DEVELOPMENT AND ANALYSIS OF MULTIGRAIN FUNCTIONAL BAKERY PRODUCTS

ABSTRACT

In recent years, Millets have gained recognition for its nutritional resilience, environmental sustainability, and culinary versatility. Multigrain-functional Breads, Buns and Muffins were prepared using the Jowar and Bajra flours in the ratio of 1:1 with addition of dried amla candy as a functional ingredient as 5% of total flour. The data obtained indicated that the proximate composition of bun, bread, muffin for their moisture, fat, Fiber, ash, protein content. The moisture (%) content of bread (14.63%), buns (14.58%), muffin (3.82%) per 100g crude fat (%) content was observed of bread (2.64%), buns (2.50%), muffins (8.06%) per 100g Ash (%) bread (2.64%), buns (2.60%) muffins (2,13%) per 100g crude fibre (%) bread (3.56%), buns (3.66%), muffins (3.82%) per100g crude protein (%) bread (11.68%), buns (11.55%) muffins (12.01%) per 100g. The sensory evaluation table reveals that the appearance of Bread was found to be 8.8 aroma was 7.7, taste was 8.0, mouthfeel scored 8.1 with an overall acceptability of 8.15. The sensory evaluation table further reveals that the appearance of Bun was found to be 8.2 aroma was 7.9, taste was 8.2, mouthfeel scored 8.2 with an overall acceptability of 8.125. The table reveals that the appearance score of Muffin was found to be 7.7, aroma was 8.1, taste was 8.3, mouthfeel scored 8.1 with an overall acceptability of 8.05.

The study concludes that the Jowar and Bajra can be utilized in the bakery industry without blending with refined wheat flour to obtain high degree of sensory acceptability in addition to their nutritional and health benefits. Moreover, dried amla candy can be successfully utilized as a functional as well as aesthetic ingredient to enhance the overall acceptability of millet-based bakery goods.

Keywords: Bajra, Jowar, Amla candy, Functional, Buns, Muffins, Bread, Multigrain

INTRODUCTION :

In recent years, bajra has gained recognition for its nutritional resilience, environmental sustainability, and culinary versatility. Bread is one of the oldest

prepared foods, with a history that dates back thousands of years. It is a staple food in many cultures and has evolved into countless varieties across the globe. Jowar atta can be used in a variety of culinary applications, including baking, cooking, and traditional Indian dishes. The nutritional composition of amla candy, including its macronutrient content, vitamins, minerals, and phytochemicals. Amla is rich in vitamin C, antioxidants, and bioactive compounds such as tannins, flavonoids, and polyphenols, which contribute to its potential health benefits. The process of making amla candy preserves these nutrients, making it a convenient and flavorful way to incorporate amla into the diet. Bajra (*Pennisetum glaucum)*, also known as pearl millet, is an ancient grain cultivated in arid and semi-arid regions of Africa and Asia. In recent years, bajra has gained recognition for its nutritional resilience, environmental sustainability, and culinary versatility. This introduction sets the stage for exploring the nutritional composition, health benefits, and culinary applications of bajra atta, it has potential as a valuable staple food and functional ingredient. Purpose Pearl millet (Pennisetum glaucum) or Bajra is a rich source of nutrients as compared to the major cultivated cereal crops. However, major factors which limit its utilization are the presence of anti-nutritional factors (phytate, tannins and polyphenols) which lower availability of minerals and poor keeping quality because of higher lipase activity. Therefore, this review focuses on the impact of different processing methods on the nutrient composition as well as anti-nutritional components of pearl millet. Design/methodology/approach This is a literature review study from 1983 to 2017, focusing on studies related to pearl millet processing and their effectiveness in the enrichment of nutritional value through reduction of anti-nutritional compounds. Findings From the literature reviewed, pearl millet processing through various methods including milling, malting, fermentation, blanching, and acid as well as heat treatments were found to be effective in achieving the higher mineral digestibility, retardation of off flavor, bitterness as well as rancidity problems found during storage of flour (Rani et al. 2018). Jowar atta can be used in a variety of culinary applications, including baking, cooking, and traditional Indian dishes. It can be used to make rotis dosas, pancakes, cookies, cakes, and more. Its slightly sweet and nutty flavor adds depth to dishes and baked goods, it is making a versatile ingredient in both savory and sweet recipes Adwika, J. M. (2011). The nutritional composition of amla candy, including its macronutrient content, vitamins, minerals, and phytochemicals. Amla is rich in vitamin C, antioxidants, and bioactive compounds such as tannins, flavonoids,

and polyphenols, which contribute to its potential health benefits. The process of making amla candy preserves these nutrients, making it a convenient and flavorful way to incorporate amla into the diet Golechha, M., & Bhatia, J. (2011). The introduction sets the stage by outlining the importance of bread as a staple food and cultural symbol. It provides an overview of the historical development of breadmaking techniques and the evolution of bread varieties across different cultures and civilizations. Furthermore, it highlights the multifaceted nature of bread, encompassing aspects of nutrition, technology, and culture Hamelman, J. (2021).

