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Research Article

Development of Nutritive Cereal Bar Incorporating Buckwheat for School-Going Children

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A B S T R A C T

Introduction: The development of low-cost, nutritious, and convenient snacks has become an important aspect of food technology. To meet the increasing market needs, formulation strategies of nutritive bars are evolving with each passing day and are changing daily to match the growing market demands. The main objective of the current study was to create a new formulation of cereal bars using flour of buckwheat, green gram whole, almonds, jaggery, white chocolate, and gum acacia (as a binding agent).

Method: Different formulations were made with variations in buckwheat from 5 g to 35 g for 111, 222, 333, and 444 respectively, and were evaluated for their organoleptic characteristics (colour, texture, appearance, taste, aftertaste, and overall acceptability) using a 9-point hedonic rating scale.

Results: The results revealed that the cereal bar developed by incorporating 35 g of buckwheat (444), obtained the highest organoleptic mean scores. The bar had higher nutritional value in terms of energy content (397.37 kcal/100 g), protein (8.64 g/100 g), and calcium (131.09 mg/100 g). The microbial activity of the developed bars was analysed showing the acceptability up to 30 days. The food cost of the bar was calculated and the food label was developed according to FSSAI guidelines.

Conclusion: Cereal bars were successfully developed for school-going children. The cereal bar containing 35 g of buckwheat (444) was preferred by the panellists. The developed bars were rich in nutrients, cost-effective, and had an extended shelf life. This study has shown that buckwheat can be used as a nutritious option for children's snacks.

Keywords: Buckwheat, Cereal Bar, Low Cost, Convenient Future Foods, Nutritive Bar

Introduction

Nutritive bars are products that are prepared by incorporating cereals, pulses, nuts, and dried fruits. These are nutritious, ready-to-eat bars that are convenient to prepare and by the value addition of functional foods the nutritional quality of cereal bars is increased. The food bars are snacks of good sensory and dietary qualities because

of their fair recipe of 10 to 15 g of protein, 20 to 30 g of carbohydrates, and 5 to 7 g of fat, lipids, and minerals. Nutritive bars give healthful advantages to the body. Many bars have been braced with supplements like iron, calcium, folate, and different micronutrients.[1]

Nutritive bars can be fortified with specific vitamins and minerals to increase their nutritive content. These bars help in the prevention of nutrient deficiency disorders and are a good snack option for school-going children as these are ready-to-eat and are a good source of energy for the child, as they can be eaten in between the main meals, fulfilling 1/4th–1/5th of the recommended dietary allowance.[2]

The requirement for expanded supplements increases for sports people, space people, and during a few physiological conditions like pregnancy, puberty, lactation, infection conditions, and more. The advised consumption during these circumstances can prompt different inadequacy problems like lack of protein – marasmus and kwashiorkor in youngsters; iron deficiency, visual impairment, osteoporosis, goitre, and other micronutrient deficiencies in women, juvenile young ladies, geriatrics, and kids. Henceforth, there emerges the requirement for the advancement of nutritious bars which are exceptionally wealthy in full scale and financially stable and satisfy the dietary hole which emerges due to busy work schedules.[3]

Nutritive bars are given to malnourished children so that energy requirements can be met easily. These bars are prepared mainly for children as they prefer to consume only certain food items to meet all nutrients and hence a healthy snack is implemented in their diet. The importance of nutritive bars in a healthy diet is understood by most people due to their busy lives and therefore they are opting for easy-to-eat products that meet their daily nutritive requirements.[4]

In the contemporary era, consumers are becoming more aware of healthy foods with balanced nutrition. Food scientists are concentrating on developing premium food products that provide considerable health benefits that offer significant health benefits. Dietary habits have changed significantly over the past few years, which raised a demand for natural and quality food options. Furthermore, there is a need to develop food products that meet the nutritional needs of every person due to the development of immune-mediated illnesses including gluten sensitivity and lactose intolerance. As a result, the creation of inclusive food options has gained popularity as a research topic.[5]

