The Pharma Innovation Journal 2021; 10(10): 2179-2185

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; 10(10): 2179-2185

www.thepharmajournal.com
Received: 19-07-2021
Accepted: 29-08-2021

Aaradhna Boria
PG Scholar, Department of Food Science and Technology, JNKVV Jabalpur, Madhya Pradesh, India

Shashi Gour
Scientist ICAR–ATARI Zone IX, JNKVV Campous Jabalpur, Madhya Pradesh, India

Alok Dhar Dubey
Ph.D., Scholar, Department of Food Science and Technology, JNKVV Jabalpur, Madhya Pradesh, India

SS Shukla
Head of the Department Food Science and Technology, JNKVV, Jabalpur, Madhya Pradesh, India

Corresponding Author:
Shashi Gour
Scientist ICAR–ATARI Zone IX, JNKVV Campous Jabalpur, Madhya Pradesh, India

Chemical composition and shelf-life of burger buns from ragi and moringa leaf powder

Aaradhna Boria, Shashi Gour, Alok Dhar Dubey and SS Shukla

Abstract
Food products would be the possible solution for enhancement of consumption, nutritional status and livelihood security of the tribal community. With the changing scenario of utilization of processed products and awareness of consumer regarding health benefits of ragi millet and moringa leaf powdera tremendous potential exists for its utilization in bakery products like burger buns, cup cakes, cookies etc. Burger buns are sweet baked products highly appreciated by consumers because of their soft texture and characteristic taste chemical composition of formulated composite flour revealed that moisture, protein, fat, carbohydrates, crude fiber, total sugar, reducing sugar and phenol content was found to be in the range of 18.45-22.51%, 6.23-7.86%, 1.23-2.63%, 67.02-72.88%, 2.15-4.20%, 4.49-5.34mg/100g, 9.65-11.8mg/100g and 0.829 to 2.651mg/100grespectively. The shelf life of burger bun fortified with ragi flour and moringa leaf powder was evaluated in HDPE bag, Aluminum foil bag and parchment paper bag. The sensory evaluation study data shows that treatment T_4 was adjudged as the best product. The HDPE bags are best packaging material to pack burger bun. The product can be packed and stored for the period of 05 days.

Keywords: Fortified Burger buns, composite flour, HDPE bags, moringa leaf powder

Introduction

Moringa (*Moringa oleifera*) also called "miracle plant" is found in abundance in the dry tropics, and it is completely edible from leaves to roots. The leaves of Moringa could be cheaply dried with solar dryers and milled to form a fine powder that could be store for use in rural household (Glover *et al*., 2017). The reported nutrient content of Moringa leaves, both fresh, and in powdered form, appears promising in terms of a nutritional supplement. The dried leaves contain proteins (6.5g), fat (0.55g), carbohydrate (41.2g), carotene (4.54mg), thiamine (0.63mg), riboflavin (4.92 mg), calcium (480.72mg), magnesium (88.32 mg), potassium (48.96mg), leucine (468mg), lysine (318 mg) (Melanie & Jed 2009) [9]. The solar dried leaf powder is an important source of vitamins, and phenolic compound including phenolic acids and flavonoids (Makkar and Becker, 1996).

Moringa's leaves, pods, seeds, gums, bark, and flowers are used to treat mineral and vitamin deficiencies, support a healthy cardiovascular system, promote normal blood glucose levels, neutralise free radicals, provide excellent anti-inflammatory support, enrich anaemic blood, and support the immune system. It also enhances vision, mental acuity, and bone strength. It possesses (Chorage *et al.* 2020)

In this era of industrialization and technological advancement, the life style of the people has changed, with which demand for ready to eat and convenient foods has increased considerably. Different types of such products are available in market like breads, biscuits, noodles and cakes. Burger buns prepared from composite flour of wheat, ragi and moringa powder can succeed as an alternative to wheat-based food products. Since the consumption of bakery products in the country is increasing day by day, it may be worthwhile to explore the possibility of replacing part of wheat flour by ragi and moringa flour. This is also necessitated by the fact that some wheat varieties may contain gluten content more than what is actually required for bread and bun manufacture therefore, in such case the flour from ragi would dilute the gluten and make composite flour suitable for preparation of bakery product. In addition, in some area wheat flour may be available at high cost while ragi is cheaper thus, in such situations also development of burger buns based on ragi and moringa flour would be economically feasible.

