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INCORPORATION OF BATHUA LEAVES (*CHENOPODIUM ALBUM)* AND GARDEN CRESS SEEDS FOR THE PREPARATION OF VALUE-ADDED BAKERY PRODUCT

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Key words*: Bathua leaves, Garden cress seeds, Bajra millets, Cinnamon herbs, Pita bread, Dehydrated.*

Abstract– Bathua leaves and Garden cress seeds are incorporated with Bajra millets and Cinnamon herbs for the development of value-added food product and the acceptability of the prepared product. The product Pita bread was prepared by incorporating Bathua leaves powder, Garden cress seeds powder, Bajra flour, and Cinnamon powder served as treatments T_1, T_2, and T_3 respectively, T_0 without incorporation of dehydrated leaves, and coarse grains served as control. The organoleptic evaluation was carried out using the nine-point hedonic scale. Based on the findings, it was observed that T_2 was found to be best with regard to color, texture, taste, and overall acceptability. The addition of prepared leaves and seed powder, as well as Bajra flour, led to an increase in the chemical composition of the T_2 product. The Pita bread had a moisture content of 30.9%, an ash content of 1.26 g per 100 g, and a protein content of 17.6 g per 100 g. The fat content was 18.82 g per 100g, while the fiber content was 1.6 g per 100g. The product also contained 2.43/100g of iron and 26 mg/100g of calcium. The carbohydrate content in the product was 52.67 g per 100g, and the energy content was 450.12 kcal per 100 g. Additionally, the DPPH radical scavenging activity was found to be 76.7%. At the current cost of raw materials, the price of Pita Bread per 100 g of dry ingredients was T_0 (control) at Rs. 7.79, while T_1 was priced at Rs. 11.65. T_2 was priced at Rs. 13.03, and T_3 was priced at Rs. 14.31. Thus, it can be concluded that Bathua leaves, and Garden cress seeds can be incorporated in the preparation of different food products to improve their nutritional properties and sensory acceptability.

INTRODUCTION

Micronutrient deficiencies are a significant global health issue, particularly in low- and middle-income countries like India. These deficiencies can lead to serious health consequences and are often exacerbated by limited access to a balanced diet. To address this problem, various organizations are implementing programs and conducting research on indigenous plants and seeds to improve nutrition intake and overcome micronutrient deficiencies. Bathua leaves (*Chenopodium album* L.), a green leafy vegetable, are rich in vitamins, minerals, and antioxidants, and have potential therapeutic benefits. These leavesmay possess anti-inflammatory and anti-cancer properties. Some studies have suggested that bathua leaves may have cholesterol-lowering and blood sugar-regulating effects, making them potentially beneficial for individuals with high cholesterol or diabetes (Kaur and Kaur, 2018) suggest that dehydrated bathua leaves could be an economical and highly nutritious alternative to overcome micronutrient deficiencies, especially among vulnerable sections of society. Garden cress seeds (*Lepidium sativum*), on the other hand, are small edible seeds that offer high nutritional value (John *et al.,* (2020) concluded that garden cress seeds are more acceptable when incorporated in cutlets than consumed as such since it forms a mucilaginous or gel-like appearance which gives an unpleasant taste and aroma. They are incorporated into dishes like cutlets and have shown promising potential in addressing protein-energy malnutrition and anemia. Bajra, or pearl millet, is a cereal grain commonly consumed in India and other regions, offering significant nutritional value and potential therapeutic properties. It is gluten-free and rich in fiber, vitamins, minerals, and antioxidants.

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Bajra is comparable and even superior in some of the nutritional characteristics to major cereals with respect to its energy value, protein, fat, and minerals (Anu *et al.*, 2007). Cinnamon (Cinnamomum verum), a widely used spice, is known for its potential health benefits such as anti-inflammatory, antimicrobial, and blood sugar-regulating properties (Nabavi *et al.*, 2015) concluded that Cinnamon has the ability to combat bacteria stemming from its bioactive phytochemicals, such as cinnamaldehyde and eugenol. These indigenous plants, seeds, and spices play a crucial role in improving nutrition and addressing micronutrient deficiencies in underdeveloped regions. Therefore, the purpose of this study wasto develop value-added food products incorporating Bathua leaves, Garden cress seeds, Pearl millets, and Cinnamon, and evaluate their sensory attributes. Additionally, the nutritional composition and antioxidant activity of the developed food product will be assessed, and the cost of production will be determined.

MATERIALS AND METHODS

The present investigation was carried out in the Nutrition Research Laboratory of Food Nutrition and Public Health Department, Ethelind College of Home Science, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, UP. Raw materials such as Bathua leaves, Garden cress seeds, Bajra flour, and Cinnamon are required for the formulation of value-added food product purchased from the local markets of Prayagraj.