Gluten intolerance is an immune-mediated disorder caused by indigestion of gluten which is a protein present in cereals such as wheat, rye, and barley. The effective treatment of this disease is to completely restrict gluten products and follow gluten-free diets. All the natural sources of rice are gluten-free and can be consumed easily. When people suffering from celiac disease consume gluten food products, their immune responds to gluten by damaging the villi present in the small intestine which results in malabsorption of nutrients, to avoid these conditions gluten-free foods- quinoa, amaranth, arrowroot, millets, pulses, rice are to be consumed.[6]

The food industry is providing many food products which are gluten-free and developing awareness of gluten-free products in the market. Up-to-date the products developed are gluten-free cookies, breads, pasta, noodles, and a lot of bakery products.

Focus Area of the Study

- To standardise and develop cereal bars for school-going children
- To do the sensory evaluation of the developed cereal bar
- To analyse the approximate composition of the developed cereal bar
- To calculate the nutritive value of the developed cereal bar
- To assess the shelf life of the developed bar
- To calculate the cost of the developed bar
- To design appropriate food labels for the developed cereal bar

Method

Location of the Study

The study was conducted at the cookery laboratory, Department of Nutrition and Dietetics, NIMS University, Jaipur, Rajasthan in 2022.

Procurement of Raw Materials

The ingredients utilised for the preparation of the cereal bar were procured from the local market of Achrol, Jaipur.

Processing of Raw Material

All the raw materials were examined thoroughly for foreign particles and adulterants. The grains like buckwheat, green gram whole, and almonds were ground into fine flours and stored in air-tight containers.

Standardisation and Development of Cereal Bar

Market Survey

An online and in-person survey of the market found that while cereal bars are convenient and offer protein, they are also costly and the products available in the market are Nature Valley, Yoga Bar, and Max Protein. This study mainly focused on developing cereal bars using locally available ingredients and low-cost bars.

Pilot Study

A pilot study was conducted with different variations between buckwheat and green gram, as the amount of

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jaggery was low and buckwheat quantity was high there was trouble in binding the nutritive bars. Modifications to the cereal bar formulation were made on the advice of the panellists. The nutritional bars were improved by adding more jaggery and using edible gum in their production. The composition of the recipe was then finalised after the pilot trial which produced positive results.

Sensory Evaluation of Developed Cereal Bar

The cereal bar compositions were subjected to determine their acceptability using a 9-point hedonic rating scale which involved 15 semi-trained panellists who evaluated the product based on its colour, appearance, texture, taste, and overall acceptability. A scorecard was prepared to quantify the quality characteristics of the product, with a score of 9-indicating high acceptability and a score of 1-indicating low acceptability. Based on the outcomes of the sensitivity threshold test that was performed before the sensory evaluation, the 15 semi-trained panellist members were selected.

Analysis of Proximate Composition of Cereal Bar

The approximate analysis of a cereal bar is a vital process that allows for the comprehensive evaluation of its nutritional composition. This analysis involves the determination of various key components, including moisture, ash, carbohydrates, protein, fibre, calcium, and iron. The standard protocols established by the Association of Official Analytical Chemists,[7] provide a reliable framework for conducting these estimations with precision and accuracy. Table 1 shows the estimation done in this study and the methods used for it.

Table 1.Estimation of Nutrients and Their Methods

Nutrients	Method
Moisture	AOAC, 2019
Ash	AOAC, 2019
Carbohydrate	AOAC, 2019
Protein	AOAC, 2019
Fat	AOAC, 2019
Fibre	AOAC, 2019
Calcium	AOAC, 2019
Iron	Wong's method[8]

Moisture Content

Method

The sample's moisture content was calculated by putting around 10 g of the sample in a Petri dish and drying it at 105 °C until the weight of the dish with its contents remained unchanged. The Petri dish was cooled in desiccators prior to weighing. The moisture content of the sample was represented as grams per 100 grams of sample.

