Educational Administration: Theory and Practice
2024, 30(5), 12539-12549
ISSN: 2148-2403
https://kuey.net/

Research Article

Sensory And Nutritional Quality Of Nutri Bars Prepared Using Different Ingredients

Prajakta J. Nande[1*]

[1*]Department of Home Science, Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur, Maharashtra-440033, India

Citation: Prajakta J. Nande, (2024) Sensory And Nutritional Quality Of Nutri Bars Prepared Using Different Ingredients, *Educational Administration: Theory and Practice, 30*(5), 12539-12549
Doi: 10.53555/kuey.v30i5.5214

ARTICLE INFO

ABSTRACT

This study investigates the sensory and nutritional quality of energy bars formulated with various ingredient combinations. The primary aim is to assess how different ingredients influence the palatability and overall acceptability of the bars, alongside their nutritional profiles. Energy bars were prepared using a base mix of broken wheat, blueberry, coconut, rajgira, dry fruits, nuts, orange with variations incorporating sweeteners. Sensory evaluation was conducted using a panel of six trained judges who rated the products on attributes such as appearance, color, texture, flavor, taste and acceptability. Nutritional profile focused on caloric content, macronutrient composition, fiber and micronutrient levels. Results indicated that the bars enriched with plant-based proteins and natural sweeteners were highly accepted for their appearance, color, texture, flavor and taste. The findings suggest that ingredient selection plays a crucial role in developing energy bars that meet consumer demands for both palatability and nutritional value. This research contributes to the development of healthier and more appealing snack options in the functional foods market.

Keywords: Nutri bar, nutritional profile, rajgira, standardization.

INTRODUCTION

The demand for convenient, nutrient-dense snack options has led to the rapid growth of the energy bar market. Energy bars are popular among consumers seeking quick, portable sources of energy, particularly athletes, busy professionals, and health-conscious individuals. These bars are designed to provide a balanced mix of macronutrients—carbohydrates, proteins, and fats—along with vitamins, minerals, and other bioactive compounds beneficial for health (Tapsell, 2015; Silva and Monteiro, 2020).

The formulation of energy bars typically includes a variety of ingredients such as cereals, nuts, seeds, dried fruits, and sweeteners. These ingredients are selected not only for their nutritional value but also for their ability to affect the sensory properties of the final product (Haug and Hostmark, 2008). Sensory attributes such as taste, texture, and appearance are crucial determinants of consumer acceptance and preference (Lawless and Heymann, 2010). Therefore, the development of energy bars requires a careful balance between nutritional quality and sensory appeal.

Previous research has demonstrated that the type and proportion of ingredients used can significantly impact both the nutritional composition and the sensory characteristics of energy bars. For instance, incorporating plant-based proteins like pea or soy protein can enhance the protein content while also affecting the bar's texture and flavor (Asgar, Fazilah, Huda, Bhat, and Karim, 2010). Similarly, the use of natural sweeteners such as jaggery, honey or dates can improve the bar's taste profile and add additional nutrients (Moskowitz, 2013).

Given the wide variety of ingredients available and the differing preferences of consumers, there is a need for systematic research to evaluate the impact of different ingredients on the sensory and nutritional quality of energy bars. This study aims to address this gap by investigating how various ingredient combinations influence the overall quality of energy bars. Specifically, it focuses on sensory evaluation conducted by a panel of trained judges and nutritional profile to determine the macronutrient and micronutrient content of the bars.

The findings from this research will provide valuable insights for food scientists and manufacturers aiming to develop energy bars that are not only nutritionally balanced but also appealing to consumers. By

understanding the relationship between ingredient composition and the quality attributes of energy bars, the industry can better meet the growing demand for healthy, convenient snack options.

METHODOLOGY

The study dealt with preparation of nutri bars. For this research, total six nutri bars were designed & standardised. These bars were named as broken wheat bar, rice crisps bar, blueberry almond muesli bar, coconut rajgira bar, dry fruits jaggery bar and figs orange bar.

Composition of bars:

Ingredients were purchased in bulk from the local market of Nagpur city. Non-perishable items were brought in bulk whereas perishables were purchased fresh as per the requirement. Tables 1 to 6 show composition of bars.