Preparation of powder from Bathua leaves

(Source- Srivastava and Kumar, 2009)

Preparation of Food product

Preparation of food product such as Pita bread made by the incorporation of bathua leaves powder, garden cress seeds powder, cinnamon powder, and other raw materials. For each basic recipe (control T_O) has three variations T_1(Maida + bajra flour + Bathua leaves powder + Garden cress seed powder+ cinnamon powder in the ratio of 69:20:6:4:1), T_2 (Maida + bajra flour +Bathua leaves powder + Garden cress seed powder+ cinnamon powder in the ratio of 56:30:8:5:1), T_3, (Maida + bajra flour + Bathua leaves powder+ Garden cress seed powder+ cinnamon powder in the ratio of 43:40:10:6:1), respectively, where the amount of one or more ingredients is varied. The ingredients used for the preparation of pita bread are Refined wheat flour, salt, sugar, refined oil, and instant yeast.

Sensory evaluation

Sensory evaluation of the food product for its acceptability will be done by a panel of 5 Judges. The scorecard based on the 9-point Hedonic Scale will be used for sensory evaluation based onthe evaluation of attributes like Colour and Appearance, Body and Texture, Taste and Flavour, and overall acceptability of the developed food product (Srilakshmi, 2007).

Chemical analysis

Proximate composition viz. moisture, ash, crude protein, crude fat, crude fiber, was analyzed by standard methods (AOAC, 1980). The moisture content of raw and processed leaves was determined by drying the samples in a Hot air oven at 105 °C. Total Ash content was estimated using a muffle furnace. Protein was calculatedby Lowry's Method. Crude fat was extracted with petroleum ether, using a continuous extractor (Soxhlet Method) and for fibre, acid-alkali washing was given (Extraction Method). The available carbohydrates were calculated by adding the value of moisture, crude protein, crude fat, fibre, and ash which was then subtracted from 100 (Calculation Method). Gross energy was computed with the help of the formula [Gross Energy (Crude protein× 4) + (Crude fat × 9) + (Carbohydrate × 4)]. Calcium was determined by Titration Method and iron was determined by the colorimetric method. Antioxidant Activity of the developed food products was done by the DPPH(2,2-diphenyl-1-picrylhydrazyl)

METHODS

Cost calculation: The cost of the prepared product was calculated by taking into account the cost of individual raw ingredients used in the preparation of food product as the prevailing market price.

Statistical analysis

The data was analysed by analysis of variance technique (ANOVA), Critical Difference and statistical analysis methods and interpreted the data (Gupta *et al.*, 2002).

RESULTS AND DISCUSSION

Sensory evaluation of prepared product 'Pita Bread'

The study incorporated Bathua leaves powder, Garden cress seed powder, Bajra flour, and Cinnamon powder into the basic recipe of "Pita Bread," with refined wheat flour as a control. Three treatments were made with varying ratios of the ingredients, namely T_1, T_2 and T_3. Fig. 1 illustrated that T_2 received the highest score for colour and appearance, body and texture, taste and flavour, and overall acceptability, followed by T_1 and T_3. The results of this study are consistent with the findings of Gupta *et al.* (2015), whose objective was to incorporate micronutrient-rich indigenous coarse grains and green leafy vegetables into parathas to increase their nutritional value while maintaining high sensory quality. The study showed that micronutrient-rich indigenous foods can be successfully incorporated into various food products, resulting in health benefits. The study also found that the highest sensory scores were achieved by incorporating a dehydrated green leafy vegetable mix powder at a ratio of 10:5:5 and 10:10:10 percent of coarse grains.

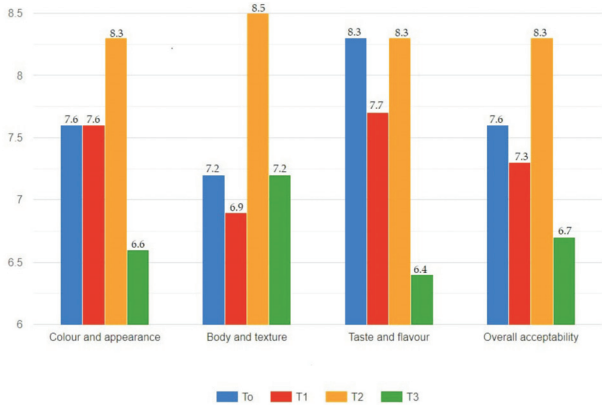

Fig. 1. Average sensory scores for different attributes of 'Pita Bread'

Nutritional composition of Developed product 'Pita Bread'

Table 1 demonstrates the differences between the control and the best treatment samplei.e., the moisture content of the developed product decreases as a result of incorporating dehydrated Bathua leaves and reducing the amount of refined wheat flour. On the other hand, the ash, protein, fat, and crude fiber content increase due to the inclusion of garden cress seeds, which are a good source of these nutrients. The carbohydrate content of T_2 decreases due to the addition of garden cress seed powder, which has a lower carbohydrate content. However, the energy, iron, calcium, and antioxidant properties increase as a result of a higher level of incorporation of Bajra flour and Bathua leaves. For the t(tabulated) value at 5% was 4.303 and all nutrients resulted as satisfactory. The results of this study are consistent with the findings of Gupta and Paul (2012), whose research aimed to enhance the nutritional value of value-added snacks by using coarse grains. The study found that Bajra, one of the coarse grains used, was comparable to or even superior to major cereals in terms of energy value, protein, fat, and minerals. The nutritional evaluation showed that Thalipeeth had the highest moisture