Formula

$$Moisture\ content = \frac{Initial\ weight - Final\ weight\ \times 100}{Weight\ of\ the\ sample}$$

Total Ash Content

Method

By placing about 5 g of the sample into a porcelain crucible that had previously been heated to around 600 °C and cooled, the amount of total ash could be calculated. After heating the crucible over a low flame until the material was totally charred, it was heated in a muffle furnace for around 4 to 5 hours at about 600 °C. After cooling, it was weighed. The crucible is once more heated in the muffle furnace for one hour, cooled, and weighed to confirm that the ashing process is complete. This process is repeated until the ash is nearly white or greyish-white in colour.

Formula

$$Ash\ content = \frac{Weight\ of\ the\ ash\ \times 100}{Weight\ of\ the\ sample}$$

Carbohydrate Content

Method

Carbohydrate content was calculated by the differential method.

Formula

$$carbohydrate = 100 - [protein(g) + fat(g) + fibre(g) + ash(g) + Moisture(g)]$$

Protein Content

Method

The Micro-Kjeldahl method was used to quantify the protein content of the dried samples as a percentage of total nitrogen. By multiplying the percentage of nitrogen by the factor of 6.25, the percentage of protein was computed.

Formula

$$percentage\ of\ protein = \frac{titer\ value\ \times normality\ of\ Hcl\ \times 14.001 \times 6.25 \times 100}{sample\ weight(g)}$$

Fat Content

Method

Fat was estimated as crude ether extract using a moisture-free sample. The solvent was removed by evaporation and the residue of fat was weighed.

Formula

$$fat\ content = \frac{weight\ of\ the\ ether\ extract \times 100}{weight\ of\ sample\ taken}$$

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Crude Fibre

Method

The crude fibre content of the sample was determined using a moisture and fat-free sample and expressed as grams per 100 grams of the sample.

Formula

$$Crude\ fiber\ = \frac{100 - (moisture + fat)\ \times We - Wa}{Weightof\ the\ sample\ taken\ (moisture\ and\ fat - free)}$$

Where W_e: weight of the dish before ashing dish, W_a: weight of the dish after ashing

Calcium Content

Method

The calcium content of the sample was estimated by preparing a mineral solution and titrating it against 0.01 N EDTA in the presence of alkaline.

Formula

$$Calcium\ = \frac{Titer\ value\ for\ Ca\ \times N\ of\ EDTA\ \times 0.02 \times total\ volume\ of\ digested\ sample}{Aliquot\ taken\ \times weight\ of\ the\ sample}$$

Where N: Normality of EDTA

Iron Content

Method

The iron content of the sample was estimated by using an atomic absorption spectrophotometer and the results were expressed in mg per 100 g of the sample.

Formula

$$Iron\ content\ (ppm) = \frac{Graph\ ppm \times Volume\ made\ up}{weight\ of\ the\ sample}$$

Shelf Life Estimation of Developed Cereal Bar

To assess the microbial activity and establish the shelf life of the developed cereal bars, the total plate count and yeast and mould count methods were utilised. These methods are commonly employed to measure the number of viable microorganisms present in a sample. The total plate count method involves inoculating the cereal bar sample onto an agar plate, followed by incubation and counting of visible colonies to estimate the total microbial population. The yeast and mould count method focuses specifically on quantifying yeast and mould populations by plating the sample on selective agar and counting visible colonies. By employing these methods mentioned in Table 2, the growth of microorganisms in the cereal bars can be monitored, providing insights into product quality and determining the consumption period.

Table 2.Methods of Shelf Life Estimation

Method	Protocol
Total plate count	IS: 5402(P-1):2021[9]
Yeast and mould count	IS: 5403:1999[10]

Nutritive Value of the Developed Cereal Bar

The Indian Food Composition Table was used to determine the nutritive value of the cereal bars.[11] This involved calculating various nutritional parameters, including energy, carbohydrate, protein, fat, fibre, calcium, and iron content. These measurements provide valuable information about the nutritional composition of the cereal bars, allowing us to assess their potential health benefits and suitability, particularly for school-going children. By understanding the specific amounts of these nutrients in the bars, we can evaluate their contribution to a balanced diet and make informed decisions regarding their consumption.