Table 1: Composition of broken wheat bar

Sr.No.	Ingredients	Quantity (g)
1	Broken wheat	12.5
2	Milk chocolate	30
3	Raisins	5
4	Almonds	5
5	Sugar	10
6	Ghee	5

Table 2: Composition of rice crisps bar

Sr.No.	Ingredients	Quantity (g)
1	Rice crisps	15
2	Chocolate chip (dark)	30
3	Maple syrup	10
5	Butter	10

Table 3: Composition of blueberry almond bar

Sr.No.	Ingredients	Quantity (g)
1	Rolled oats	20
2	Puffed rice	10
3	Almonds	5
4	Dried blueberries	5
5	Honey	15.5

Table 4: Composition of coconut rajgira bar

Sr.No.	Ingredients	Quantity (g)
1	Desiccated coconut	10
2	Rajgira puffed	5
3	Flax seeds	3
4	Black raisins	5
5	Walnuts	5
6	Pumpkin seeds	3
8	Date palm jaggery	25
9	Coconut oil	5

Table 5: Composition of dry fruits jaggery bar

Sr.No	Ingredients	Quantity (g)
1	Jaggery	30
2	Peanuts	10
3	Fennel seeds	5
4	Carom seeds	5
5	Cashew nuts	5
6	Pistachio nuts	5
7	Ghee	5

Table 6: Composition of figs orange bar

Sr. No.	Ingredients	Quantity (g)
1	Dried figs	20
2	Almond flour	10
3	Orange zest	5
4	Orange juice	5
5	Cashew nuts	5

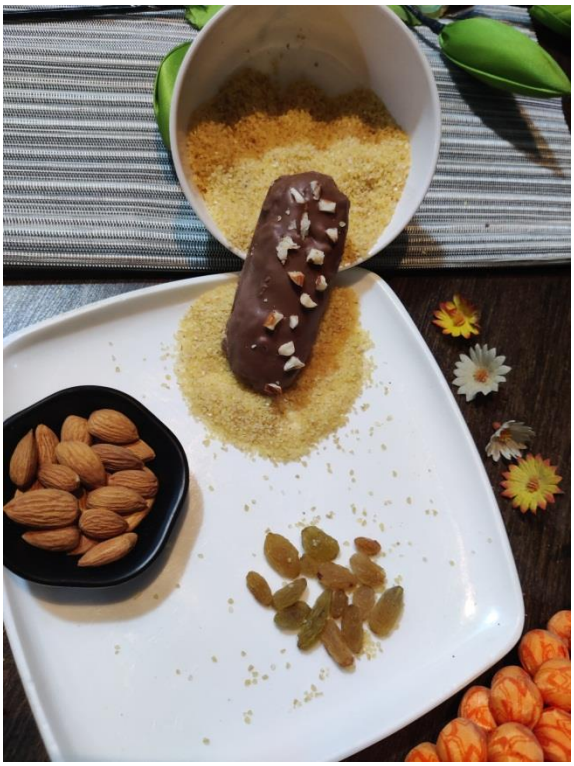

Plate 1: Broken wheat bar

Plate 2: Rice crisps bar

Plate 3: Blueberry almond muesli bar

Plate 4: Coconut rajgira bar

Plate 5: Dry fruits jaggery bar

Plate 6: Figs orange bar

Sensory evaluation of bars:

Sensory evaluation of bars was conducted with the help of six judges in three trials using a 9 point hedonic scale. After collecting the ratings from the panelists, the mean score for each attribute was calculated.

Table 7: Hedonic scale for sensory evaluation of bars

Points for Scoring	Scale
1	Dislike extremely
2	Dislike very much
3	Dislike moderately
4	Dislike slightly
5	Neither like nor dislike
6	Like slightly
7	Like moderately
8	Like very much
9	Like extremely

Nutritive value of bars:

Nutritive values of all control and experimental recipes were calculated using standard Indian food composition tables **(Longvah, T. et al., 2017).**

RESULTS AND DISCUSSION

BASIC DATA OF NUTRI BARS:

Table 8: Basic data for nutri bars

Sr. No.	Parameters	Broken wheat bar	Rice crisps bar	Blueberry almond bar	Coconut rajgira bar	Dry fruits jaggery bar	Figs orange bar
1	Weight (g)	67.5	64	55.5	61	65	45
2	Cooking time (minutes)	10	5	10	15	10	10
3	Refrigeration time (hours)	2	1	2	1	1	1
4	Length (cm)	8	9	8.9	8	9	8.5
5	Width (cm)	2	3	2	2.2	2.5	2.5
6	Thickness (cm)	1	0.5	1	1	1.5	1.3

When considering the dimensions of an energy bar, several factors come into play that can influence both consumer satisfaction and the product's practicality. The size of the energy bar affects its convenience. Typical energy bars range from about 35 g to 70 g. The size can influence portability, portion control and satiety. Here, for this study, nutri bars weighted from 45 g to 67.5 g as shown in table 8. The weight of the energy bar is closely related to its size but also impacts nutritional content. A carefully considered weight ensures a balance between calories, protein, fats, and carbohydrates. A bar that is too light might not provide enough energy, while one that is too heavy might be overwhelming or not fit within dietary restrictions.