This section delves into the vast array of bun varieties found across different regions and cuisines. From Asian steamed buns like Chinese baozi and Japanese nikuman to European bread rolls like French brioche and German pretzel buns, each bun variety offers a unique sensory experience rooted in local ingredients, flavors, and culinary techniques Li K. et al . (2020). Smilax perfoliate is a woody climbing plant and widely used in traditional cuisine by many tribes of North-east India. The main objectives of the study were to develop muffins from dried Smilax perfoliate leaf powder and to check its acceptability, shelf life, moisture content and the microbial count of the accepted formulated muffin with its constituent ingredients. For the development of muffins, the ingredients were made into five different formulations in different proportions. For evaluating the acceptability of the developed formulations, the score card method was selected. The qualities taken into consideration were color, appearance, taste, texture, flavor and overall acceptability of food products. The muffins were kept in six plastic bottles for 10-20 days for product development at room temperature. The moisture content was determined by an oven drying method using standard AOAC (1975) procedure. Dates are usually taken as such or with Arabian coffee, milk, or yoghurt. In the processed form, they are consumed as paste, syrup, pickles, jams, jellies, and are used in many bakery or confectionary products together with chocolate, coconut, honey, vinegar, and others (Khatchadourian et al., 1987; El-Shaarawy et al., 1986; Al-Hoti et al., 1997; Besbes et al., 2009). Masmoudi et al. (2010) reported that various types of jellies prepared from date fruit and lemon by-products had less quantity of sugar, decreased pH, and resulted in significantly firmer jellies, with higher adhesiveness, chewiness, cohesiveness, and taste attributes and gave higher sensory evaluation.

Bread is made primarily from flour and water, usually by baking. It can also include ingredients such as yeast or other leavening agents, salt, and other flavourings or enrichments. Sherry, P. R., & Hey, S. J. (2015).

Buns are a type of small, usually round bread roll that can be sweet or Savory. They are versatile and popular in many culinary traditions around the world. Buns can be plain or filled with a variety of ingredients, and they can be used in numerous culinary applications, from snacks to main meals Davidson, A. (2014) Muffins are small, individual-sized baked goods that can be either sweet or Savory. They are characterized by their moist and tender crumb and are typically made using a batter rather than a dough. Muffins are a popular breakfast item and snack due to their convenience, variety, and ease of preparation. They are baked in muffin tins, which give them their distinctive cup-like shape Belitz,et al. (2009).

METHDOLOGY:

All the raw materials were procured from local market Mallana, Ambala, Haryana. The bakery products (bread, buns, muffins) were prepared in the bakery lab of food science Department (MMICT& BH(HM) One staple food that is directly associated with people's daily lives is bread. It is made by baking dough, which is made up of water, flour, and leavening agents. Bread is one of the oldest foods and is enjoyed by people all around the world. The multigrain functional bread was prepared with sorghum millet flour and pearl millet flour in 1:1 ratio. Add all the dry ingredients like yeast, amla candy, baking powder, sugar and salt, mix well and then add a little amount of olive oil in it and knead the dough with warm water. The multigrain functional bun was prepared with sorghum millet flour and pearl millet flour in 1: 1 ratio. Add all the ingredients like like yeast, amla candy, baking powder, sugar and salt, mix well and then add a little amount of olive oil in it and knead the dough with warm water. Let the dough rest and then place it in well-greased moulds. Bake the bread at 150ºC for15 minutes, The multigrain functional bun was prepared with sorghum millet flour and pearl millet flour in 1: 1 ratio. Add all the ingredients like amla candy, baking powder, sugar and salt dried, dates, fresh cream and vanilla essence and add butter mix the all ingredients and make the batter and pour in the Molds. Bake the muffins at 180ºC for 15 minutes. The data present in table indicates that the proximate composition of bun, bread, muffin for their moisture, fat, Fiber,

ash, protein content. The moisture (%) content of bread (14.63%), buns (14.58%), muffin (3.82%) per 100g crude fat (%) content was observed of bread (2.64%), buns (2.50%), muffins (8.06%) per 100g Ash (%) bread (2.64%), buns (2.60%) muffins (2,13%) per 100g crude fibre (%) bread (3.56%), buns (3.66%), muffins (3.82%) per100g crude protein (%) bread (11.68%), buns (11.55%) muffins (12.01%) per 100g. Muffins are cereal based bakery products characterized by a typical porous structure and high volume which confers a spongy texture (Martinez et al., 2012). A muffin batter is a complex mixture of interacting ingredients; which is consisted of high level of sugar and variable levels of fat, flour, egg, emulsifier, milk powder, preservative and baking powder. For getting a desired spongy texture, stable batter with many small air bubbles is required. The bun was prepared by blending wheat flour with de-oiled maize germ flour (DMGF) in different combinations. The different proportions of DMGF at 5, 10, 15, 20, and 25% levels were mixed with wheat flour. The composition, physical properties, color, texture, and sensory evaluation were analyzed for de-oiled maize germ (DOMG)-fortified flour bun Date, the fruit of date palm, can be considered as an ideal food that provides a wide range of essential nutrients with many potential health benefits. Traditionally, dates have been considered as the staple food in the Arab Gulf regions (Erskine et al., 2004). Bread is one of the oldest prepared foods, with a history that dates back thousands of years. It is a staple food in many cultures and has evolved into countless varieties across the globe. Bread is made primarily from flour and water, usually by baking. It can also include ingredients such as yeast or other leavening agents, salt, and other flavourings or enrichments. Sherry, P. R., & Hey, S. J. (2015).

OBJECTIVES OF THE STUDY:

The main objectives of the study were to developed muffins from dried Smilax perfoliate leaf powder and to check its acceptability, shelf life, moisture content and the microbial count of the accepted formulated muffin with its constituent ingredients. For the development of muffins, the ingredients were made into five different formulations in different proportions. For evaluating the acceptability of the developed formulations, score card method was selected. The qualities taken into consideration were colour, appearance, taste, texture, flavour and overall acceptability of food products. The muffins were kept in six plastic bottles for 10-20 days for

product development at room temperature. The moisture content was determined by oven drying method using standard AOAC (1975) procedure.

PREPARATION OF MULTIGRAIN -FUNCTIONAL BREAD:

One staple food that is directly associated with people's daily lives is bread. It is made by baking dough, which is made up of water, flour, and leavening agents. Bread is one of the oldest foods and is enjoyed by people all around the world.