Materials and Method

Experimental material and methods adopted for conducting the experiment. The present investigation entitled, "Development and evaluation of burger buns from composite flour of ragi and moringa leaf powder" was carried out in the Department of Food science and Technology, College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur during the year 2020-2021. The methodologies for preparation of raw materials, analysis of raw materials, preparation of burger buns and its quality evaluation

Chemical analysis of burger buns

Moisture content

The 5 g bun sample was taken in a pre-weighed moisture box and subjected to dry in oven at 105°C for 5 hrs and transferred to desiccators for cooling for 30 min. After cooling the sample was weighed. The procedure was repeated until a constant weight was obtained.

$$\text{Moisture (\%)} = \frac{(W1 - W2)}{(W1 - W)} \times 100$$

Where

W1 = Weight (g) of the box with the material before drying
W2 = Weight (g) of the box with the material after drying
W = Weight (g) of the empty box

Fat

The fat content of the selected sample was estimated by the Soxhlet method of (A.A.C.C. 2000) [2].

Equipments

1. Soxhlet extraction assembly consisting of three parts
   - Condenser
   - Extractor
   - Receiver flask

2. Extraction thimble, cotton wool
3. Petroleum ether (boiling point 40 – 60 ºC).

Procedure

Powdered sample 5 g each of composite flour of (refined wheat flour, ragi flour, moringa leaf powder) and prepared burger buns was taken on a filter paper and made a suitable size packet. Placed the packet in extraction flask of Soxhlet unit and attached it to collecting flask. Poured one siphon full of solvent through extraction flask into pre weighed collecting flask. Assembly condenser was connected to tap water and the flask was heated at 60 ºC. Sample with 6 – 8 siphoning was extracted and distilled off most of the solvent to extraction flask. The collecting flask was dried on water bath and then at 100 ºC for 1 h in oven. The flask was cooled and weighed. Increase in weight of flask represents crude fat content.

$$\text{Crude fat (\%)} = \frac{A - B}{\text{Weight of sample (g)}} \times 100$$

Where,

A. Weight of flask containing fat residue after evaporation of solvent (g)
B. Weight of dry empty flask (g)

Protein

Total protein content of the samples was estimated by determining total nitrogen content using standard micro-kjeldhal method (A.A.C.C., 2000) [2]. Total protein content was calculated by multiplying the estimated total nitrogen content with a factor 5.83 FAO (2020) [8].

Reagents

1. Conc. sulphuric acid (specific gravity 1.84 g/cc, purity, 98.08% nitrogen free)
2. Catalyst mixture: Potassium sulphate (9.9 g), mercuric oxide (4.1 g) and copper sulphate (0.8 g) were weighed, mixed and ground into a fine powder.
3. Sodium hydroxide (50%, w/v): 50 g of sodium hydroxide and 5 g of sodium thiosulphate were dissolved in distilled water separately, mixed and the volume was made up to 100 ml with distilled water.
4. Boric acid (4%, w/v): Four g of boric acid was dissolved in distilled water and the volume was made up to 100 ml with distilled water.
5. Mixed indicator: Mixed indicator was prepared by dissolving 0.1 g of bromocresol green and 0.1 g of methyl red in 100 ml of 95% (v/v) alcohol separately. Ten parts of bromocresol green and 2 parts of methyl red indicator were mixed together and transferred to a bottle provided with a stopper.

Procedure

Powdered defatted sample 0.2g of each composite flour of (refined wheat flour, ragi flour, moringa leaf powder) and burger bun was accurately weighed and transferred to a digestion flask. One gram of catalyst mixture was added and mixed thoroughly with the sample add five ml of conc. sulphuric acid were carefully added and the sample was digested in digestion chamber. Initially the flasks were heated slowly for 10 to 15 min and then the temperature was raised gradually so that the contents boiled briskly. The digestion was continued until the sample became clear and colour less. The flasks were then cooled and after cooling the contents they were transferred to volumetric flasks. The digestion flasks were washed 3 to 4 times with distilled water. All the washings were transferred to volumetric flasks and the volume was made to 50 ml. Ten ml of boric acid solution was pipette into a 100 ml beaker and 6 to 8 drops of mixed indicator solution were added. The beaker was placed under the condenser of the distillation unit to collect at least 50 ml distillate. At the end of distillation, the tip of condenser was washed with distilled water to collect all ammonia. The distillate was then titrated with standard hydrochloric acid solution. Before distillation, the colour of boric acid plus indicator was pink which changed to blue green during distillation and finally to pink red at the end of titration. Blank titration was simultaneously carried out. The percentage of nitrogen content was calculated from the quantity of standard hydrochloric acid required for titration of the sample. The protein content was calculated by multiplying the nitrogen content by a factor of 5.83. Total protein content of sample was calculated by formula.