Cost Analysis of the Developed Cereal Bar

To determine the cost of the cereal bar, a thorough analysis was conducted considering the current market prices of all the raw ingredients needed for its preparation. Additionally, overhead charges, and profit, were taken into consideration to accurately reflect the total cost of production. Furthermore, to ensure a reasonable profit margin, the estimated cost was adjusted accordingly. Profit margins are essential for sustaining the business, covering operational expenses, and allowing for future growth and development.

Food Label of the Developed Nutritive Cereal Bar

The food label for the cereal bar was developed in adherence to the guidelines set by the Food Safety and Standards Authority of India (FSSAI).[12] The label contains all the necessary information required by consumers, ensures transparency, and helps individuals make informed dietary choices. Procreate is a graphic design platform that offers a user-friendly interface and diverse tools for creating visually appealing food labels. Users can select templates or create custom designs, incorporating high-quality graphics, icons, and images to represent ingredients, nutritional information, and allergens. The app allows for easy text editing, drag-and-drop functionality, and colour customisation to achieve a balanced and cohesive label design. Procreate simplifies the process of creating professional-quality labels that effectively communicate information to consumers.

Results and Discussion

Procurement and Processing of Ingredients

Raw ingredients were purchased from the local market of Achrol, Jaipur. They were inspected and were free of

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adulterants. To create a nutritious bar, these elements were carefully chosen and mixed in a particular ratio. To increase the nutritional content of the components, the germination approach was used and grains were preserved after being processed into flour. The ingredients required for the development of the nutritive cereal bar are listed in Table 3.

Table 3.List of the Ingredients

S. No.	List of Ingredients
1	Buckwheat
2	Green gram whole
3	Almonds
4	Jaggery
5	White chocolate
6	Gum acacia

Standardisation and Development of Cereal Bar

For the development of cereal bars for school-age children, ingredients included were shortlisted based on health benefits and nutritive value from different food groups the ingredients were buckwheat, green gram whole, almonds, jaggery, and white chocolate. The pilot study conducted revealed that buckwheat had poor bonding characteristics, which ultimately had an impact on the cereal bar's binding. Acacia gum, an edible gum derived from the dried sap of acacia species' stems and branches, was used to properly bind the ingredients together.

Four formulations were created utilising various combinations of buckwheat and green gram, while the other ingredients remained the same in each formulation. The bar was developed by combining all of the dry ingredients in the specified amounts with jaggery syrup. The prepared bar was then moulded into shape and covered in white chocolate. The standardised quantity of different ingredients used for the preparation of cereal bars is listed in Table 4.

Table 4.Proportion of Different Ingredients in Different Formulations of Cereal Bar

Ingredients/ Sample Bars	111 (g)	222 (g)	333 (g)	444 (g)
Buckwheat flour	5	15	25	35
Green gram	35	25	15	5
Almonds	10	10	10	10
Jaggery	30	30	30	30
White chocolate	20	20	20	20
Gum acacia	1	1	1	1
Total	100	100	100	100

