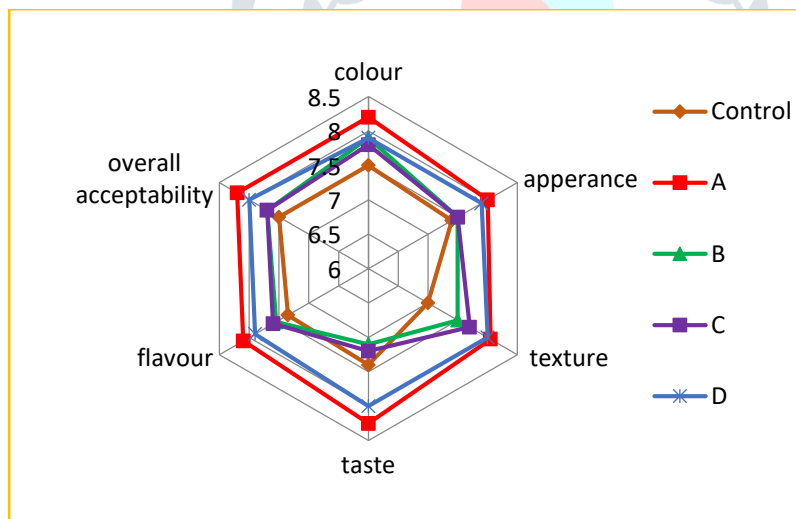


Fig 3. Radar diagram representing average sensory score of all five samples.

The results is clear that formulation A is nutritionally rich containing good amount of protein (13.96 %), dietary fibres (2.56 %) and minerals such as calcium and iron. Being rich in proteins and fibres, it will provide the feeling of satiety as well boost our energy levels.

Conclusion:

The addition of soy flour in developing snack product adds value to product. The developed snack bars delivers a good amount of protein (13.96%) and fibres (2.56 %) which founds to be acceptable. The textural parameters of soy flour and peanut incorporated bars were found to be satisfactory. The snack bars developed with breakfast cereals incorporating peanuts and soy flour can be utilized as a healthier snacking option for all age group people as it enhances the levels of proteins and fibres in our diet. Hence, the development of protein and fibre rich snack bars proves to be a nutritional treat to enjoy healthy snacks and 'on the go snack'.

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