The multigrain functional bread was prepared with sorghum millet flour and pearl millet flour in 1:1 ratio. Add all the dry ingredients like yeast, amla candy, baking powder, sugar and salt, Mix well and then add a little amount of olive oil in it and knead the dough with warm water. Let the dough rest and then place it in well-greased moulds. Bake the bread at 105ºC FOR 15 minutes,

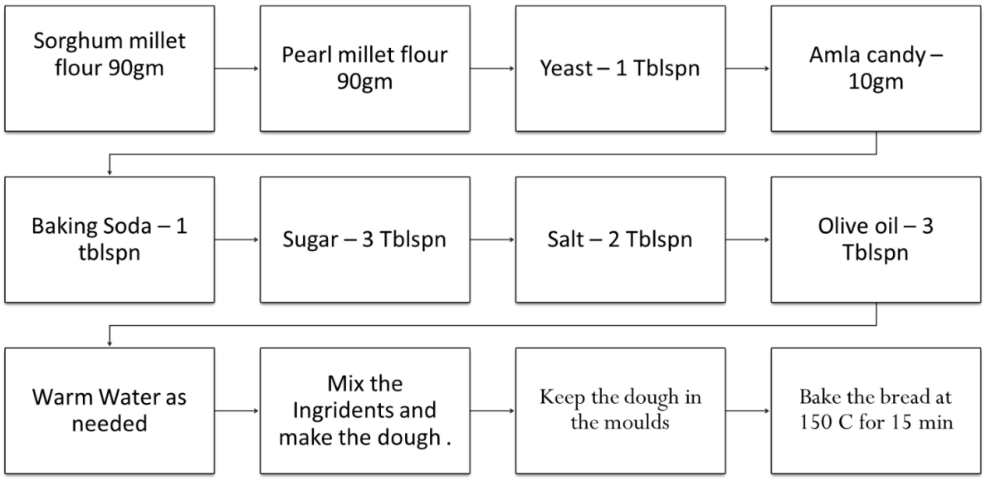

Fig 1: Process flow chart of preparation of multigrain bread

Image 1: Multigrain Functional bread

PREPARATION OF MULTIGRAIN -FUNCTIONAL BUNS:

Buns are small, round, or oblong bread rolls that are often slightly sweetened and can be either plain or filled with various ingredients. They are made from a dough of flour, water or milk, yeast, sugar, and fat (such as butter or oil), which is then baked or steamed. Buns can be Savory or sweet and are a versatile component of many cuisines, serving as the base for sandwiches, the wrapper for Savory fillings, or a sweet treat with or without toppings.

The multigrain functional buns were prepared with sorghum millet flour and pearl millet flour in 1: 1 ratio. Add all the ingredients like like yeast, amla candy, baking powder, sugar and salt, mix well and then add a little amount of olive oil in it and knead the dough with warm water. Let the dough rest and then place it in well-greased moulds. Bake the bread at 150ºCfor15minutes.

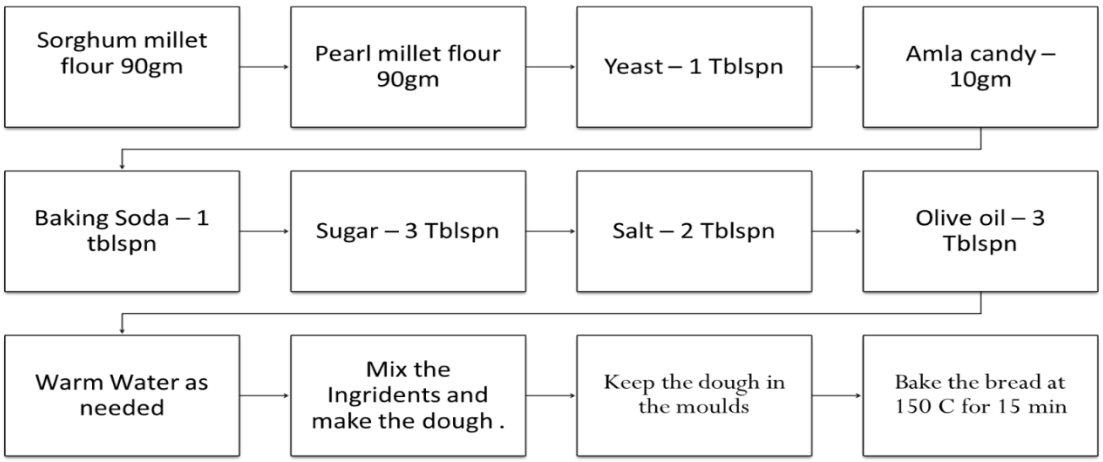

Fig2 : Process flow chart of preparation of multigrain buns

Image 2: Multigrain Functional Buns

PREPARATION OF MULTIGRAIN-FUNCTIONAL MUFFINS:

Muffins are small, individual-sized baked goods that are typically leavened with baking powder or baking soda rather than yeast. They can be either sweet or Savory and are characterized by a moist and tender crumb. Sweet muffins often contain ingredients such as fruit, chocolate chips, nuts, or spices, while Savory muffins might include cheese, vegetables, or meats. Muffins are baked in a muffin tin, which gives them their distinctive cup-like shape.

The multigrain functional bun was prepared with sorghum millet flour and pearl millet flour in 1: 1 ratio. Add all the ingredients like amla candy, baking powder, sugar and salt dried, dates, fresh cream and vanilla essence and add butter mix the all ingredients and make the batter and pour in the Molds. Bake the muffins at 180ºC for 15 minutes.