The shape of the energy bar can impact its ease of consumption and appeal. For this study, rectangular bars were prepared which fit comfortably in the hand and is easy to bite into enhances the eating experience.

A smaller bar is easier to carry, making it ideal for on-the-go consumption. A moderate size helps in controlling calorie intake, which is crucial for health-conscious consumers. The size should be sufficient to provide a feeling of fullness without being overly large. As presented in table 8, the size of the bars (length x width x thickness) varied from 8 cm x 2 cm x 1 cm to 9 cm x 3 cm x 1.5 cm. The thickness of an energy bar can affect its texture and eating experience. Thicker bars might offer a more substantial bite, which some consumers prefer for a satisfying chew. The thickness of the nutri bars varied from 0.5 to 1.5 cm.

The dimensions of an energy bar encompass size, shape, thickness, weight, and more. These factors influence consumer satisfaction, convenience, and nutritional adequacy. By carefully considering these dimensions, manufacturers can create an energy bar that meets consumer needs and stands out in the market.

SENSORY EVALUATION OF NUTRI BARS:

Table 9 presents the mean palatability of nutri bars.

Table 8: Palatability evaluation results for nutri bars

Sr. No.	Nutrients	Broken wheat bar	Rice crisps bar	Blueberry almond bar	Coconut rajgira bar	Dry fruits jaggery bar	Figs orange bar
1	Appearance	9	9	9	9	9	8
2	Colour	9	9	9	9	9	8
3	Texture	9	9	9	9	9	9
4	Flavor	9	9	9	9	9	9
5	Taste	9	9	9	9	9	9
6	Overall Acceptability	9	9	9	9	9	8

Appearance and colour:

The bar prepared using broken wheat, milk chocolate, raisins, almonds, sugar, and ghee had a textured look from the broken wheat with dark specks of raisins and glossy, smooth milk chocolate on top. Almond pieces are visible, adding visual interest.

Bar made out of rice crisps, dark choco chips, maple syrup, and butter was dark in color outside and light and airy with the rice crisps inside, dotted with dark choco chips and rice crisps. The bar had a glossy finish from the maple syrup and butter.

Blueberry almond bar showed mixed colours with visible oats, puffed rice, almond slices, and dried blueberries. The honey gave a slight sheen.

Coconut rajgira bar demonstrated mixed colors with visible seeds like flax and pumpkin seeds, nuts like walnuts, dry fruit like black raisins and coconut. The dark jaggery gave it a rustic look.

Appearance of bar prepared by incorporating sugarcane jaggery, peanuts, fennel seeds, carom seeds, cashew nuts, pistachio nuts, and ghee was light golden sprinkled with green fennel seeds, blackish carom seeds with broken nuts like peanuts, cashew nuts and pistachio nuts. Golden colour was attributed to sugarcane jaggery.
The dried figs bar with use of orange juice and zest was light golden yellow in colour with specks of orange zest and visible cashew nut pieces inside.
With the exception of figs orange bar, all other five nutri bars were liked extremely for their appearance and colour with mean score of 9 on 9-point hedonic scale. Figs orange bar had been scored 8 by the judges which was for 'like very much' (Table 9).

Texture:

For the present research, broken wheat nutri bar demonstrated a texture firm and chewy texture which was a combination from the wheat, creamy from the chocolate, and crunchy from the almonds. Raisins added a chewy, juicy contrast. Gajula, H. and Koganti, V. (2019) emphasized the role of broken wheat in providing a unique texture and nutty flavor. The addition of milk chocolate and raisins was found to enhance the overall acceptability due to their sweet and chewy characteristics.
Here, rice crisps bar was found to be light and crispy from the rice crisps, with pockets of smooth and melting chocolate. The syrup and butter gave a cohesive, slightly sticky texture. A study by Lee, S., & Min, D. B. (2017) suggests that rice crisps paired with dark chocolate chips provide a contrasting texture and rich flavor, while maple syrup contributes a distinctive sweet aroma and buttery flavor, enhancing the sensory profile of energy bars.
In this research, blueberry almond bar had chewy texture from oats, crispy texture from puffed rice, crunchy texture from almonds, and chewy, juicy bursts from blueberries. Kumar, A., & Sharma, S. (2018) examined the sensory characteristics of snack bars made with rolled oats and puffed rice, highlighted the balance of chewy and crispy textures.
It was noted for this study that the texture of coconut rajgira nutri bar was crunchy from flax seeds, pumpkin seeds and walnuts, chewy from raisins, and a slightly oily moist texture from coconut oil. The research done by Patel, J., & Desai, M. (2020) highlights the sensory appeal of energy bars enriched with various seeds and nuts. Desiccated coconut and puffed amaranth seeds contributed to the unique texture and flavor profile, while date palm jaggery and coconut oil enhanced sweetness and mouthfeel, making these bars highly acceptable to consumers.
Here, jaggery peanuts bar showed crunchy texture from three types of nuts like peanuts, cashew nuts and pistachio nuts. This bat was slightly chewy from jaggery, and had a smooth, rich texture from ghee. It was had slightly unique grainy rough mouthfeel owing to the use of fennel seeds and carom seeds. The study by Singh, R., & Kaur, G. (2016) focuses on the sensory attributes of traditional Indian snack bars, emphasizing the use of jaggery as a natural sweetener. The combination of peanuts, cashew nuts, and pistachio nuts provided a crunchy texture, while fennel and carom seeds added aromatic notes. Ghee was noted for its rich, buttery flavor, enhancing the overall sensory experience.
In this study, it was slightly sticky and chewy because of use of figs. Also, the dried figs bar was smooth and slightly moist because of use of almond flour and orange juice, and crunchy from cashew nuts. The study by Park, E., & Kim, H. (2018) investigates the sensory qualities of energy bars made with dried fruits and nuts. Dried figs were highlighted for their natural sweetness and chewy texture, while almond flour and cashew nuts provided a smooth, nutty flavor. The addition of orange zest and juice contributed bright, citrusy notes that were well-received by consumers.
Here, all six bars were extremely liked for their texture (mean score of 9).

Flavor and Taste:

The broken wheat bar prepared in this research possessed nutty base from wheat, sweet and creamy chocolate, bursts of raisin sweetness, and nutty almonds; moreover, ghee added a rich, buttery note. Sweet and creamy aroma of broken wheat bar was attributed to the use of chocolate; fruity and nutty taste was from raisins and almonds, and rich taste was attributed to the ghee. The study by Gupta, M., & Bawa, A. S. (2018) explores the sensory properties of energy bars made with cereals and dried fruits. The inclusion of broken wheat provided a distinctive nutty flavor and coarse texture. The combination of milk chocolate and raisins enhanced sweetness and chewiness, while almonds contributed a crunchy texture. The use of ghee imparted a rich, buttery flavor, enhancing overall sensory appeal.
Here, the bar prepared using rice crisps had sweetness from maple syrup, rich and slightly bitter chocolate, and buttery undertones. It had rich chocolate aroma, complemented by the sweet scent of maple syrup and buttery notes. Research by Lee, J. H., & Kim, H. J. (2017) focuses on the sensory attributes of rice crisp-based bars. The light and airy texture of rice crisps, combined with the rich, slightly bitter taste of dark chocolate chips, was well-received. Maple syrup provided a pleasant sweetness and slight stickiness, while butter added a creamy mouthfeel. The study noted the bars' high overall acceptability due to their balanced flavor and texture.
For this study, the bar prepared using blueberries, almonds, rolled oats, puffed rice and honey had mild sweetness from honey, nutty flavour from almonds, fruity aroma from blueberries, and a wholesome taste from the oats. The inclusion of almonds and dried blueberries in nutrient dense snack bars by Kumar, A., &

Sharma, S. (2018) indicated the enhancement of flavor complexity, while honey provided a natural sweetness and pleasant aroma. It was observed by Smith, L., & Jones, P. (2019) that rolled oats provided a chewy texture, while puffed rice added lightness and crunch. Almonds contributed a nutty flavor and crunchy texture, and dried blueberries added a sweet and tangy flavor profile. Honey served as a natural sweetener, enhancing overall flavor and aroma.

Here, in this research, desiccated coconut-puffed rajgira bar had sweetness from dates palm jaggery, nutty and earthy flavour from flax seeds and pumpkin seeds, rich taste from coconut oil, and fruity notes from raisins. Patel, S., & Rao, S. (2020) concluded that desiccated coconut added a unique texture and flavor, while puffed amaranth seeds contributed lightness. Flax seeds, black raisins, and walnuts provided a mix of textures and flavors, enhancing complexity. Date palm jaggery imparted a deep, rich sweetness, and coconut oil contributed a smooth mouthfeel, resulting in high consumer acceptance.

For the present research, the jaggery peanuts bar had sweet and earthy taste from jaggery, nutty flavour from peanuts, cashews, and pistachios, and aromatic flavour from fennel and carom seeds. Carom seeds and fennel seeds imparted a hint of spice slight pungency to this bar. Sharma, V., & Singh, R. (2016) reported that jaggery provided a robust, earthy sweetness to traditional Indian energy bars. Peanuts, cashew nuts, and pistachio nuts added crunch and nutty flavors. Fennel and carom seeds introduced aromatic and slightly spicy notes. Ghee enhanced the rich, buttery flavor and smooth texture, making the bars highly palatable.