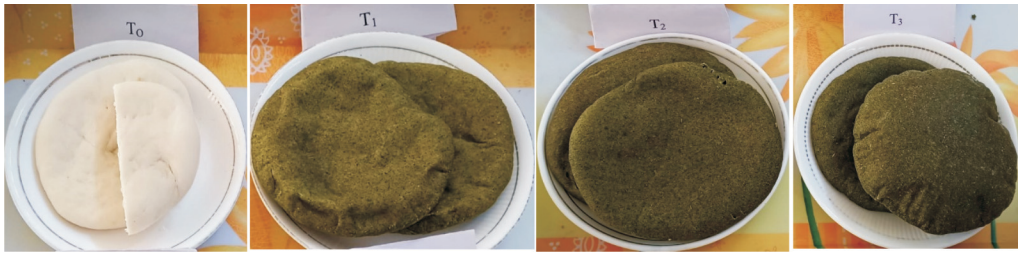

Plate 1. Developed value-added Pita Bread

Table 1: Ratio of ingredients for making formulated Pita Bread

Treatments	Refined wheat flour	Pearl millet (Bajra)	Bathua leaves powder	Garden cress seeds powder	Cinnamon powder
T_o	100	-	-	-	-
T_1	69	20	6	4	1
T_2	56	30	8	5	1
T_3	43	40	10	6	1

Table 2. The average nutritional composition of control and best treatment sample of 'Pita Bread' per 100g.Top of Form

Nutrients	(T_0)	(T_2)	Difference(T_2-T_1=D)	t(calculated)
Moisture (%)	18.1	15.9	2.2	17.93
Ash(g)	0.44	1.26	0.82	68.01
Protein (g)	10.03	17.6	7.57	71.16
Fat (g)	13.78	18.82	5.04	5.59
Crude fibre (g)	0.3	1.6	1.3	36.66
Carbohydrate(g)	68.82	52.67	16.14	30.75
Energy (kcal)	440.5	450.12	9.62	13.7
Iron (mg)	1.53	2.43	0.9	9.06
Calcium (mg)	15.7	26	10.3	22.34
DPPH radical scavenging activity (%)	21.03	76.7	13.67	36.36

t(tabulated) value at 5% = 4.303, Result = Satisfactory.

content (47.34%) and ash content (1.5%), while protein content was similar in all four products, with the highest found in Gatta (7.7%). Laddo had the highest carbohydrate content (59.69%), iron (3.08mg), calcium (59.34 mg), and energy (466kcal), followed by Pua, Gatta, and Thalipeeth, respectively. Finally, fat content was highest in Laddo (22.3%) and Pua (22.3%), followed by Thalipeeth (7.3%) and Gatta (7.6%). The findings of this study are consistent with the results of Ragaee *et al.*, (2006), who evaluated the antioxidant properties of whole grains and wheat flours based on their scavenging activity for DPPH(2,2-diphenyl-1-picrylhydrazyl) radicals and ABTS (2,22-azino-bis-(3-ethylbenzothiazoline-6-sulfonic) acid) radical cations using grain methanolic extracts. The study found that Pearl millet had a DPPH scavenging activity of 21.0 μmole/g, indicating that it contained reasonable levels of antioxidant properties. The study suggests that incorporating such materials into bakery product could enhance their nutritional and physiological properties, but their functionality and acceptability must also be taken into consideration.

Cost of the prepared product 'Pita Bread'

At the prevailing cost of raw materials, the Pita Bread's cost per 100g of dry ingredients was Rs. 7.79 for the control recipe (T0). For T1, the cost increased to Rs. 11.65 per 100g of dry ingredients, indicating a higher expense compared to the control. T2 had a further cost increase, reaching Rs. 13.03 per 100g of dry ingredients. Lastly, T3 had the highest cost at Rs. 14.31 per 100g of dry ingredients. These varying costs reflect the influence of ingredient modifications and additions on the overall expense of producing Pita Bread, with each variation having its unique combination and quantity of ingredients, thus impacting the total cost per 100g of dry ingredients.

CONCLUSION

It is concluded that Bathua leaves, Garden cress seeds, cinnamon and bajra flour could be successfully incorporated in refined wheat flour to enhance the nutritive value of value-addedpita bread. Among the experimental treatments, the treatment incorporated with 8% Bathua leaves powder, 5% Garden cress seed powder, 1% cinnamon powderand 30% bajra flour T2 was the most acceptable for the productname Pita bread. The nutrient contents such as protein, fiber, energy and iron increased significantly in "Pita Bread" and also increased the cost but it is comparatively cheaper than the control even through it was marginal. Thus, Pita bread can be recommended for the people suffering from micronutrient deficiencies such as iron, vitamin A, zinc, and folate,including anaemia also which leads to impaired cognitive

development, weakened immune function, and increased risk of infections and chronic diseases.

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