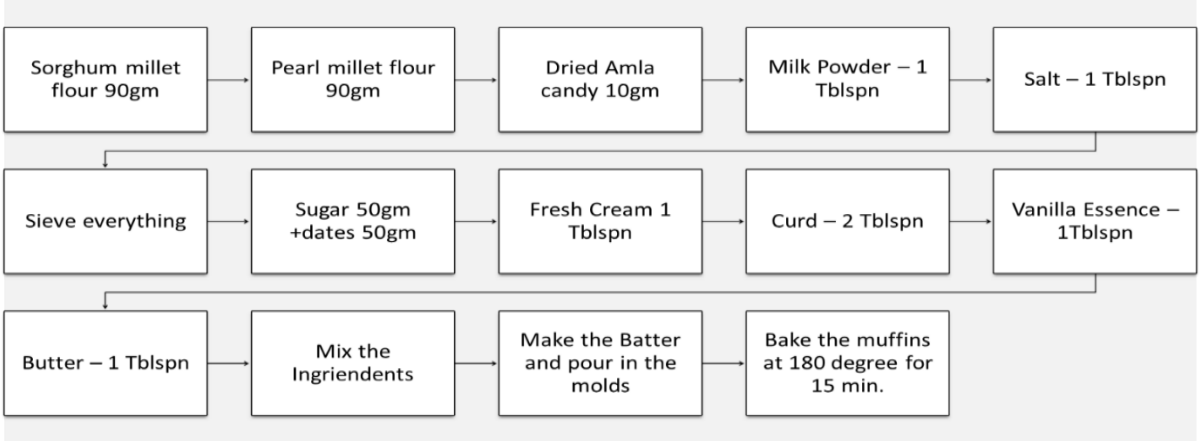

Fig 3: Process flow chart of preparation of multigrain muffins

Physico-chemical analysis of prepared multigrain functional bakery products (moisture, ash, fat, Fiber, protein)

1. Moisture content

   To determine the moisture content of the material *is heated under carefully specified temperature and the loss of weight is* taken as a measure of the moisture content of the sample.

   % Moisture content = W2-W1×100 / W

   Where, W2 = Weight of the sample after drying

   W1 = Weight of the sample before drying

W = Initial weight of the sample

2. Ash content

The weight loss that results from the sample completely oxidizing at a high temperature of 500 to 600°C due to the combustion and volatilization of organic components is used to calculate the amount of ash present.

Weigh precisely three grams of the material in the dish that has already been dried in an air oven. First, heat the dish gently over a flame, and then vigorously in a muffle furnace at 550±10°C until it turns grey. Weigh after the food has cooled in a desiccator.

Reheat the dish for 30 minutes at 550±10°C. Utilizing a desiccator, cool the dish and weigh

% Ash content = W2-W1× 100 / W

Where, W2 = Weight of the sample after ashing

W1 = Weight of the sample before ashing

W = Initial weight of the sample

3. Fat content

A sample's fat content is generally determined quantitatively by means of extraction using a lipophilic solvent. The free fat is recorded by direct extraction, without prior digestion.

The most commonly used extraction method is solid/liquid extraction. The prepared sample is extracted using the solvent. After extraction, the solvent is evaporated and the dried residue is weighed. The free fat content is calculated from the difference between the initial sample weight and the output weight.

% Fat content = W2-W1× 100 / W

Where, W2 = Weight of the thimble after drying with sample

W1 = Weight of empty thimble

W = Initial weight of the sample

4. Fiber content

The term "crude Fiber" describes the insoluble residue left over from boiling diluted acid and alkali in turn. Weeden's method yields a residue consisting of the resistant portion of carbohydrates and the ash (mineral matter) of the feed after the

sample is digested in an acidic and alkaline solution. The organic stuff in the residue oxidizes when it is burnt, leaving behind inorganic residue, or ash. Therefore, the weight of crude fiber can be determined by comparing the weight of the residue before and after ashing.

% Fiber content == W2-W1× 100 / W

Where, W2 = Weight of crucible + sample after ashing

W1 = Weight of crucible + sample before ashing

W = Initial weight of the sample

5. Protein content

Strong acids are used to digest food, releasing nitrogen that can be measured using an appropriate titration method. Next, using the food's nitrogen content as a starting point, the amount of protein is determined. Even with several advancements to expedite the procedure and produce more precise results, the fundamental methodology remains the same. It is typically regarded as the accepted technique for figuring out protein concentration. A conversion factor (F) is required to translate the reported nitrogen concentration to a protein concentration because the Kjeldahl method does not directly assess the protein content. Many applications utilize a conversion factor of 6.25, which is equivalent to 0.16 g nitrogen per gram of protein; nevertheless, this is merely an average figure, though, as each protein has a unique conversion factor based on the arrangement of its amino acids. Three easy processes make up the Kjeldahl method: titration, neutralization, and digestion.

% Nitrogen = 14.01×0.1N×(TV-BV) ×100/W×100

%Protein = %N×6.25

Where, 14.01 = Molecular weight of ammonia

0.1N = Titration solution’s normality

TV =Titre Value

BV = Blank Value

W = Sample Weight

Protein Factor = 6.25

SENSORY EVALUATION:

The 9-point hedonic scale was used to evaluate the sensory characteristics of biscuits, according to Mahony (2017). There are nine categories that comprise the degree of affection, ranging from "dislike highly" to "like exceedingly." In order to facilitate statistical analysis, these categories were given numerical values, with "dislike extremely" obtaining a value of 1 and "like greatly" receiving a value of 9. Because some consumers may perceive a rating of 5 as neither liked nor hated, while others may rate it as mildly liked, it is vital to communicate both the number and the indicator of that specific number to the consumers in order to enable them to evaluate the product.

