Sensory Evaluation of Nutri Bar with Date Fruit (*Phoenix dactylifera*) and Roasted Safflower Seeds

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Abstract

Energy bars are a well-accepted, convenient food that would be an ideal food format for delivering all required nutrients in appropriate proportions for consumers. The aim of the present study was to develop an energy bar by adding roasted safflower seeds, dates, oats, soy flour, and skimmed milk powder. The energy bar was formulated in three variations (i.e., T1, T2, and T3), in which T3 was selected by sensory analysis. The value-added snack bar was evaluated in comparison to control (without the addition of safflower seeds) and the best accepted variation treatment (T3- with addition of safflower seeds) to analyze the nutritional composition and investigate the shelf-life of the formulated bar. The energy bars were rated on a 9-point hedonic scale for sensory evaluation, and the attributes of control (C) and T3 resulted in color (C-8.5 ± 0.01, T3-8.9 ± 0.2), taste (C-7.9 ± 0.21, T3-8.65 ± 0.34), flavor (C-7.95±0.02, T3-8.6±0.28), texture (C-7.9 ± 0.51, T3-8.85 ± 0.73), appearance (C-6.85 ± 0.07, T3-8.75 ± 0.20), and overall acceptability (C-7.3 ± 0.04, T3-8.6 ± 0.07), thus proving that the formulated product (T3) is more acceptable than control group. The Nutri bar developed for further analysis of nutritional attributes such as energy, protein, fat, carbohydrate, dietary fiber, iron, and calcium results in a well-balanced microbial analysis of newly formulated product is safe to consume.

Key words: Energy bar, Snacks, Dates, Safflower seeds, Sensory analysis

Creating innovative health-conscious foods aligns with the recommendations of the World Health Organization. The growing consumer demand for natural, nutritious, and safe products has increased the popularity of snack bars as a popular choice [10]. Energy bars, categorized as food bars, are convenient and are predominantly composed of cereals and high-energy ingredients. Their sensory and nutritional appeal are attributed to the presence of carbohydrates, lipids, proteins, and minerals. Lifestyle changes, heightened health awareness, and increased physical activity have positioned energy bars as preferred energy sources [11]. Globally, dates cultivated for millennia have cultural significance. Whether consumed fresh, dried, or as a natural sweetener in various culinary applications, dates are recognized for their nutritional value and for providing energy, fiber, and essential nutrients. With a high natural sugar content comprising glucose and fructose, dates offer a distinctive sweet flavor. They also contain dietary fiber, B vitamins, vitamin K, and essential minerals such as potassium, magnesium, and iron [3].

Safflower seeds obtained from the annual flowering plant Carthamus tinctorius were white, elongated, and slightly pointed. Primarily, as a source of safflower oil, these seeds are extensively used in cooking, cosmetics, and industry. In addition to oil extraction, safflower seeds are used as roasted snacks. Safflower seeds are rich in proteins, fats, vitamin E, and potassium, and may contribute to heart health, inflammation reduction, and blood sugar management, owing to their abundance in unsaturated fatty acids and antioxidants [4], [8]. To analyze the sensory attributes of the formulated snack bar using a 9-point hedonic scale and to evaluate the mean, standard deviation, and t-test.

MATERIALS AND METHODS

The raw materials used for the formulation of the energy bar were procured at Perambur Chennai in a local supermarket and checked for expiry dates. The formulation and standardization of the energy bar were prepared easily at home using the following steps:

Step 1- The dry ingredients such as oats, soy flour, and safflower seeds were roasted gently and kept aside (each ingredient was roasted separately).

Step 2- Dates fruit is washed, dried, and pitted.

Step 3- Fresh dates were steamed at 80 °C and blended to make a paste.

Step 4- All the prepared ingredients were mixed thoroughly in a clean bowl along with the addition of skimmed milk powder to improve protein quality.

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Step 5: Take a tray, spread the mixture over the baking sheet or butter paper, and allow it to set at room temperature.

Step 6- Then, cut into rectangular-shaped bars (width: 3 cm, length: 5 cm, height: 1.5 cm) weighing approximately 30 g per portion.

Step 7- Control (C) was prepared using roasted chickpea flour; T1, T2, and T3 treatments were prepared using roasted safflower seeds in different concentrations, as given in Table-1.

Table 1 Indicates the variation proportions of ingredients

Samples	Oats (g)	Chickpea flour (g)	Soy flour (g)	Safflower seeds (g)	Dates paste (g)	skimmed milk powder (g)
Control	12.5	12.5	12.5	-	30	5
T_1	12.5	-	12.5	6.5	30	5
T_2	12.5	-	12.5	9.5	30	5
T_3	12.5	-	12.5	12.5	30	5

RESULTS AND DISCUSSION

The main findings of this study indicate the overall acceptability of the newly formulated energy bar in terms of sensory parameters such as taste, appearance, flavor, texture, color, and overall acceptability of the product.