Here, in this study, there found natural sweetness in dried figs bar which was derived from figs, nutty flavour from almond flour and cashew nuts, and bright citrus notes from orange zest and juice. Research done by Park, S. H., & Kim, E. J. (2018) focuses on the sensory characteristics of fruit and nut-based energy bars. Dried figs provided natural sweetness and chewiness, while almond flour added a smooth texture and nutty flavor. Orange zest and juice contributed bright, citrusy notes, enhancing overall flavor complexity. Cashew nuts added a rich, creamy texture, resulting in a well-balanced and flavorful energy bar.

Here, with incorporation of different ingredients, all six nutri bars were extremely liked for their flavor and taste.

Overall Acceptability:

Broken wheat bar was found to be visually appealing with varied textures, rich and balanced flavors and a pleasant aroma made this bar highly acceptable.

Rice crisps bar was very much showed very high acceptability due to its light, crispy texture, and rich, sweet flavors. The chocolate and maple syrup combination was particularly appealing.

Nutri bar made out of rolled oats, puffed rice, almonds, dried blueberries, and honey was a healthy and appealing option with balanced textures and natural sweetness, thereby liked very much by judges.

The bar prepared with desiccated coconut, puffed amaranth seeds, flax seeds, black raisins, walnuts, pumpkin seeds, date palm jaggery, and coconut oil had excellent acceptability with a complex flavor profile, making it appealing for those looking for a nutritious snack.

The unique combination of sweet and aromatic flavors, along with varied textures, made this jaggery peanuts bar interesting and appealing.

The unique combination of figs and orange provided a refreshing and exotic flavor, making the dried figs orange bar highly appealing with the mean score of 8 for 'like very much'.

Rests of the five nutri bars were rated 'extremely liked' by the panelists (Table 9).

NUTRITIONAL QUALITY OF NUTRI BARS:

Table 10 demonstrates nutritional profile of all six nutri bars prepared using different ingredients.

Table 10: Comparative nutrient density nutri bars (per 100 g)

Sr. No.	Nutrients	Broken wheat bar	Rice crisps bar	Blueberry almond bar	Coconut rajgira bar	Dry fruits jaggery bar	Figs orange bar
1	Energy (kcal)	859.25	481.69	766.6	1095.7	724	622
2	Carbohydrate (g)	39.46	37.92	73.53	54.67	51.90	16.85
3	Protein (g)	7.68	4.12	8.84	8.45	8.61	15.1
4	Fat (g)	28.90	32.07	8.10	40.67	23.63	10.82
5	Total dietary fibre (g)	2.91	5.12	5.67	5.67	4.21	2.92
6	Thiamine (mg)	0.16	0.10	0.20	0.07	0.13	0.11
7	Riboflavin (mg)	0.06	0.13	0.10	0.05	0.02	0.05
8	Niacin (mg)	1.25	1.76	1.11	0.42	0.21	0.46
9	Pyridoxine (mg)	0.72	0.16	0.86	0.23	0.293	1.42
10	Total folate	10.25	32.5	5.35	30.75	7.06	9.57

	(µg)						
11	Vitamin C (mg)	1.48	3.92	0.35	0.23	0.92	10.5
12	Calcium (mg)	30.11	45.15	44.3	208.6	57.46	44.12
13	Phosphorus (mg)	85.7	142.1	208.8	207.2	118.6	74.42
14	Magnesium (mg)	52.3	99.07	40.27	74.09	50.69	52.7
15	Iron (mg)	1.58	5.95	2.82	4.09	2.03	0.54
16	Zinc (mg)	0.26	1.52	0.55	5.22	0.41	0.76
17	Potassium (mg)	167.4	370.4	108.5	369.1	189.07	382.7
18	Sodium (mg)	1.67	219.6	1.56	50.42	4.96	2.47

From the table 10, it is seen that the broken wheat bar provided high calorific value of 859.25 kcal/100 g with a fat content of 28.90 g/100 g which was because of use of ghee. The protein content is quite good (7.68 g/100 g). Broken wheat contributed complex carbohydrates and fiber, while almonds added protein and healthy fats. Milk chocolate and sugar increased the carbohydrate and calorie content. Raisins and almonds are rich in vitamins and minerals, such as magnesium, and potassium. Ghee adds fat-soluble vitamins like A. The addition of sugar and milk chocolate increases the bar's sugar content, and the presence of nuts and whole grains enhanced the bar's nutritional value. This study by Johnson, C. R., & Smith, A. L. (2017) examines the nutritional profile of snack bars made with cereals like broken wheat, which provide complex carbohydrates and fiber. The inclusion of almonds added protein and healthy fats, while raisins contribute vitamins and minerals such as potassium and iron. Ghee increased the content of fat-soluble vitamins (A, D, E, and K). The study highlighted the overall nutritional balance, but also noted the high sugar content from sugar and milk chocolate, which may be a concern for some consumers.