People's reactions to the product are therefore influenced by cognitive variations among the population. There should be explicit instructions about each number and what it means in order to obtain a uniform response and use the data for future compilation and statistical analysis.

RESULTS AND DISCUSSION:

The results obtained in the present investigation entitled “development and analysis of multigrain functional bakery products” is summarized and discussed for their significance under suitable heading.

The data present in table indicates that the proximate composition of bun, bread, muffin for their moisture, fat, fiber, ash, protein content.

Products	Total moisture (%)	Crude fat (%)	Crude Fiber (%)	Total ash (%)	Crude protein (%)
BREAD	14.63%	2.64%	3.56%	2.64%	11.68%
BUNS	14.58%	2.50%	3.66%	2.60%	11.55%
MUFFINS	3.82%	8.06%	3.82%	2.13%	12.01%

TABLE 1 : Proximate composition of multi-grain functional bakery products

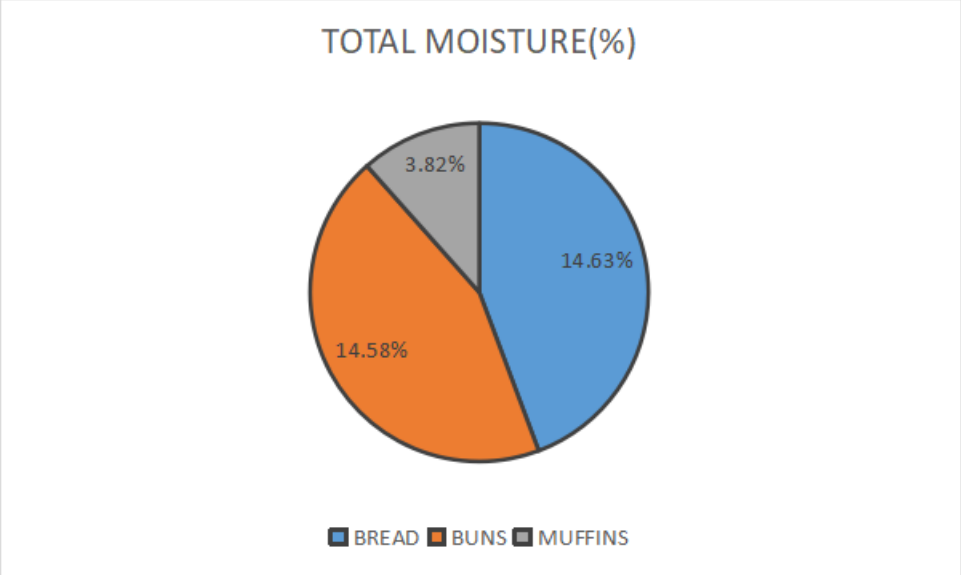

Figure 4 : Pie chart showing total moisture content

The moisture (%) content was found to be: bread (14.63%), buns (14.58%), muffin (3.82%) per 100g

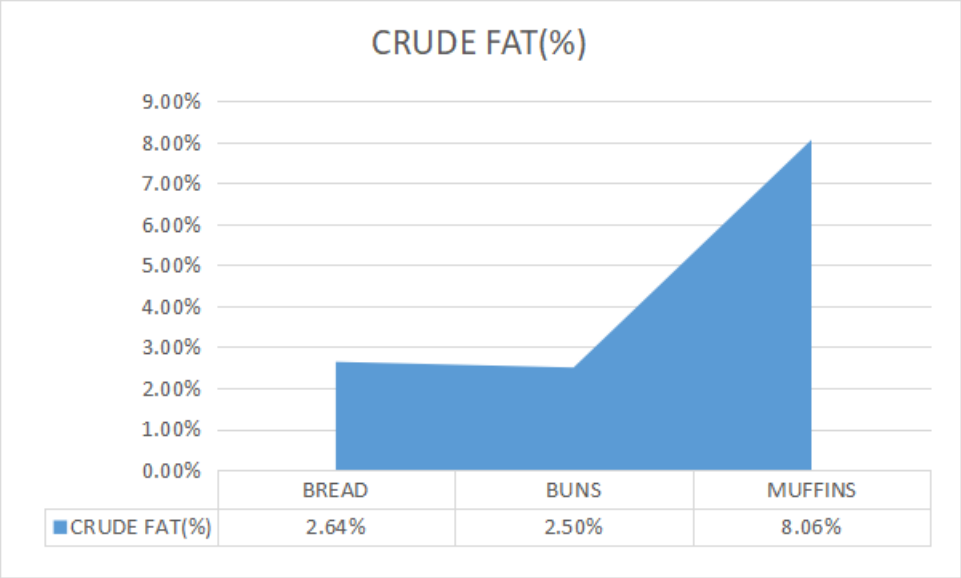

Figure 5 : Graph showing percentage of crude fat

The content of crude fat (%)was found as follows bread (2.64%), buns (2.50%), muffins (8.06%) per 100g.