Sensory analysis

The sensory analysis of an energy bar involves evaluating its appearance, aroma, flavor, and texture. This method assesses the product's sensory attributes to ensure that it meets quality standards, providing valuable insights into its overall acceptability and consumer appeal based on human senses [1]. The energy bar was formulated in different treatment (T1, T2, T3); among all sample T3 (Treatment 3) was accepted by the semi-trained panelist of SDNB Vaishnav College for Women, Chromepet, Chennai-44 and further analysis was done. This study examined sensory acceptability (using the 9-point hedonic scale Scorecard), as shown in table-2 and was evaluated by calculating the average mean value and standard deviation from the collected data. The below Table 2, the mean acceptability score results that comparing to the three-treatment group Treatment T3 has higher acceptability scores. Therefore, Treatment group and Control group was further analyzed.

Table 2 Indicates the mean acceptability score

Sensory Attributes	Control	Treatment 1	Treatment 2	Treatment 3
Color	8.5 ± 0.01	6.0 ± 0.05	5.8 ± 0.14	8.9 ± 0.2
Taste	7.9 ± 0.21	5.7 ± 0.42	6.0 ± 0.08	8.65 ± 0.34
Flavor	7.95 ± 0.02	5.9 ± 0.42	5.8 ± 0.26	8.6 ± 0.28
Texture	7.9 ± 0.51	5.4 ± 0.54	5.45 ± 0.18	8.85 ± 0.73
Appearance	6.85 ± 0.07	5.65 ± 0.12	5.75 ± 0.91	8.75 ± 0.20
Overall acceptability	7.3 ± 0.04	5.75 ± 0.11	6.1 ± 0.25	8.6 ± 0.07

Statistical inference

Statistical inference, the process of drawing predictions or decisions about a population from a sample, involves making conclusions about population parameters using statistical methods. It comprises two main branches: estimation and hypothesis-testing. Examining the data in (Table 2), statistical inference, including the mean score values and standard deviations, was performed across various treatments and a control group. Notably, Treatment 3 exhibited the highest mean acceptability scores compared to the other treatments, indicating that the formulated bar is deemed acceptable for consumption based on sensory attributes [7].
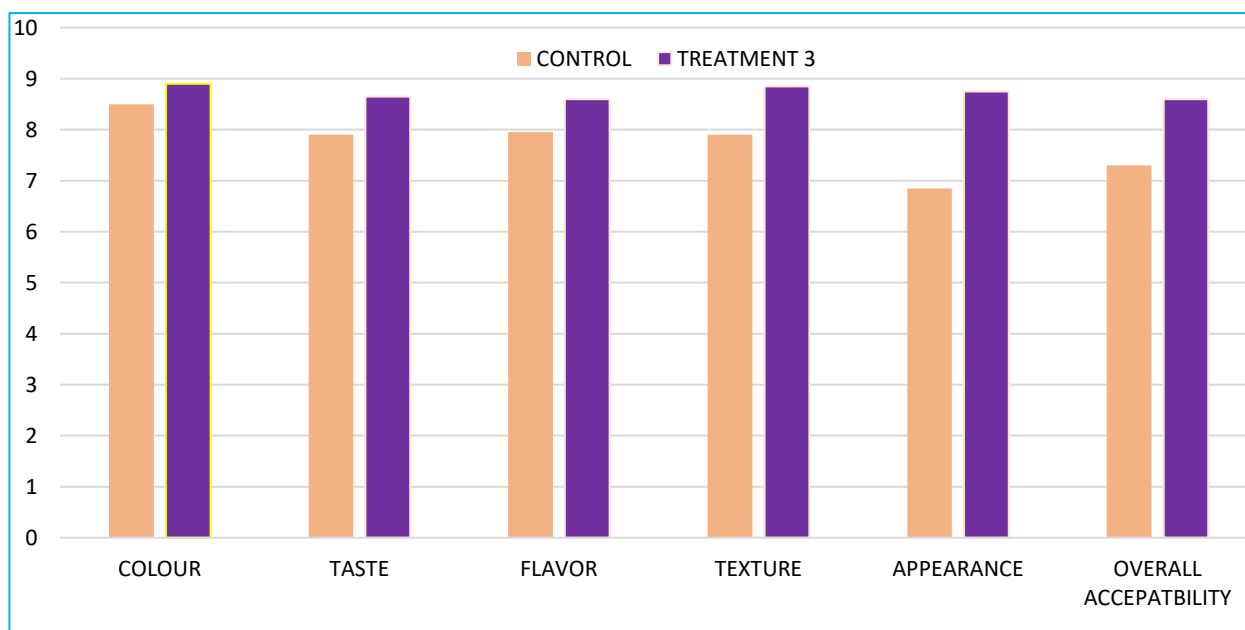

