

Formulation and Evaluation of Millet Brownie Mix Incorporated with Dry Date Powder

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Abstract

The sugars added in processed food nowadays are a serious health concern as they lead to bad skin, cancer, heart diseases, weight gain, and the formation of dental cavities. Sugar is consumed in a large amount throughout the world so, it is good for looking alternatives to sugars. This study uses dry date powder as a natural sweetener to develop a brownie mix using millet. Dry date powder is high in fiber, helps reduce cholesterol levels in the body, and has a low glycemic index so it is an excellent choice for diabetes patients. Pearl millet is used for making this brownie mix as it is gluten-free, low-cost, and lowers blood glucose levels since it has a high amount of zinc. It is also good for bone health. The product was developed and standardized by various methods, including T1, T2, T3, and control. Based on sensory components using a nine-point hedonic scale T1 has a high mean (8.9) and was chosen for further analysis. The physical, microbial, shelf life and proximate were all examined. It has a good shelf life, and no microbial growth yeast or mold is detected hence, it is a highly nutritious, and iron-rich food.

Key words: Pearl millet, Dry date, Gluten-free, Nutritional snacks, Low cost

In recent years these ready-to-eat (RTE) foods have grown. People also focus on nutritional and healthy food options. RTE foods are a type of food that is already prepared and requires less time to cook. Although RTE foods are convenient and less time-consuming certain measurements are taken to ensure the safety of food. The increase in demand for RTE food is due to working men and women as they don't have enough time to cook food because of their busy schedules. The food they consume needs to be nutritious as well as time-consuming and healthy food options [8].

Age is the most important indicator of convenience food intake, with many young individuals eating more convenient meals. People today expect nutritious food, thus inventing and producing more healthy convenience foods [3]. Millet products are still scarce in ready-food items made from rice, wheat, and corn because they have a distinct nutritional profile, particularly because they are gluten-free. They are also high in fiber, carbs, phenolic compounds, and minerals [9]. In recent days, millet-based bakery products have also been available commercially. The sugars added in processed food nowadays are a serious health concern as they lead to bad skin, cancer, heart diseases, weight gain, and the formation of dental cavities. Sugar is consumed in a large amount throughout the world so, it is good for looking alternatives to sugars. This study uses a dry date powder as a natural sweetener for the development of brownie mix using millet. Dry date powder is high in fiber, it also helps

in reducing cholesterol levels in the body, and it has a low glycaemic index so excellent choice for diabetes patients. Dates are used in many forms in food products such as date paste, date syrup, date cake, and many more. Among all the minor cereals, millets play a major role in improving the health of an individual. Pearl millet is used for making this brownie mix as it is gluten-free, low-cost, and lowers blood glucose levels since it has a high amount of zinc and iron in it also good for bone health and is a low-cost food. This is also high in unsaturated fatty acids, with a higher content of the nutritionally important omega-3 fatty acids. Nowadays, vegan, and vegetarian are growing among people greatly. Hence, this ready-to-bake brownie mix was developed with wholesome millet and dry date as a base ingredient.

MATERIALS AND METHODS

This study entitled "Formulation and evaluation of millet brownie mix incorporated with dry date powder" has been approved by the Institutional Human Ethics Committee (IHEC) with protocol no – SDNBVC/HSC/IHEC/2023/24 conducted on November 12th, 2023, by the Department of Home Science, Shrimathi Devkunvar Nanalal Bhatt Vaishnav College for Women, Chromepet, Chennai – 44, Tamil Nadu.

The millet-based brownie mix was developed using ingredients such as pearl millet flour, cocoa powder, dry date

powder, and baking soda (purchased from the local supermarket).

Preparation of millet flour and brownie mix

All the ingredients were cleaned to remove dirt. Pearl millet was washed, filtered, dried, and milled to obtain flour. Pearl millet, cocoa powder, baking powder, and dry date powder are weighed, mixed well, and then sieved to obtain this mix.



This brownie mix underwent various examinations, including its proximate composition, microbial content, shelf-life, and sensory attributes.

The sensory attributes utilized a 9-point hedonic scale [12] while proximate composition such as energy, protein, fat, crude fiber, carbohydrates, ash, moisture, iron, and zinc [1], [11]. The shelf life was determined by microbial count like yeast and mold count, and bacterial count on the 3rd, 5th, 7th, 14th, and 28th days [4-5].

Cost analysis

Cost analysis of the formulated brownie mix was calculated based on raw material cost and processing cost [6].

$$\text{Cost production} = \frac{\text{cost A} + \text{cost B}}{Q}$$

Where;

Cost A – The cost of raw materials

Cost B – is the cost of processing and

Q is = the quantity of mix (g).

