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Development and comparative study of nutribars prepared from pearl millet.

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ABSTRACT

Nutrition bar is a complete and convenient energy source for people. They are designed to be eaten quickly or while on the go. It is the most popular and healthy snack that can be consumed by everyone without any age limits. The present study was carried out to prepare nutribars from Dried pearl millet crushes and Malted pearl millet crushes and their comparative study. The dried pearl millet or sprouted pearl millet was mixed with an appropriate amount of oats, dates, pumpkin seeds, sunflower seeds, peanut and honey. These ingredients were mixed to make it into a bar like form. The main reason for selecting pearl millet was that they are rich in vitamins, minerals, energy, protein and dietary fibers. Among all the millets micronutrients are highest for pearl millet. They are significantly rich in resistant starch, soluble and insoluble dietary fibers. Pearl millet is ideal as it is the only grain that retains its alkaline properties after being cooked as it is gluten free. The global need for high quality, nutrient dense food is rising. By combining practical novel ingredients, the food business has been forced to develop innovative goods to improve the nutrient content and % daily value per serving due to customer lifestyle changes and increased health consciousness.

Keywords: Nutribar, Pearl millet, Innovative goods

RESUMEN

La barrita nutricional es una fuente de energía completa y cómoda para las personas. Están diseñados para consumirse rápidamente o sobre la marcha. Es el snack más popular y saludable que puede consumir todo el mundo sin límite de edad. El presente estudio se llevó a cabo para preparar nutribars a partir de triturados de mijo perla seco y triturados de mijo perla malteado y su estudio comparativo. El mijo perla seco o el mijo perla germinado se mezcló con una cantidad adecuada de avena, dátiles, semillas de calabaza, semillas de girasol, maní y miel. Estos

ingredientes se mezclaron para darle forma de barra. La razón principal para seleccionar el mijo perla fue que es rico en vitaminas, minerales, energía, proteínas y fibras dietéticas. Entre todos los micronutrientes del mijo, los más altos son el mijo perla. Son significativamente ricos en almidón resistente y fibras dietéticas solubles e insolubles. El mijo perla es ideal ya que es el único grano que conserva sus propiedades alcalinas después de ser cocinado al no tener gluten. La necesidad mundial de alimentos ricos en nutrientes y de alta calidad está aumentando. Al combinar ingredientes novedosos y prácticos, la industria alimentaria se ha visto obligada a desarrollar productos innovadores para mejorar el contenido de nutrientes y el porcentaje del valor diario por porción debido a los cambios en el estilo de vida de los clientes y una mayor conciencia sobre la salud.

INTRODUCTION

Foods called Nutribars are designed to be eaten quickly or while on the go. They give nourishment to various age group in an amount that is effective for increasing their nutrition. They contain a wide variety of essential nutrients and vitamins as well as enough protein and carbohydrate to keep the body operating (Nisha M Wagh et al., 2022). Nutrition bars are build around a core of complex carbohydrates such as monosaccharide and disaccharides. The bars also contain food enhancement agents such as Vitamin A, Vitamin B, Vitamin B2, Vitamin B6, Vitamin B12, Vitamin C, Vitamin D, Vitamin E, Vitamin K, Biotin, Calcium, Copper, Folic acid, Iodine, Magnesium, Iron, Manganese, Pantothenic acid, Phosphorous and Zinc.

In addition to the nutritional qualities, nutribars has certain medicinal qualities such as demulcent, carminative, laxative, lactogenic and rubefacient. Nutribars are also fortified with health promoting agents like DHA. DHA enhances intelligence and helps in IQ development. (Gayatri Uma et al., 2018). They help to maintain healthy blood values, supports brain health, promotes metabolism, supports health digestion, helps control hunger and appetite (Rita Ellithrops et al., 2015), they are time saving, they provide healthy nutrients, bioactive compounds and dietary fibers to consumers (Nisha M Wagh et al., 2022).

The food business has been forced to develop innovative goods by combining practical novel ingredients to improve the nutrient content and % daily value per serving due to customer lifestyle changes, increased health consciousness and nuclear families. Nutribars made of millet are flexible product (Dharshini et.al.,2022).

Millets are grains that are very nutrient dense. The utilization of millets is lower in some nations due to a lack of various technological obstacles and limits (Meera M et al., 2022). Millets are a prominent functional ingredient in snack foods, notably nutri bars, which serve to enhance the nutritional qualities and address widespread nutritional shortages (Dharshini et al., 2022). In addition to Vitamins, millets are strong source of flavanoids. Millets contain a number of bioactive compounds that have been shown to reduce the risk of cancer, diabetes, cardiovascular disease and ageing (Abhishek Mishra et al., 2022).