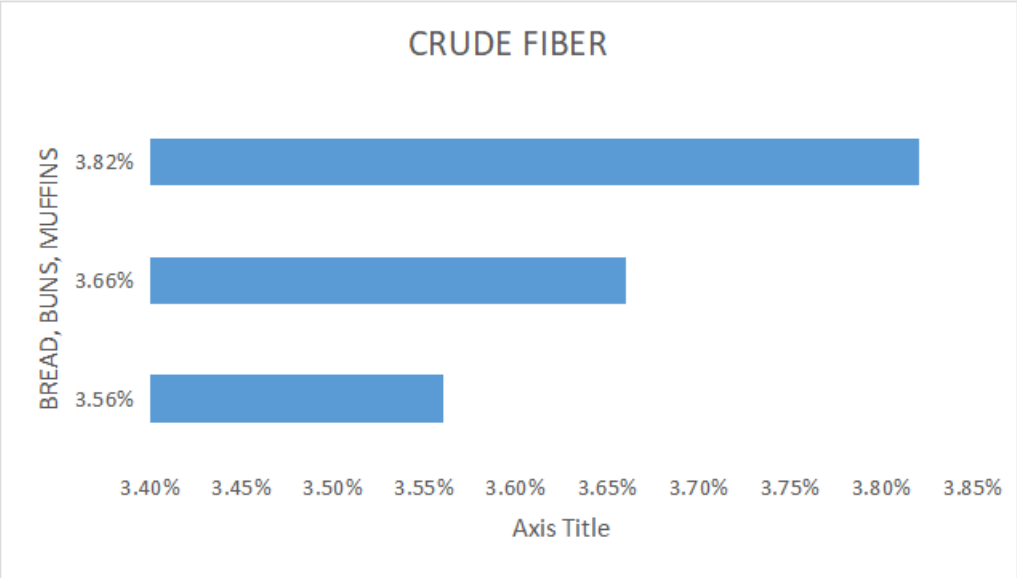

Figure 6 : Graph showing percentage of crude fiber

The content of crude fibre (%) was found as bread (3.56%), buns (3.66%), muffins (3.82%) per100g

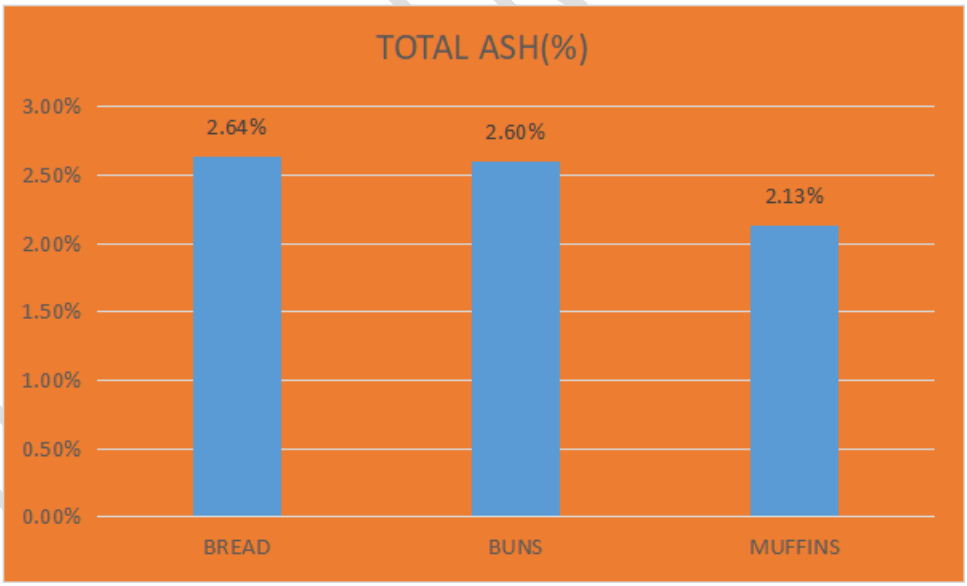

Figure 7 : Graph showing percentage of total ash

Ash (%) content was found to be: bread (2.64%), buns (2.60%) muffins (2,13%) per 100g

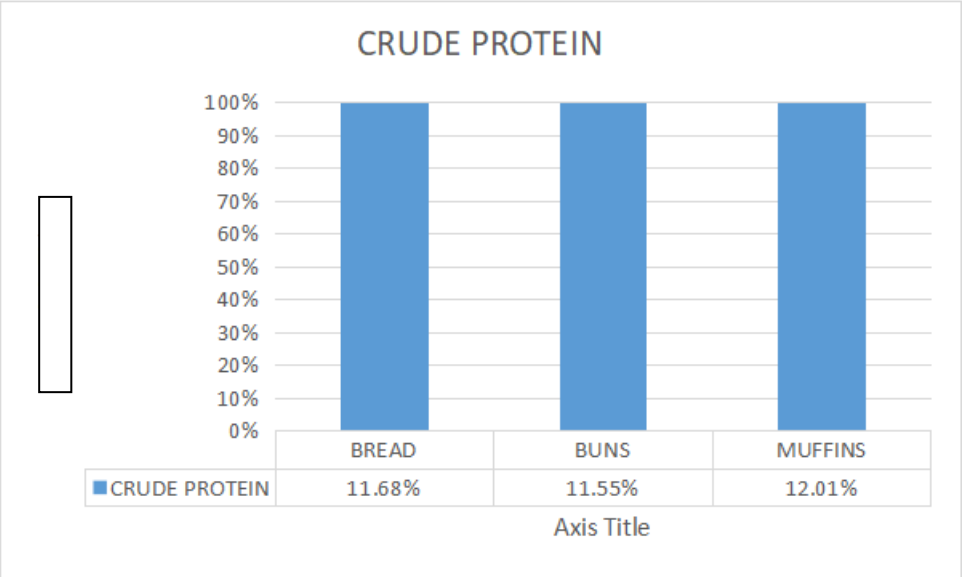

Figure 8 : Graph showing percentage of crude protein

The crude protein (%) content in bread (11.68%), buns (11.55%) muffins (12.01%) per 100g.

