THE ERGOGENIC POTENTIAL OF AN OAT-BASED ENERGY BAR: A COMPREHENSIVE NUTRITIONAL EVALUATION

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Date of Receipt :04.12.2023          Date of Acceptance : 22.2.2024

ABSTRACT

The study was conducted during the year 2022 and the objective was to develop a minimally processed energy bar using peanuts, oats, whey, dates, and pumpkin seeds. The ideal composition of the energy bar was determined as a combination of 60% oats and 40% peanuts, based on the sensory analysis. The energy bar exhibited a moisture content of approximately 10%, ash content of 1.55%, crude fat content of 16.42%, crude fibre content of 3.73%, and crude protein content of 20.83%. The energy value was calculated as 213.13 kcal per serving. The hardness value of the energy bar was found to be 150 ± 0.870 N. The nutritional analysis of this minimally processed energy bar suggested it is a convenient and functional ergogenic aid for health-conscious people, particularly athletes, and active individuals.

Keywords: Energy bar, Ergogenic aid, Oats, Sensory analysis, Whey protein

INTRODUCTION

Amidst the current post-pandemic scenario, people are prioritizing their health and well-being more than ever before and this has led to a raised awareness of dietary choices. Consumers now seek functional food options that promote a healthy lifestyle along with offering convenience in handling, storage, and consumption. Energy bars, also known as snack bars, have gained immense popularity as they cater to these health needs. These bar-shaped snacks are designed as ergogenic aids, providing essential nutrients and serving as energy boosters. They are widely enjoyed by people of all ages but are especially favored by physically active individuals and athletes (Aljaloud et al., 2020; Barakat and Alfheeaid, 2023).

Energy bar preparation involves a diverse mix of ingredients in the right quantity. These are made with ingredients such as oats, wheat, barley, and millets to increase their fiber content and to provide sweetness, alternative sugar sources like dates, jaggery, or sugar substitutes can be incorporated (Safvi et al., 2023). In energy bars designed for athletes, high-protein ingredients like whey protein isolate, peanuts, and cheddar cheese are often included (Jabeen et al., 2020).

Whey, a valuable by-product of the cheese industry, is often disposed off as waste despite containing essential nutrients (Leon-Lopez et al., 2020). However, recognizing its nutrient value and wastage, food industries are exploring ways to incorporate whey in high-
protein bars to improve product texture and structure (Maecki et al., 2020; Ahmed et al., 2023). Also, the energy bar can be topped with nutritious ingredients like pumpkin seeds which are packed with essential nutrients, bioactive compounds, and valuable minerals, promoting a healthy lifestyle (Dotto and Chacha, 2020.)

In recent times, functional foods have become increasingly accessible to consumers through extensive processing. This study aimed to create a minimally processed energy bar using readily available technologies, incorporating ingredients such as peanuts, oats, whey, dates, and pumpkin seeds, and subsequently evaluating its physicochemical properties and sensory attributes.

**MATERIAL AND METHODS**

The study was conducted in the Experiment Laboratory, at the College of Dairy Science and Technology, Kerala Veterinary and Animal Sciences University, Wayanad, Kerala, during the year 2022.

**Raw materials**

The raw materials, peanuts, oats, pumpkin seeds, and dates (Mazafati variety), were procured from the local market, Wayanad, Kerala. Milk for the preparation of whey was obtained from Livestock farm, Kerala Veterinary and Animal Sciences University, Wayanad.

**Optimization of ingredients**

The ingredients used in the preparation of the energy bar underwent some pretreatments. The dry ingredients (oats, peanuts, and pumpkin seeds) were first roasted for 2 minutes. The dates were then pitted and crushed into a fine paste. One-third of the peanuts were ground to a smooth paste, while the rest were crushed into a powder along with half the amount of oats and pumpkin seeds. The wet ingredient, whey was prepared by heating milk to 90 °C, followed by cooling to 70 °C and adding citric acid at a rate of 1.5% of the milk. After coagulation, the curd was pressed and

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**Figure 1. Procedure for the preparation of energy bar**

1. Weighing of the ingredients
2. Mixing of peanut paste with peanuts, oats and pumpkin seed powder
3. Addition of pre-weighed whey into the mixture
4. Homogenous mixture spread into sheets by a rolling pin onto tray
5. Setting in freezer for 1 to 2 hours
6. Energy bars weighing 50g packed in aluminium foil and served
whey was separated as per the method suggested by Shanaziya et al. (2018) and was concentrated to 60º brix. The rate of addition of pumpkin seed and dates was fixed at levels 18% and 7%, respectively. The quantity of oats: peanuts was adjusted in the ratio 30:70, 40:60, 50:50, and 60:40 and the treatments were labeled as T1, T2, T3, and T4, respectively.