Here, for this research, rice crisps bar was good in carbohydrates due to the rice crisps and maple syrup (37.92 g/100 g). Dark choco chips provided some fats, while butter contributed saturated fats (32.07 g/100 g). Dark chocolate offers antioxidants, iron, and magnesium. This bar was found to be good in iron (5.95 mg/100 g), phosphorus (142.1 mg/100 g), magnesium (99.07 mg/100 g), total folate (32.5 µg/ 100 g) and potassium (370.4 mg/100 g). Maple syrup provided small amounts of minerals like zinc. The bar was relatively low in protein (4.12 g/100 g) but fairly good in fiber (5.12 g/100 g). The research by Lee, H. J., & Park, J. Y. (2018) focuses on the nutrient density of energy bars containing rice crisps, which were low in fiber and protein but high in carbohydrates. Dark chocolate chips added antioxidants and small amounts of minerals like iron and magnesium. Maple syrup, while a natural sweetener, increased the bar's sugar content. Butter contributed saturated fats, enhancing the caloric density of the bar. The study concludes that while these bars are energy-dense, they lack significant amounts of protein and fiber.

It can be observed from table 10 that the bar prepared using rolled oats, puffed rice, almonds, dried blueberries and honey offered a good balance of carbohydrates from oats, puffed rice, and honey (73.53 g/100 g), along with protein (8.84 g/100 g) and healthy fats from almonds (8.10 g/100 g). Utilization of all these ingredients provided very dense energy value of 766.6 kcal/100 g. Dried blueberries provided antioxidant vitamin like vitamin C. Oats are rich in B vitamins, iron, and fiber, while almonds added healthy fats and magnesium. The natural sweetness from honey and blueberries made this bar a healthier option for those avoiding refined sugars. The fiber content is beneficial for digestion and satiety. This study by Kumar, R., & Mehta, D. (2019) assesses the nutritional content of oat-based bars, highlighting the high fiber and beta-glucan content from rolled oats, which are beneficial for heart health. Almonds provided protein and healthy fats, while dried blueberries added antioxidants and vitamins like vitamin C and K. Honey acted as a natural sweetener with additional antimicrobial properties. The research emphasizes the balanced nutritional profile, suitable for a healthy snack option.

For this study, it was found that the coconut rajgira bar was nutrient-dense with healthy fats from coconut, walnuts, and flax seeds (40.67 g/100 g). Coconut oil provided saturated fats. Puffed amaranth seeds and raisins contributed carbohydrates (54.67 g/100 g), while flax seeds, pumpkin seeds and nuts added protein (8.45 g/100 g) and fiber (5.67 g/100 g). This bar provided very high amount of energy (1095.7 kcal/100 g). This bar was found to be rich in total folate (30.75 µg/100 g), calcium (208.6 mg/100 g), phosphorus (207.2 mg/100 g), magnesium (74.09 mg/100 g), zinc (5.22 mg/ 100 g), iron (4.09 mg/100 g) and potassium ().369.1 mg/100 g. The high content of healthy fats and fiber made this bar very satiating. It was a good source of plant-based protein and contained no refined sugars, making it a nutritious choice. The results are shown in table 9. The paper by Patel, K., & Desai, V. (2020) highlights the nutritional benefits of using seeds and nuts, which are high in protein, fiber, and essential fatty acids. Puffed amaranth seeds added protein and lysine, an essential amino acid. Flax seeds contributed omega-3 fatty acids and fiber. Date palm jaggery is a natural sweetener that added minerals like iron and magnesium. Coconut oil provided medium-chain triglycerides (MCTs), which are easily metabolized for energy. The study concludes that these bars offer a nutrient-dense, balanced option with no refined sugars.