According to Yaqoob et al et al., (2019) The difference was found between Iron (11.25) Moisture (29.98), Energy (147.9), Protein (69.63), Carbohydrate (51.75), Calcium (82.19) and Fibre (4.68), content of control and best treatment. Non-significance difference was found for Fat (0.68) and Ash (2.45) content of control and best treatment. Incorporation of multigrain flour and fruit pulp/juice utilized in different ratio for product development and their standardization results to improve nutritional content of Muffins. It was concluded that its nutritional composition as per 100g was found to be rich in Calcium, Iron, Fiber, Carbohydrate and Protein was found to be rich in treatment T_5 (40:25:35) as compared to control T_0 due to multigrain flour (Ragi flour, Bajra flour, oats, maize flour) and fruit pulp/juice (pineapple and orange). multigrain flour can provide more nutrient and antioxidant.

The nutritional analysis of the poori produced with the various blends shown in CF6 (19.5%) had the largest calorie (432 kcal), protein (43%), fat (19.5%), and fibre (3.7%) content, while CF1 (69.4%) had the highest carbohydrate content and the lowest levels of protein (12%) and fat (2.7%). The higher percentage of fat absorbed in CF6 may be attributable to the higher fibre content. The amount of water retained in the blend was strongly correlated with the amount of fat absorbed during frying.

Additionally, soy flour itself includes a significant amount of oil, which accounts for the maximum oil recorded in CF6. Changes in fibre content can be the cause of the shift in the moisture percent.

In the nutritional analysis, the poori made with the different blends, CF6 (19.5%) had the highest percentage of calories (432 kcal), protein (43%), fat (19.5%), and fibre (3.7%), while CF1 (69.4%) had the highest percentage of carbohydrates and the lowest percentages of fat (2.7%) and protein (12%). It's possible that CF6's higher fibre content accounts for its higher fat absorption percentage. The amount of water retained in the blend and the amount of fat absorbed during frying were found to be highly associated by Smith, A. F. (2013). The greatest oil reported in CF6 is also attributed to the substantial oil content of soy flour itself. The variation in the moisture percentage may be due to changes in the fibre content.

SENSORY EVALUATION:

The sensory table shows the sensory acceptability and consumer intention assessment using 9 – point hedonic scale. The sensory panel was of a cohort of 30 participants, including faculty member, research expert, chiefs, and research scholars of MMDU, Mullana, Ambala. All the participants were healthy.

PRODUCTS	APPEARANCE	AROMA	TASTE	TEXTURE/ MOUTHFEEL	OVERALL ACCEPTABILITY
(BREAD)	8.8	7.7	8.0	8.1	8.15
(BUNS)	8.2	7.9	8.2	8.2	8.125
(MUFFINS)	7.7	8.1	8.3	8.1	8.05

TABLE 2 : Sensory attributes of functional bakery products

The sensory evaluation table reveals that the appearance of Bread was found to be 8.8 aroma was 7.7, taste was 8.0, mouthfeel scored 8.1 with an overall acceptability of 8.15. The sensory evaluation table further reveals that the appearance

of Bun was found to be 8.2 aroma was 7.9, taste was 8.2, mouthfeel scored 8.2 with an overall acceptability of 8.125. The table reveals that the appearance score of Muffin was found to be 7.7, aroma was 8.1, taste was 8.3, mouthfeel scored 8.1 with an overall acceptability of 8.05.