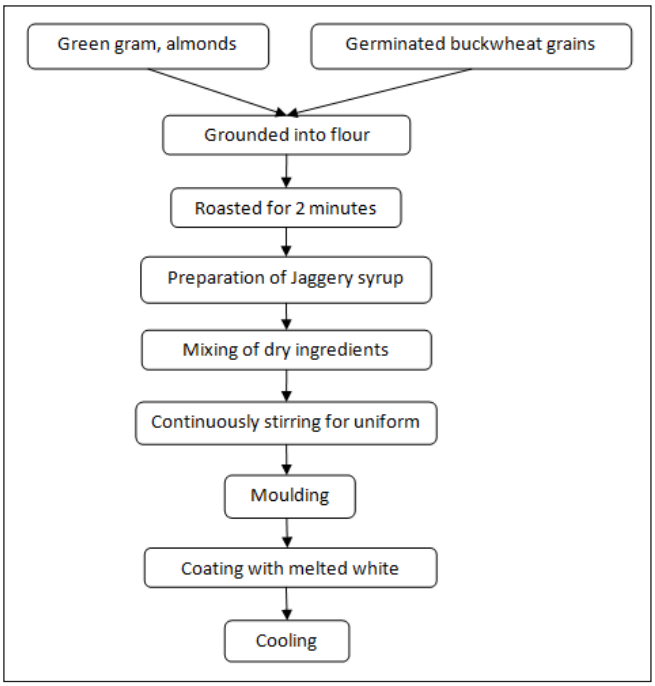

Figure 1.Flowchart for Preparation of Cereal Bar

For the cereal bars, four compositions totalling 100 g of components each were prepared. Green gram decreased from 35 g to 5 g, while buckwheat flour varied from 5 g to 35 g. The amount of almonds remained at 10 g. All compositions contained 20 g of white chocolate and 30 g of jaggery added in equal amounts. In addition, 1 g of acacia gum was used for binding the cereal bars. Figure 1 illustrates the flow chart of the cereal bar production process.

Sensory Evaluation of Developed Cereal Bars

A sensory evaluation was conducted on four different formulations of cereal bars, along with a control, by a panel of 15 semi-trained members. The sensory attributes, namely colour, taste, aftertaste, texture, appearance, and overall acceptability, were evaluated using a 9-point hedonic rating scale, where scores ranged from 1 to 9. Table 5 illustrates the mean sensory scores assigned to each cereal bar sample and Figure 2 shows the various formulations prepared and the control used.

The table represents the sensory evaluation of the cereal bar samples in terms of six parameters: colour, taste, aftertaste, texture, appearance, and overall acceptability. Among the control and four cereal bar samples (111, 222, 333, and 444), 444 received the highest mean scores for all sensory parameters, with a score of 7.93 ± 1.09 for colour, 8.26 ± 1.09 for taste, 8.06 ± 1.22 for after-taste, 7.86 ± 1.01 for texture, 8.20 ± 0.81 for appearance, and 8.33 ± 0.81 for overall acceptability. Sample 333 also received high scores for all parameters, except for taste and aftertaste, which were slightly lower than the mean scores of sensory parameters 444.

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Table 5.Mean Scores of Sensory Analysis of Cereal Bar

Sensory Attributes/ Sample Code	Colour	Taste	After taste	Texture	Appearance	Overall Acceptability
Control	6.66 ± 1.04	6.73 ± 1.43	6.80 ± 1.20	6.60 ± 1.18	6.86 ± 1.18	7.13 ± 1.06
111	6.60 ± 1.35	6.06 ± 1.03	5.46 ± 0.91	5.80 ± 1.37	6.46 ± 1.50	6.20 ± 1.20
222	6.73 ± 1.03	6.73 ± 1.33	6.46 ± 1.30	6.40 ± 1.54	6.80 ± 1.26	6.86 ± 1.30
333	7.06 ± 0.96	7.53 ± 1.06	7.46 ± 0.63	7.26 ± 0.96	7.53 ± 1.06	7.46 ± 0.83
444	7.93 ± 1.09	8.26 ± 1.09	8.06 ± 1.22	7.86 ± 1.12	8.20 ± 1.01	8.33 ± 0.81

Figure 2.Cereal Bar Samples Prepared for Sensory Evaluation, Showcasing the Variations in Green Gram and Buckwheat Flour Content

Proximate Composition of Cereal Bar

Proximate composition analysis for the developed cereal bar offers useful information about its nutritional content. In addition to evaluating important factors like moisture and ash content, this analysis evaluates the quantities of macronutrients including carbohydrates, proteins, and lipids. The proximate composition of the cereal bar with higher acceptability in all the sensory parameters was analysed for moisture, ash, energy, carbohydrate, protein, fat, calcium, and iron. The composition is mentioned in Table 6.