Fig 1 Sensory analysis of control and treatment 3

Table 3 Indicates the statistical interference of control and treatment-3 evaluation

Sensory attributes	Types	Mean	Standard deviation	t-value (0.05%)	Rejection (H_0) / acceptance (H_a)
Color	Control	8.5	0.32	0.05	Accepted
	Treatment-3	8.9	0.18		
Taste	Control	7.9	0.26	0.00	Accepted
	Treatment-3	8.65	0.07		
Flavor	Control	7.95	0.09	0.00	Accepted
	Treatment-3	8.6	0.12		
Texture	Control	7.9	0.07	0.02	Accepted
	Treatment-3	8.85	0.13		
Appearance	Control	6.85	0.39	0.37	Rejected
	Treatment-3	8.75	0.03		
Overall acceptability	Control	7.3	0.19	0.00	Accepted
	Treatment-3	8.6	0.15		

*t-value indicates that significant difference at 5% level significance

Control- without addition of Safflower seeds.

Treatment 3 – addition of Safflower seeds

Organoleptic evaluation

Organoleptic evaluation entails analyzing a product using human senses, such as sight, smell, taste and touch. When applied to energy bars, this assessment considers appearance, aroma, flavor, texture, and overall acceptability [6]. Further analysis involved conducting an organoleptic evaluation of the energy bar by comparing values between the control and treatment 3, as presented in (Table 3, Fig 1).

From the above (Table 3), the t-test value at 0.05% significance level for the control and Treatment-3 of the energy bar was examined and the results were calculated by using t-test followed by steps involved in calculating mean and standard deviation; sensory attributes such as color (<0.05), taste (<0.05), flavor (<0.05), texture (<0.05), appearance (>0.05), and overall acceptability (<0.05). Therefore, states that the formulated product(T3) is highly acceptable by evaluating the sensory attributes using 9-point hedonic scale.

Statistical conclusion

In statistics and hypothesis testing, an alternate hypothesis is often denoted as the null hypothesis (H_0) / alternate hypothesis (H_a). This statement suggests that there is a significant difference, effect, or relationship between variables. This contrasts with the null hypothesis (H_a), which posits that there is no significant difference or effect [2].

The alternate hypothesis is that researchers aim to support or demonstrate this through their study. It typically represents the research hypothesis or idea that there is a meaningful relationship or effect that warrants further investigation. The formulation of the alternate hypothesis depends on the specific goals and questions of the study [9]. From the above results, the calculated t-values of the sensory attributes such as color, taste, texture, and overall acceptability of T3 were higher than those of the control group, and the hypothesis was framed based on the values that appeared in (Table 5).

Table 5 Indicates hypothesis on sensory attributes of nutri bar

Sensory attributes	Null hypothesis	Alternate hypothesis	Conclusion
Color	There is no significant difference in sensory attribute color between control and T3.	There is a significant difference in sensory attribute color between control and T3.	Alternate hypothesis was accepted since T_3 has higher color attribute than that of control group, p (< 0.05).
Taste	There is no significant difference in sensory attribute between control and T3.	There is a significant difference in sensory attribute taste between control and T3.	Alternate hypothesis was accepted since T_3 has higher taste attribute than that of control group, p (< 0.05).
Flavor	There is no significant difference in sensory attribute flavor between control and T3.	There is a significant difference in sensory attribute flavor between control and T3.	Alternate hypothesis was accepted since T_3 has higher flavor than that of control group, p (< 0.05).
Texture	There is no significant difference in sensory attribute texture between control and T3.	There is a significant difference in sensory attribute texture between control and T3.	Alternate hypothesis was accepted since T_3 has higher texture value than that of control group, p (< 0.05).
Appearance	There is no significant difference in sensory attribute appearance between control and T3.	There is a significant difference in sensory attribute appearance between control and T3.	Alternate hypothesis was rejected since p (> 0.05).
Overall acceptability	There is no significant difference in sensory attribute overall acceptability between control and T3.	There is a significant difference in sensory attribute overall acceptability between control and T3.	Alternate hypothesis was accepted since the overall acceptability in T_3 is higher compared with control group, p (< 0.05).

CONCLUSION

In the sensory evaluation aspect, the participants favored the energy bars for their appealing taste and texture. The combination of dates and roasted safflower seeds provided a pleasant flavor profile, satisfying both sweet and savory preferences. The bars demonstrate a balanced composition, meeting consumer expectations in terms of mouthfeel and overall satisfaction. The study's sensory analysis underscores the potential success of these energy bars in meeting consumer

preferences for both health- and taste-conscious individuals. The findings from the current study led to the conclusion that the date-based fiber-enriched energy bar serves as a nutritious food as well as an appealing taste for consumers as a result of sensory analysis.

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