The different treatments were subjected to sensory analysis by a panel consisting of 5 semi-trained judges. The parameters assessed were flavor, color and appearance, sweetness, body and texture, mouth feel and overall acceptance of the samples. The sensory analysis was performed using a 9-point hedonic scale, where a score of 1 indicated ‘dislike extremely’ and a score of 9 indicated ‘like extremely’. The results obtained were analyzed using the ‘Kruskal Wallis test’ using IBM SPSS STATISTICS (version 26.0).

Procedure for preparation of energy bar

The procedure for preparation of oats-based energy bar is given in Figure 1 and the sliced energy bars are shown in Figure 2.

![Figure 2. Sliced energy bar](image)

Proximate analysis

The energy bar was subjected to analysis based on the standard procedures outlined by AOAC International (2007) to determine its moisture, crude ash, crude fat, crude fiber, and crude protein content. The total amount of carbohydrates was estimated by calculating the difference between the sum of the values of other analyses conducted.

Energy value

The total calorie content per serving size of the energy bar was determined by multiplying the protein, carbohydrates, and fat content by the respective factors: 4.0 for protein, 9.0 for fat, and 4.0 kcal/g for carbohydrates.

Texture Profile analysis

The major texture attribute, the hardness of the energy bar was assessed following the method suggested by Kumar et al. (2018). A Universal Testing Machine (TRAPEZIUM EZ-SX, Shimadzu, Japan) was used for the analysis. The samples were tempered at room temperature prior to analysis. Five sample replications (2.5 cm * 2.5 cm * 2 cm), were analyzed for hardness which was compressed with a 3-point bending rig. The cross-head moved at a constant speed of 1 mm/s.

RESULTS AND DISCUSSION

Optimization of ingredients

The sensory scores obtained for different treatments are given in Table 1. The statistical analysis revealed that while there were no significant differences (p < 0.1) in the scores for color and appearance and sweetness among the different treatments, there were significant differences (p < 0.1) in the scores for flavor, mouthfeel, body and texture, and overall acceptability. The scores indicated that the energy bar formulated with a ratio of 60% oats to 40% peanuts (T2) achieved the highest scores compared to the other samples. This provides strong evidence that the specific composition used in sample T2 significantly contributes to the superior sensory quality of
the product. The sensory quality of bars based on overall acceptability is in the order T2>T3>T1>T4.

**Moisture content**

The moisture content of energy bars can exhibit significant variability, primarily influenced by the variety of ingredients utilized in their formulation. In this study, the energy bar revealed a moisture content of approximately 10%, demonstrating an optimal balance between dryness and stickiness, ultimately contributing to a desirable mouthfeel for consumers. The carefully selected binding agents, including dates, whey, and peanuts, played a crucial role in achieving this balance.

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**Ash content**

The ash value of the energy bar has been determined to be 1.55%. The observed ash value indicated the presence of essential minerals in the product, such as calcium, magnesium, potassium, and phosphorus, which are crucial for supporting various physiological functions and overall well-being (Bilge *et al.*, 2016). Ahmad *et al.* (2017)
reported an ash value of 1.51% in their study on a high-energy granola bar, which closely aligns with the ash value obtained for the energy bar. This similarity in ash content suggests that both bars may share comparable mineral compositions, potentially offering similar nutritional benefits.

**Crude fat**

The energy bar had a significant crude fat content of 16.42%. This high-fat content may be attributed to the presence of healthy fats, which contribute to the bar’s higher calorie density, as mentioned by Gill and Singh (2020). Nuts and seeds, as essential ingredients in an energy bar, are rich sources of fats and have been proven to exert a protective effect against cardiovascular disease development (Batool et al., 2022). Peanuts in the bar provide a good source of monounsaturated fatty acids, while pumpkin seeds offer both polyunsaturated and monounsaturated fatty acids, as given by Bardaa et al. (2016).