Table 6.Proximate Composition of Cereal Bar

Proximate Composition	Amount
Moisture (g/100 g)	13.58
Total ash (g/100 g)	1.99
Energy (kcal/100 g)	397.37
Carbohydrates (g/100 g)	63.82
Protein (g/100 g)	8.64
Insoluble dietary fibre (g/100 g)	4.31

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Soluble dietary fibre (g/100 g)	1.42
Fat (g/100 g)	11.97
Calcium (mg/100 g)	131.09
Iron (mg/100 g)	4.49

The results of the proximate analysis revealed that its moisture content was measured to be 13.58 g per 100 g, which was similar to the findings of Agbaje et al.,[13] where the moisture content of puffed rice cereal bars falls within the range of 11.35% to 18.73%. The total ash content of the cereal bar was found to be 1.99 g per 100 g. This ash content is lower as compared to a snack bar developed by Ishak et al.,[14] where the ash content ranged from 0.57% to 1.33%. However, it is similar to the ash and moisture content found in the developed cereal bar.

In terms of energy content, the cereal bar measured 397.37 kcal per 100 g. This higher energy value can be attributed to the presence of carbohydrates and fat in the bar. It surpasses the energy content of the snack bar developed by Ishak et al.,[14] which ranged from 381.8 to 382.4 kcal per 100 g. The protein content of the cereal bar is significantly higher than the protein contents found in the cereal bars developed by Agbaje et al.,[13] which were 3.38 g and 4.04 g for puffed and non-puffed rice bars, respectively. However, the protein content of the cereal bar is comparable to that of a quinoa-based nutria bar, which contains 8.09 g of protein. The carbohydrate content of the cereal bar was measured at 63.82 g per 100 g, which is higher compared to a cereal bar developed by de Arruda et al.[15]

Regarding fat content, the cereal bar contained 11.97 g per 100 g, which is nearly identical to a quinoa-based cereal bar developed by Pravalika et al.,[16] with a fat content of 12.1 g. It is also higher than the fat content found in sports bars, which had 6.9 g of fat content.[17] The cereal bar also exhibited a fibre content of 4.31 g of insoluble dietary fibre and 1.42 g of soluble dietary fibre. These values are similar to the cereal bar developed by de Arruda,[15] which contained 3.4–4 g of fibre.

In terms of mineral content, the cereal bar contained 131.09 g of calcium and 4.49 g per 100 g of iron. These levels are similar to a millet-based composite sports bar, which has a higher calcium content (159.5 mg/100 g) and a lower iron content (2.9 mg/100 g).[17]

Shelf Life Estimation of the Developed Nutritive Cereal Bar

To assess the microbial quality and shelf life of the cereal bars, the standard plate count method and yeast and mould count method were utilised. These methods measure the quantity of viable microorganisms present in a given sample. The analysis was conducted at three different time points: 0 days, 15 days, and 30 days. Upon conducting the analysis, it was observed that the microbial counts of the cereal bars consistently remained within acceptable limits throughout the testing period. The microbial value results are mentioned in Table 7.

The shelf life of a cereal bar can be estimated based on the changes in its microbiological parameters over time. Three time points, i.e., the initial day, and after 15 days and 30 days of storage, were considered in this study. Two important microbiological parameters, namely Total Plate Count (TPC) and Yeast & Mould Count, were monitored during this period. The Total plate count, measured in colony forming units per gram (cfu/g), was found to be 1.073×10^4 cfu/g, 1.084×10^4 cfu/g, and 1.095×10^4 cfu/g on the initial day, after 15 days, and after 30 days, respectively. The YMC, also measured in cfu/g, was found less than 1×10^{-2} cfu/g at all three time points. Based on the results, the developed cereal bar demonstrated an acceptable shelf life of up to 30 days, aligning with the microbial growth limits specified by the Food Safety and Standards Authority of India (FSSAI), where the TPC should be below 10^4 to 10^5 cfu/g, and the YMC should be below 10^2 to 10^3 cfu/g to ensure product safety and quality.