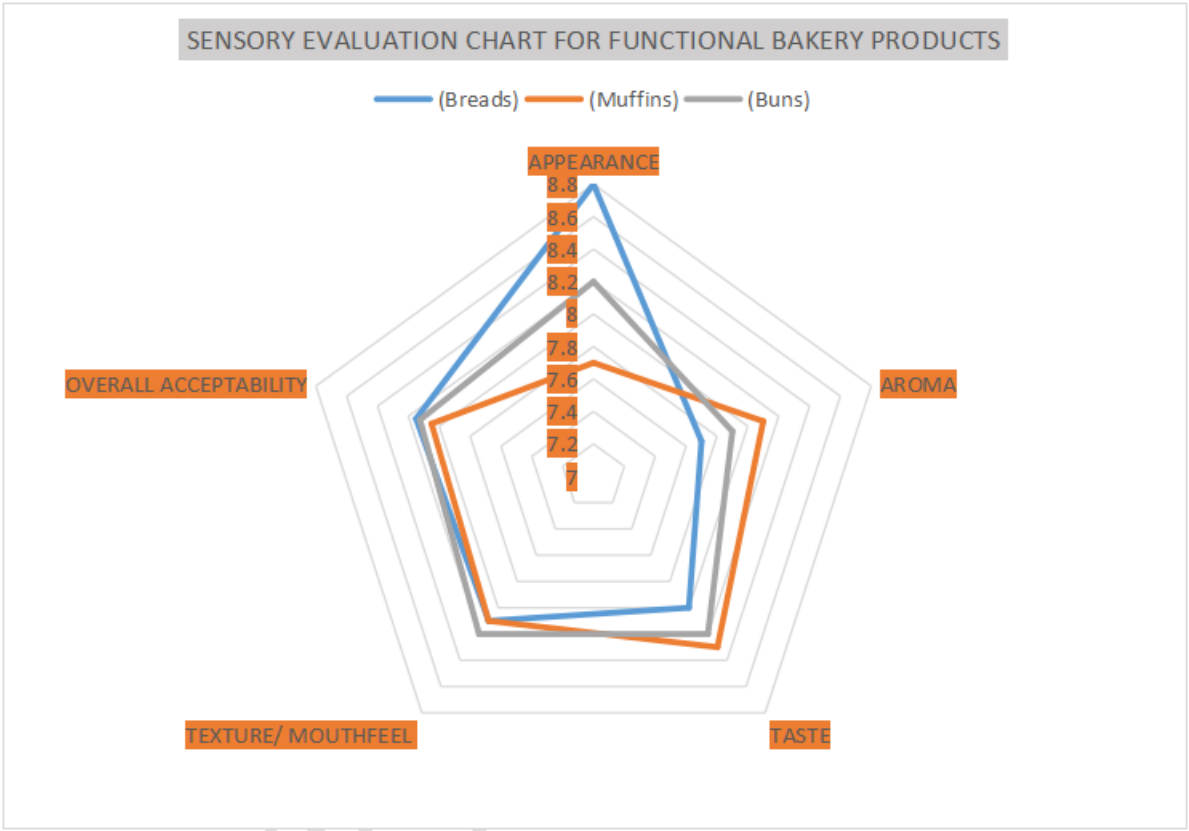

Figure 9: SENSORY EVALUATION CHART FOR MULTI-GRAIN FUNCTIONAL BAKERY PRODUCTS

A sensory evaluation of muffins made with multigrain flour and fruit pulp/juice revealed that, based on the overall acceptability mean score of the muffins, treatment T5 (8.5) received the highest score, followed by treatments T0 (8.2), T1 (6.6), T2 (6.6), and T3 (7.1), T4 (8.1), in that order. According to the panel's nine-point hedonic scale, T5 is the most preferred option. This is followed by Colour and Appearance, Body and Texture, Taste and Flavour Overall acceptability of Cookies was recorded more than 8.0 Malshe *et al.*, (2014) concluded that the acceptance of blended healthy gluten free high protein) flour; our aim was to standardize an innovative, preservative free, simple, nutritional blend that is coast effective.

CONCLUSION:

The above study concludes that the Jowar and Bajra can be utilized in the bakery industry without blending with refined wheat flour to obtain high degree of sensory acceptability in addition to their nutritional and health benefits. Moreover, dried amla candy can be successfully utilized as a functional as well as aesthetic ingredient to enhance the overall acceptability of millet-based bakery goods. These products can be commercialized for the benefit of human health.

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

Option 2:

Author(s) hereby declare that generative AI technologies such as Large Language Models, etc have been used during writing or editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology

Details of the AI usage are given below:

1.

2.

3.

References:

1. Al-Hooti, S., Sidhu, J.S., and Qabazard, H. 1995. Studies on the physico-chemical characteristics of date fruits of five UAE cultivars at different stages of maturity. Arab Gulf Journal of Scientific research 13: 553–569.
2. AOAC, Official methods of analysis of association of official analytical chemists, (Association of Official Analytical Chemists, Arlington, Virginia, USA), 2007

3. Beitz, H.-D., Grosch, W., & Schieble, P. (2009). *Food Chemistry.* Springer. - Provides scientific details on the chemistry of baking and the ingredients used in muffins

4. Besbes, S., Drira, L., Blecker, C., Deroanne, C., and Attia, H. 2009. Adding value to hard date (Phoenix dactylifera L.): Compositional, functional and sensory characteristics of date jam. Food Chemistry 112: 406–411.

5. Davidson, A. (2014). *The Oxford Companion to Food.* Oxford University Press. Offers historical and cultural insights into the development and significance of muffins.

6. El-Shaarawy, M.I., Mesalam, A.S., El-Nakhal, H.M., and Wahdan, A.N. 1986. Studies on extraction of dates. Proceedings of the 2nd Symposium on the Date Palm in Saudi Arabia. II, pp. 259–270, 3–6 March, 1986.

7. Goletcha, M., & Bhatia, J. (2011). Arya, D. S. Studies on effects of Emblica officinalis (Amla) on oxidative stress and cholinergic function in scopolamine induced amnesia in mice. Journal of Environmental Biology, 32(4), 477–485.

8. Hamelman, J. (2021). *Bread* (3rd ed.). Wiley. Retrieved from https://www.perlego.com/book/3865668 (Original work published 2021)

9. Khatchadourian, H.A., Sawaya, W.N., Ayaz, M., and Al-Mohemmed, M.M. 1987. Processing date varieties into pickles. International Journal of Food Science and Technology 22: 243–247.

10. Li. Kun, Min Zhang , Bhesh Bhandari, Jicheng Xu and chouhi Yang (2020). Improving storage quality of refrigerated steamed buns by mung bean starch composite coating enriched with nano-emulsified essential oils. Journal of Food Process Engineering 43(1). DOI: 10.1111/jfpe.13475.

11. Malshe D , Velani D and Shekhar A (2014). A study of a multigrain gluten free and protein rich flour – meal to heal. International journal of food and nutritional sciences. 3(3). 167-171.

12. Martínez-Cervera, S. & Sanz, Teresa & Salvador, Ana & Fiszman, Susana. (2012). Rheological, textural and sensorial properties of low-sucrose muffins reformulated with sucralose/polydextrose. LWT - Food Science and Technology. 45. 213-220. 10.1016/j.lwt.2011.08.001.

13. Masmoudi, M., Besbes, S., Blecker, C., and Attia, H. 2010. Preparation and characterization of jellies with reduced sugar content from date (Phoenix dactylifera L.) and lemon (Citrus limio L.) by-products. Fruits 65: 21–29.

14. Rani S, Singh R, Sehrawat R, Upadhyay A. and Kaur B.P. (2018) Pearl millet processing: a reviewNutrition & Food Science 48(3):00-00DOI: 10.1108/NFS-04-2017-0070

15. Sherry, p. R., & hey, s. J. (2015). The contribution of wheat to human diet and health.*food and energy security*. 4 (3), pp. 178-202. Https://doi.org/10.1002/fes3.64.

16. Yaqoob M, Aggarwal P and Ahluwalia P (2019). Enhanced functional properties and shelf stability of muffins by fortification of kinnow derived phytochemicals and residues.Think India Journal. 22(37). pp 1421-45.