**Crude fibre**

The energy bar contains a crude fiber content of 3.73%. This fairly good amount of crude fiber may be obtained from various ingredients, with oats contributing significantly to the fiber content at 6.16% (Chauhan et al., 2018). Additionally, peanuts add to the fiber content with 3.07% (Devhare et al., 2021). Including dates and pumpkin seeds in the formulation also contributes to the overall fiber content of the energy bar (Aljaloud et al., 2020; Habib et al., 2015). Crude fibre contains a considerable portion of dietary fibre which not only enhances the nutritional profile of the product but also provides potential health benefits (Madhu et al., 2017). Sports or ergogenic diets are encouraged to include dietary fiber in it, as this promotes optimal bowel function and enhances gut microbial diversity, making their incorporation into energy bar formulations a valuable way to support their performance and overall health (Jang et al., 2019).

**Crude protein**

The energy bar was found to contain 20.83% crude protein, which is noteworthy. This high protein content can be attributed to the inclusion of key ingredients such as peanuts, pumpkin seeds and whey, which are rich sources of protein. Peanuts are a rich source of protein and other macronutrients, providing all the essential amino acids required for promoting body growth and metabolism (Akhtar et al., 2014). Whey is rich in bioactive peptides and amino acids, which are easily digestible and readily absorbed, making it ideal for post-exercise recovery and muscle synthesis (Patel, 2015). Pumpkin seeds are a valuable plant-based protein source, providing a wide range of essential amino acids that support muscle repair and recovery, making them particularly beneficial for athletes and individuals with high-performance requirements (Dotto and Chacha, 2020).

**Carbohydrate content**

The energy bar, with a total carbohydrate content of 48.8g, is uniquely formulated with a combination of nutritious ingredients such as peanuts, oats, whey, pumpkin seeds, and dates.

Carbohydrates serve as the primary energy source, providing quick energy to the body, superior to any other macronutrient, and act as the primary fuel for exercise and metabolism (Mul et al., 2015). Significantly, in the energy bar, dates act as a natural sweetening agent, eliminating the need for added sugars, which makes it a safer choice for individuals with diabetes (Arshad et al., 2022).
Energy content

The energy value of the energy bar was calculated as 213.13 kcal per serving. This high energy value is contributed by the ingredients, such as peanuts, oats, whey, pumpkin seeds, and dates and this value states that the bar can be considered as an ideal ergogenic aid for individuals with high energy requirements.

For highly active individuals and athletes, energy is important as it serves as the fuel that powers their intense physical activities and performance and prevent premature fatigue (Benardot, 2020). The inclusion of healthy fats, proteins, and complex carbohydrates from these ingredients ensures a steady and efficient energy supply, making it a practical choice for athletes and active individuals seeking optimal nutrition (Arenas-Jal et al., 2020).

Textural analysis

The hardness of energy bars can vary significantly depending on their ingredient composition. In this study, the energy bar showed a hardness of 150± 0.870N, which is slightly higher than that obtained for a whey protein isolate-based energy bar (100N) developed by McMahon et al. (2009), but lower than that of the energy bar made with sea algae proteins and coated with chocolate (276.43N) as studied by Ma³ecki et al. (2020), highlighting how different ingredients can influence the texture and firmness of energy bars.

The texture is considered an important factor influencing consumers’ perception, which decides their repeated buying. Hardness refers to the amount of force needed to compress food between the tongue and palate to achieve a specific deformation or penetration (Park et al., 2020). A study comparing a high-protein bar to commercially available bars found that the high-protein bar was less firm. However, consumer sensory analysis indicated that this slight difference in hardness did not affect the acceptability of the product. Therefore, it can be concluded that the texture of the protein bar may not be a barrier to its acceptance among consumers (Jovanov et al., 2021)

CONCLUSIONS

The study focused on formulating a minimally processed energy bar using oats, whey, peanuts, dates, and pumpkin seeds, and the composition was optimized as a ratio of 60% oats to 40% peanuts demonstrating superior sensory quality and nutritional value. The energy bar exhibited a desirable balance of moisture, ash, fat, fiber, protein, and carbohydrates, contributing to its overall appeal as a healthy and efficient ergogenic aid. As proteins play a crucial role in muscle building and repair and by incorporating protein-rich ingredients such as peanuts, pumpkin seeds, and whey into the energy bar formulation, individuals, especially athletes, can conveniently access a nutrient-dense snack that may meet their protein needs for optimal growth, development, and performance. Also, minimal processing techniques used in this energy bar formulation offer the advantage of retaining the natural nutritional properties of ingredients, providing a healthier and more wholesome product compared to energy bars produced using sophisticated processing methods that may involve excessive heat, additives, and preservatives.

REFERENCES