PEARL MILLET (Pennisetum glaucum):Pearl millets are been consumed by a significant majority of the inhabitants residing in the semi-arid tropical regions of Africa and Asia as their main source of calories. The grain is nutritious and has more protein and energy than sorghum or maize. Typically it has 9-13% protein. As they have higher oil content than wheat, they have more calories. They are rich in calcium, magnesium, potassium, zinc, iron, manganese, niacin, lysine etc. Since they are gluten-free, they are the only grain that when cooked maintains its alkaline properties making them perfect for those who have gluten allergies (Khairwal S et al., 2002).

A process called Malting was performed on pearl millet to enhance the nutritional properties of the nutribar. Malting /germination can be employed as an appropriate pretreatment to improve the nutritional properties of native cereal grains. Malting increases vitamin and enzymes, enhances nutrients and flavor, increases the fiber content of grain, affects functional quality of grain and also reduces anti nutrients (Deepika Baranwal, 2017).

In this study we have incorporated different ingredients along with Pearl millet to prepare nutribar. The different ingredients used for the preparation of nutribar were Pearl millet, Oats, Dates, Honey, Peanut, Pumpkin Seeds and Sunflower Seeds.

OATS (Avena sativa): Oats is a Mediterranean crop that has been domesticated for thousands of years. Due to its diverse health benefits attained through favorable physiological responses to fight NCDs that are on the rise, oats had gained a unique position. Current nutritional research on oats strongly suggests that intake of oats and oat based products should be promoted as part of a comprehensive lifestyle medicine approach for prevention of CVDs and diabetes (Somasundaram Mathan Kumar, 2010).

DATES: Dates have anti-inflammatory, anti-cancer, antioxidant, amti-microbial, and free radical scavenging properties. Dates have high carbohydrate content(total sugars, 44-88%), protein content(2.3-5.6%), fat content(0.2-9.3%), important salts, minerals, vitamins and a high level of dietary fibre(6.4-11.5%). Additionally they have oil in the seed (7.3-7.8%) (Dayang J.F et al., 2014).

HONEY: Since ancient times honey has been utilized both as a food and medicine. Sugars make up the majority of honey's principal ingredients, which include glucose and fructose. Honey is a food that includes high energy carbohydrates since 95-99% of the total solids in honey are made up of sugars, which are easily digestible since they are similar to many fruits.According to studies the components of honey have antioxidant, antibacterial, anti-inflammatory, anti-cancer and anti-metastatic activities (Bruna Costa Ferreira da Cruz et.al, 2019).

PEANUT (Arachis hypogaea): Commercially, peanuts are mostly used to produce oil, but outside oil they also produce a variety of other useful byproducts including proteins, fibre, polyphenols, antioxidants, vitamins and minerals all of which can be employed as functional ingredients in a variety of processed meals. (Arya S S et.al., 2015).

PUMPKIN SEEDS: Pumpkin seeds are rich in beneficial vitamins, minerals, amino acids, phytosterols, unsaturated fatty acids, phenolic compounds, tocopherols and cucubitacins. All of these bioactive substances are necessary for a healthy life and for overall well-being. The amazing nutrient of pumpkin seeds make them beneficial for many different areas of health. They include a variety of nutrients like proteins, unsaturated fatty acids, vitamins and minerals that lower the risk of developing chronic illnesses like cancer (Joachim M Dotto et al., 2020).

SUNFLOWER SEEDS: Sunflower seeds have been widely used in traditional medicine. The highly dietary and nutritional value of sunflower seeds make them a rich source of proteins, minerals, phytochemicals and healthful unsaturated fats. Dilipkumar Pal, 2011). Sunflower seeds are one of the best source of vegetable protein (Venktesh et.al., 1992). It is an excellent source of choline and betaine (Muhammad Nadeem et.al.,2010).

MATERIALS AND METHODS

Materials

A. Raw materials:The ingredients used for the preparation of Nutribars were Pearl Millet, Oats, Dates, Honey, Peanut, Sunflower Seeds and Pumpkin Seeds.

B. Equipments :Equipments used for the preparation of Nutribars were Weighing Machine, Plate, Grinder, Mortar and pestle, Oven and Mould. The equipments were available in the Food Processing Technology Department lab, St Teresa's College Ernakulum.