Here, from table 10, it is noticed that the dry fruits jaggery bar offered a substantial amount of protein (8.61 g/100 g) and healthy fats (23.63 g/100 g) from peanuts, cashews, and pistachios. Jaggery as a natural sweetener provided carbohydrates (51.90 g/100 g). 100 g of this bar gave 724 kcal. This bar was found to be good in minerals such as calcium (57.46 mg/100 g), phosphorus (118.6 mg/100 g), magnesium (50.69 mg/100 g), potassium (189.07 mg/100 g) and iron (2.03 mg/100 g). Fennel and carom seeds contributed additional micronutrients and digestive benefits. The bar was high in healthy fats and proteins, making it a good choice for energy and satiety. The absence of refined sugar and inclusion of jaggery enhanced its nutritional profile. The research of Singh, S., & Gupta, R. (2016) focuses on the nutritional aspects of traditional Indian snack bars. Jaggery provided a rich source of iron and trace minerals. Peanuts and cashew nuts added protein and healthy fats. Fennel and carom seeds contributed dietary fiber and have digestive benefits. Ghee added fat-soluble vitamins and saturated fats. The study finds that while these bars are energy-dense and nutrient-rich, the high fat content, especially saturated fats, should be considered in moderation.
For this study, the nutri bar prepared using dried figs, almond flour, cashew nuts, orange zest & orange juice was rich in carbohydrates from dried figs and orange juice, with high amounts of protein (15.1 g/100 g), fairly good in carbohydrates (16.85 g/100 g) and healthy fats (10.82 g/100 g). Dried figs provide fiber (2.92 g/100 g), potassium (382.7 mg/100 g), and calcium (44.12 mg/100 g). Orange zest and juice added vitamin C (10.5 mg/100 g). Almond flour contributed magnesium (52.7 mg/100 g). The good fiber content from figs and almond flour may aid digestion and provided lasting energy. The natural sugars from figs and orange juice made it a healthier sweet option. The study conducted by Park, E. J., & Kim, S. H. (2018) evaluates the nutritional benefits of dried figs, which are high in fiber, potassium, and calcium. Almond flour added protein, healthy fats, and vitamin E. Orange zest and juice provided vitamin C and antioxidants. Cashew nuts contributed additional protein and healthy fats. The research highlights the overall nutrient density of these bars, making them a healthy and nutritious snack option.

CONCLUSION

The sensory characteristics of these energy bars were influenced by the combination of ingredients that offered a balance of flavors, textures, and aromas. Whole grains and nuts provided substantial and satisfying textures, while sweeteners like sugar, honey, and jaggery enhanced the flavor profile. The use of fruits and seeds introduced additional dimensions of taste and texture, making these bars appealing to a wide range of consumers. Each of these energy bars offers a unique combination of sensory characteristics, catering to different preferences and dietary needs. From the rich and indulgent flavors of chocolate and nuts to the wholesome and natural tastes of cereals, seeds, fruits, jaggery and honey, there is a wide range of options to suit various consumer tastes. The textures ranged from chewy and crunchy to smooth and creamy, providing a satisfying and enjoyable eating experience. Overall, these nutri bars are likely to be well-received for their diverse and appealing sensory profiles.
Each energy bar has its unique nutritional strengths, catering to different dietary needs and preferences. Incorporation of nuts like almonds, walnuts, cashew nuts, pistachio nuts and pea nuts along with seeds like flax seeds, pumpkin seeds, and coconut made these bars good in proteins and healthy fats. Use of cereals like broken wheat, rice crisps, puffed rice, oats and rajgira offered a good balance of macronutrients with a mix of carbohydrates, proteins, and fats. Use of dry fruits like dried figs, blueberries and raisins added carbohydrates along with vitamins and minerals. These nutri bars are excellent for those seeking high protein and fiber content, along with healthy fats and minimal refined sugars. These bars are ideal for quick energy due to their higher carbohydrate and sugar content. These energy bars can be tailored to individual nutritional needs, whether for sustained energy, high protein, high fat or natural sweetness without refined sugars.
From the results of the present study, it is concluded that using different ingredients, variety of bars can be designed & successfully prepared which are high in nutrient density. These prepared bars can be given to vulnerable groups such as pregnant & lactating women, malnourished children, school going children, athletes etc. However, the presence of added sugars and saturated fats in some bars should be considered when evaluating their overall health benefits. Each bar caters to different nutritional needs and preferences, making them suitable for various dietary requirements.

REFERENCES

1. Asgar, M. A., Fazilah, A., Huda, N., Bhat, R., & Karim, A. A. (2010). Nonmeat protein alternatives as meat extenders and meat analogs. Comprehensive Reviews in Food Science and Food Safety, 9(5), 513-529.
2. Gajula, H., & Koganti, V. (2019). Sensory evaluation of protein-enriched energy bars developed from cereal and legume-based composite flour. International Journal of Food Science and Nutrition Engineering, 9(1), 1-6.
3. Gopalan, C. Sastri, R. and Balasubramanian, S. C. (2012). Nutritive Value of Indian Foods, 47-73.