Nutritive Content of the Developed Cereal Bar

The nutritive value of the cereal bars was determined using the Indian Food Composition Table.[8] This involved calculating the energy, carbohydrate, protein, fat, fibre, calcium, and iron content of the bars. These parameters provide important insights into the nutritional composition of the cereal bars, helping to understand their potential health benefits and suitability for school-going children. The values are listed in Table 8.

Table 7.Shelf Life Estimation of Cereal Bar

Test Parameter	0 Day (cfu/g)	15th Day (cfu/g)	30th Day (cfu/g)
Total plate count (x $10^{4)}$	1.073	1.084	1.095
Yeast & mould count (x 10^{-2})	< 1	< 1	< 1

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Table 8.Nutritive Content of Cereal Bar

Ingredients	Amount (g)	Energy (kcal)	Protein (g)	Fat (g)	Fibre (g)	Carbohydrate (g)	Calcium (mg)	Iron (mg)
Buckwheat	35	113.05	3.61	0.84	3.01	22.79	22.4	5.43
Green gram whole	5	14.69	1.13	0.06	0.85	2.31	4.62	0.24
Almonds	10	60.92	2.08	5.89	1.31	1.05	23.00	0.46
Jaggery	30	106.12	0.56	0.05	-	25.46	32.10	1.39
White chocolate	20	107.8	1.17	6.42	-	11.85	39.80	0.05
Gum acacia	1	0.01	-	-	-	0.05	-	-
Total	100	403.14	8.55	13.26	5.17	63.51	121.92	7.57

Cost Analysis of Developed Cereal Bar

The cost of the developed cereal bar for school-going children was calculated to be Rs. 45 for every 100 g. This cost estimation included various components such as ingredient costs, production expenses, overhead costs, and a profit margin (Table 9). By factoring in these elements, the price of the cereal bar was determined to ensure affordability while covering the necessary expenses and allowing for a reasonable profit. This approach enables the provision of a nutritious snack option to school children while maintaining commercial viability and sustainability.

Table 9.Cost Analysis of Developed Cereal Bar

S. No.	Expenses	Amount (g)	Price (INR)
1.	**Ingredients**		
	Buckwheat	35	10.5
	Green gram whole	5	1.4
	Almonds	10	7.6
	Jaggery	30	2.64
	White chocolate	20	9.5
	Gum acacia	1	0.6
Food cost		100	32.2
2.	Overhead charges (including labour, fuel, machinery, depreciation, taxes etc.)	-	6.44
3.	Profit (20%)	-	6.44
Total cost of the cereal bar			45.08

Food Label of Developed Cereal Bar

The food labels for the developed cereal bars were designed using an application named Procreate, while adhering to the guidelines of FSSAI[12] and ensuring regulatory compliance and the provision of accurate information to consumers. This study aimed to create a comprehensive label that includes allergen information, a barcode for easy product identification, cost details, and nutritional composition. The nutritional composition information empowers individuals to monitor their dietary intake by providing essential details such as calories, proteins, carbohydrates, and fats. The developed food label is depicted in Figure 3.

Figure 3.Food Label of the Developed Cereal Bar

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Conclusion

The study successfully developed cereal bars tailored for school-going children. Sensory evaluation was employed to assess the acceptability of various formulations. Among the different options tested, the cereal bars containing 35 g of buckwheat (444) received the highest mean scores in terms of their sensory parameters, indicating a higher level of preference among the panellists. In addition to their sensory appeal, the cereal bars were found to be cost-effective and packed with essential nutrients. They are a rich source of energy, carbohydrates, proteins, fibre, calcium, and iron, making them a valuable addition to children's diets. The shelf life of the developed cereal bars was also assessed, and it was found that they remained acceptable for consumption for up to 30 days when stored under hygienic conditions. This extended shelf life is crucial for practical purposes, as it allows for widespread distribution and availability of cereal bars. The findings of the research highlight the potential of buckwheat in cereal bars as a nutritious and convenient snack option for school-going children. By addressing the need for wholesome and nutrient-dense snacks, these bars have the potential to positively impact children's dietary habits and overall well-being.

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Conflict of Interest: None

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