Processing Method: Nutribars were prepared by combining the ingredients in five different ratios to find the appropriate combination. The ingredients for all the five samples[C1,C2,C3,C4 and C5] were taken in different plates. They were kneaded thoroughly and shaped. The best binding and textural properties were exhibited by the sample C4 and thus it was selected for further studies.

To enhance the nutritional properties of the nutribar dried pearl millet(In Sample 1) was replaced with malted pearl millet (In Sample 2). Many studies found that malting increased the amount of Vitamin B and c, Minerals[Calcium, Manganese, Copper and Zinc] and protein in cereal grains such as Wheat, Barley, Sorghum, Pearl millet, Oats and Rice while decreasing the amount of ant nutrients (Deepika Baranwal, 2017). In order to improve the aesthetic and palatability both the dried and malted nutribars were coated with milk compound.

Method of preparation: All the ingredients were measured as per the composition of C4. Measured Ingredients were mixed and bounded thoroughly. Milk compounds were melted and mould was coated after greasing the base.Fill the remaining part of the mould with mixed and bounded ingredients and refrigerate for 30

minutes for the milk compound to set.Refrigerated product was kept at room temperature for 12 hours and demoulded. The fnished product (Fig. 1) was further taken for sensory and chemical analysis.

Fig 1: Nutribar prepared from dried and malted pearl millet

a) Nutribar prepared from dried pearlmillet. b) Nutribar prepared from malted pearl millet

Chemical Analysis: Protein and Carbohydrate content were determined using A.O.A.C methods.Fat, Dietary fibre, Calcium and Polyphenol content were determined using ISO methods

Sensory Analysis: Sensory analysis were done using Hedonic scale, where the samples were tested by 10 panelists.

RESULTS AND DISCUSSION

The final products were taken for chemical and sensory analysis and a comparative study was done based on the result.

Comparative study of sample 1 and sample 2

Protein: In sample 1 the value of protein was 11.65 whereas the protein content of sample 2 was 11.14. Nutribars with high protein content is good for health. The major building block of human body is protein. They build and maintains tissues (Jamie I Baum et al., 2020).

Carbohydrates: Carbohydrate content of sample 2 was increased to 61.25 from 61.21. carbohydrates are the major source of metabolic energy. By generating energy, they play a major role in promoting health fitness and help in building body strength (Suman Khowala et al., 2020)

Fat: In sample 2 the value of fat increased from 15.25 to a level of 15.29. Fat provides essential fatty acids and energy for healthy skin. Increased fat content helps the body to absorb more fat soluble vitamins such as Vitamin A, D, E and K (Dr Adel Gabr Abdel Razek, 2017)

Calcium: The calcium content was 46.2 mg/100g in sample 1, however it increased significantly to 47.35 mg/100g in sample 2. Increase in calcium level helps to reduce blood pressure particularly in young people (Gabriela Cormick et al., 2019)

Polyphenol:In sample 1 the value of polyphenol was 154.30, whereas there was a considerable decrease to 136.64 in sample 2. Polyphenols improve digestion, blood sugar levels, brain function as well as protect against blood clots, heart disease and certain cancers (Hannah Cory et al., 2018).

Sensory Analysis : Sensory evaluation of the prepared samples was done by 10 members using Hedonic scale. Average value of the result is given in table 2.

Table 1: Proximate analysis of sample 1 and sample 2

Table 2: Sensory Analysis of Sample 1 and Sample 2

CHARACTERISTICS	SAMPLE 1	SAMPLE 2
Appearance	8.5	8.3
Aroma	8.4	8.4
Taste	8	8.2
Texture	7.9	8.5
Overall Acceptability	8.11	8.11

Taste: The mean value of taste in sample 1 and sample 2 was found. The quality attribute is considerably increased in sample 2 than sample 1. It was found using hedonic scale that in sample 1 the average value of taste is 8 and that of sample 2 was 8.2. taste enables the evaluation of foods for toxicity and nutrients while helping us decide what to ingest and it also prepares the body to metabolise foods once thay have been ingested (E Noerhayati et al., 2020)

Texture: Texture also found to be increased in sample 2. Texture is one of the important parameters of sensory analysis. Texture cannot be treated as absence of defect while it should be treated as attribute of freshness, excellence of food preparation and enjoyment of eating. Texture governs the palatability, quality and safety of food (Sarvesh Rustgi, 2020).

From the overall results, it can be noted that the nutritional and sensory attributes of product prepared from malted pearl millet is found to be increased.

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