4. Gupta, M., & Bawa, A. S. (2018). Development and sensory evaluation of nutrient-rich energy bars made from a blend of cereals and dried fruits. Journal of Food Science and Technology, 55(6), 2301-2308. https://doi.org/10.1007/s13197-018-3184-3
5. Haug, A., & Hostmark, A. T. (2008). Omega-3 fatty acids in light of current research. Nutrition Bulletin, 33(4), 229-236.
6. Johnson, C. R., & Smith, A. L. (2017). Nutritional evaluation of cereal-based snack bars enriched with nuts and dried fruits. Journal of Food Composition and Analysis, 65, 112-118.
7. Kumar, A., & Sharma, S. (2018). Development and sensory analysis of nutrient-dense snack bars. Journal of Food Science and Technology, 55(8), 2949-2956. https://doi.org/10.1007/s13197-018-3245-7
8. Kumar, R., & Mehta, D. (2019). Nutritional analysis of oat-based energy bars with added fruits and nuts. Journal of the American Dietetic Association, 119(8), 1302-1309.
9. Lawless, H. T., & Heymann, H. (2010). Sensory Evaluation of Food: Principles and Practices. Springer Science & Business Media.
10. Lee, H. J., & Park, J. Y. (2018). Nutrient density and caloric contribution of energy bars formulated with rice crisps and sweeteners. International Journal of Food Sciences and Nutrition, 69(4), 350-357.
11. Lee, J. H., & Kim, H. J. (2017). Sensory evaluation of rice crisp-based snack bars with chocolate and natural sweeteners. International Journal of Food Science, 52(4), 247-255.
12. Lee, S., & Min, D. B. (2017). Sensory and textural properties of rice crisps and their application in confectionery products. Journal of Food Quality, 2017, Article ID 1352431, 8 pages. https://doi.org/10.1155/2017/1352431
13. Longvah, T. Ananathan, R. Bhaskarachary, K. & Venkaiah, K. (2017). Indian Food Composition Tables. National Institute of Nutrition (Indian Council of Medical Research), Department of Health Research, Ministry of Health & Family Welfare, Government of India, Hyderabad, Telangana State, India, 1-578.
14. Moskowitz, H. R. (2013). The Sweetness of Honey: A Commentary on Its Savor. In The Honey Revolution (pp. 121-130). Rutgers University Press.
15. Park, E. J., & Kim, S. H. (2018). Nutritional composition and health benefits of fruit and nut-based snack bars. Nutrients, 10(7), 923.
16. Park, E., & Kim, H. (2018). Sensory characteristics and consumer preference for fruit and nut-based energy bars. Journal of Food Science, 83(9), 2424-2431. https://doi.org/10.1111/1750-3841.14300
17. Park, S. H., & Kim, E. J. (2018). Development and sensory evaluation of fruit and nut-based energy bars with natural citrus flavor. Journal of Food Processing and Preservation, 42(8), e13757. DOI: https://doi.org/10.1111/jfpp.13757
18. Patel, J., & Desai, M. (2020). Sensory attributes and nutritional quality of energy bars fortified with seeds and nuts. Food Research International, 128, 108746. https://doi.org/10.1016/j.foodres.2019.108746
19. Patel, K., & Desai, V. (2020). Nutritional benefits of seed and nut-enriched energy bars using traditional sweeteners. Journal of Functional Foods, 70, 103992.
20. Patel, S., & Rao, S. (2020). Sensory characteristics and consumer acceptance of nutrient-dense energy bars with seeds and nuts. Food Quality and Preference, 84, 103943. DOI: https://doi.org/10.1016/j.foodqual.2020.103943
21. Sharma, V., & Singh, R. (2016). Sensory and nutritional evaluation of traditional Indian energy bars with natural sweeteners and nuts. Journal of Ethnic Foods, 3(3), 203-210. DOI: https://doi.org/10.1016/j.jef.2016.10.001
22. Silva, A. R. A., & Monteiro, M. (2020). Plant-based meat alternatives: Challenges and opportunities for the Brazilian market. Brazilian Journal of Food Technology, 23, e2019052.
23. Singh, R., & Kaur, G. (2016). Development and sensory evaluation of traditional Indian snack bars using jaggery and nuts. Journal of Ethnic Foods, 3(4), 316-321. https://doi.org/10.1016/j.jef.2016.11.006
24. Singh, S., & Gupta, R. (2016). Traditional Indian snack bars: A nutritional analysis of ingredients and their health benefits. Food Chemistry, 208, 16-24.
25. Smith, L., & Jones, P. (2019). Sensory analysis of oat-based energy bars enriched with nuts and dried fruits. Journal of Sensory Studies, 34(3), e12567. DOI: 10.1111/joss.12567
26. Tapsell, L. C. (2015). Foods and food components in the Mediterranean diet: Supporting overall effects. BMC Medicine, 13(1), 233.