Statistical analysis

The product values are statistically analyzed using SPSS software. The findings of all the parameters seen are given as mean \pm standard deviation.

RESULTS AND DISCUSSION

Proximate analysis

Energy

The energy of the control brownie mix (396.06kcal) was less energy compared to treatment T1(407.14kcal). This may be due to the use of date powder instead of sugar.

Protein

Protein content is beneficial for the human body in helping prevent colon cancer, treat diabetes, and control the body's weight. The values obtained for treatment T1 ($4.4 \pm 0.10\text{g}$) is higher than the control sample ($3.3 \pm 0.10\text{g}$).

Fat

The fat content in the formulated product is higher when compared to the control. The fat content of the control group is ($4.7 \pm 0.02\text{g}$) and the treatment T1 value is ($6.9 \pm 0.10\text{g}$) which has the highest fat content. This could be due to the addition of dry date powder. As dates are rich in unsaturated fatty acids.

Carbohydrates

The carbohydrate content of the control brownie mix was found to be lower (85.14g). The carbohydrate content of treatment T1 was found to be (81.86g). This may be due to the addition of refined sugar in the control sample as it is rich in carbohydrates.

Dietary fiber

The addition of pearl millet flour and dried date powder was rich in fiber content. The values estimated for control are ($3.8 \pm 0.03\text{g}$) and treatment ($4.1 \pm 0.04\text{g}$) respectively. These also helps in functioning of gut microflora function and also gives appetite easily. It contributes to the overall metabolic health [2].

Ash

Ash is a chemical residue left over from the combustion or oxidation of organic materials in food. The overall mineral content of food is determined through ash analysis. The obtained value for treatment 1 ($1.74 \pm 0.15\%$) was slightly higher compared to the control ($1.66 \pm 0.02\%$).

Moisture

Moisture content is very important in maintaining the shelf life of the products. Moisture content was the highest in the control ($5.2 \pm 0.01\%$) in comparison to treatment 1 ($5.1 \pm 0.24\%$). It could be due to the use of dry date powder in treatment 1 and powdered sugar in the control group.

Iron

Iron is an important component of several enzyme systems, including cytochromes, which are involved in oxidative metabolism. The iron content of the control is 4.3 mg and the treatment are 6.2 mg. The result showed higher iron content in treatment 1 because date powder has a high iron content.

Zinc

Zinc is an essential mineral for life as it regulates immune responses and displays antioxidant and anti-inflammatory activities. The zinc content of the control is 3.1 mg and the treatment 1 is 3.8 mg. The result shows a high amount of zinc content is present in treatment 1 because date powder has a high zinc content.

Microbial analysis of the mix

There is no bacterial count, yeast, or mold growth in millet brownie mix powder. Hence, the product was prepared in a hygienic condition. The microbial analysis concluded that the microbial growth was under < 10 logs and is microbially safe for human consumption.

Evaluation of the shelf-life

A food product's shelf life is an important feature for both manufacturers and consumers. The most important factor for shelf-life evaluation of food is safety, followed by quality including physical, chemical, and sensorial properties. Shelf-life studies can provide information to manufacturers and consumers to ensure a high-quality product during the storage period [7]. On the 3rd, 7th, 9th, 14th, and 28th day, there is no

bacterial count, yeast, and mold growth, in the brownie mix (per 100g of sample). It can be concluded that the total bacterial, yeast, and mold growth count of the mix was within the permitted limit due to the decreased moisture content which does not support the growth of microorganisms. This is because the mix has a lower moisture content and it was prepared under hygienic conditions.

Table 1 Sensory analysis

Treatments	Appearance	Taste	Texture	Color	Overall acceptability
Control	138.33±1.522	147.33±1.527	138.33±1.522	151±2	146±2
T1	178.66±2.516	178±2	171±3	178.33±3.511	178.33±3
T2	170.66±5.507	142.66±4.509	146.33±4.507	147.66±4.509	148.66±4.509
T3	167.33±5.033	139.66±4.509	144.66±6.027	145.33±5.507	144.66±6.027
P Value	1.754	9.735	4.850	1.739	4.341

Sensory evaluation

The sensory characteristics of the millet-based brownie mix incorporated with dry date powder brownie mix were determined in terms of appearance, color, texture, taste, and overall acceptability according to the sensory evaluation technique carried out. The sensory analysis uses a 9-point hedonic scale by 20 untrained panelists. Among all the treatments T1 has a greater acceptability of 8.9 percent.

Table 2 Microbial analysis

Microbial analysis	Sample
Total plate count – Bacterial count	Nil
Total plate count – Yeast and mold count	Nil

Table 3 Shelf-life analysis

Days	Sample CFU/10 ⁴
3	Nil
7 th	Nil
9 th	Nil
14 th	Nil
28 th	Nil

Appearance

The appearance of the food is the first quality perceived by the human senses, and it plays a significant part in identifying and selecting food. Color, shape, size, gloss,

dullness, and transparency all contribute to the visual experience of food [10]. T1 (178.66 ± 2.516) has the greatest mean value among other treatments. The texture of the brownie made from pearl millet was good in appearance. The texture of the brownies depends upon the amount of all the ingredients in a correct ratio, and baking temperature.

Colour

Color is the basic sensory parameter of food. The product's color can be used to detect specific flaws and blemishes. The mean score for treatment T1 was 178.33 ± 3.511 which was the highest mean score in color aspects compared to control and other treatments. The dark brown color of the brownie is because of the color of the cocoa powder, flour, and the right temperature at which the brownies are baked.

Texture

The texture is sensed through a mix of senses, including touch, mouthfeel, sight, and hearing. It is one of the most important characteristics of food. It also includes consistency, thickness, fragility, chewiness, and particle size and form in food [10]. The texture of T1 (171±3) was preferred by the panelists and has a higher score. T3 has the lowest scoring. The texture of the brownie depends upon the ratio of all the ingredients added to it especially baking powder and baking soda because if these two components are added in the wrong ratio, the texture will not seem to be acceptable.

Table 4 Proximate analysis

Parameters	Control	Treatment	P value	Significant value
Energy (kcal/100g)	395.7±4.50	407.12±5.00	0.0183	S*
Protein (g/100g)	3.3±0.10	4.4±0.13	0.0657	NS
Fat (g/100g)	4.7±0.02	6.9±0.02	0.0139	S*
Crude fibre (g/100g)	3.8±0.03	4.1±0.04	0.3266	NS
Ash (g/100g)	1.66±0.02	1.74±0.15	0.1749	NS
Moisture (g/100g)	5.2±1.10	5.1±0.24	0.9447	NS
Carbohydrates (g/100g)	85.14±5.04	81.81±0.22	0.0031	S***

Parameters	Control	Treatment 1	P value	Significant value
Iron mg	4.33±0.45	6.23±0.55	0.3232	NS
Zinc mg	3.13±0.35	3.83±0.65	0.0067	S***

Taste

Taste is the sensation of constituents after they have been absorbed in saliva, oil, or water by taste receptors located on the tongue and the other areas of the mouth [10]. It was evident from the evaluation that T1 (178±2) was the best mean score for the taste attribute. T3 was the least acceptable sample because the sweetness was less in the product. The taste of the brownies depends on the amount of sweetness added to it.

Overall acceptability

The overall acceptability of the samples helps to understand the acceptability of a sample in its entirety. The overall acceptability of all 3 samples and the control depicted and graded from highest to lowest mean score. When compared to the other treatments in all attributes, including the control treatment T1 (178.33±3) was the most highly accepted. According to the data calculated.

Table 5 Cost analysis

Materials required	Cost (Rs)
Total raw material cost	211.00
Total processing cost	75.00
Total cost	286.00
Total cost (Per 100g)	28.6.00
Standard cost of brownie mix	349.00

Cost analysis

The cost analysis of the formulated brownie mix, based on a 100g serving size revealed that the production cost of Rs 28.6 compared to the commercial price of the brownie mix was Rs. 69.8. The difference between the costs of these reflects various factors including ingredient costs, labor costs, and desired profit margins. Overall, the nominal difference between production cost and retail price suggests that the formulated brownie mix is priced competitively to the market providing snacks to the people while also achieving the profit target.

CONCLUSION

Healthy eating practices are crucial for the population because the prevalence of numerous lifestyle disorders such as

obesity, diabetes mellitus, and cardiovascular disease is increasing in today's society. On the other hand, people have a busy schedule working women population, and the prevalence of avoiding breakfast is on the rise; therefore, meeting nutritional demands is a serious concern. Formulation and evaluation of millet brownie mix incorporated with dry date powder would be a healthy snack substitute; nutritionally rich products with the incorporation of available ingredients. Hence, the present study was intended to develop and formulate a millet-based brownie mix. This formulated mix was found to have an excellent nutrition profile and greater acceptability of snacks prepared, among customers. This study also concluded that the product developed was gluten-free with low glycemic index properties and is nutritionally rich in energy, protein, fat, fiber, iron, and zinc with a minimal amount of carbohydrates. Hence, it was evident from the present investigation that the formulated millet-based healthy brownie mix can effectively replace the unhealthy regular brownies made of refined flour providing various nutritional benefits of consumption of indigenous locally available ingredients. Value-added ready products using pearl millet and dry date powder can be commercialized in the future for improved health among consumers.

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