$$\text{Nitrogen (\%)} = \frac{(S\text{-}B) \times N \times 14.007}{\text{Weight of sample (g)}} \times \frac{\text{Volume made (ml)}}{\text{Volume taken (ml)}} \times 100$$

Where

S = ml of HCl required for sample titration
B = ml of HCl required for blank titration
N = Normality of HCl (0.02 N)
Protein (%) = Nitrogen (%) x 5.83

Crude fiber
Crude fiber content of the selected samples was determined by the method of (A.A.C.C. 2000) [2].

Apparatus
Weighing balance, muffle furnace and oven.

Reagent
1. Sulphuric acid (0.255 N)
2. Sodium hydroxide (0.313 N)
3. Potassium sulphate (10% solution)

Procedure
Transfer two-gram composite flour of (refined wheat flour, ragi flour, and moringa leaf powder) fat free residue sample separately to digestion flask. Add 200 ml boiling sulphuric acid and immediately connect flask to condenser. Heat the flask and boil by frequently rotating for 30 min maintain the volume with hot water. Then filter through filter cloth in a fluted funnel. Wash the residue on cloth with hot water/potassium sulphate solution. Return the residue to digestion flask by washing with hot water, add 200 ml boiling sodium hydroxide, and boil for 30 min. Adjust the volume with boiling water. Filter through muslin cloth and wash the residue free of alkali. Transfer the residue into crucible and wash with 15 ml alcohol and dry the crucible at 110˚C for 2 hour. Cool the crucible in desiccators and weigh. Ignite the crucible in furnace at 550˚C for 30 min, cool and weigh. The loss in weight represents the crude fiber.

$$\text{Crude fiber (\%)} = \frac{(W1 - W2)}{\text{Weight of sample (g)}} \times 100$$

Where,
W1 = Weight of material before ashing (g)
W2 = Weight of material after ashing (g)

Ash
The total minerals of the selected samples were estimated by the ashing method of (A.A.C.C. 2000) [2].

Procedure
About five grams of powdered sample of each composite flour of (refined wheat flour, ragi flour, and moringa leaf powder) and burger bun sample was accurately weighed separately in to apre-weighed silica crucible and charred over hot plate. It was then placed in muffle furnace until grey ash was obtained at 550 ˚C. Ash was then removed and cooled in desiccators and weighed.
The weight of ash was recorded as per cent ash content in sample.

$$\text{Ash (\%)} = \frac{\text{Weight of ash (g)}}{\text{Weight of sample (g)}} \times 100$$

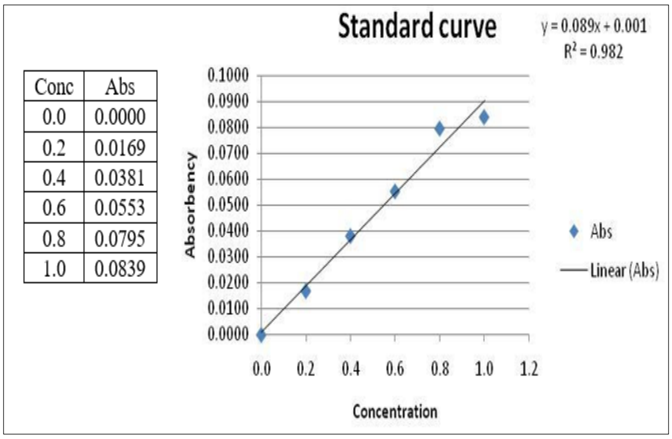
Total Carbohydrates
The content of carbohydrate in the selected samples were obtained by subtracting from 100, the sum of values of moisture, protein, fat, ash and crude fiber content per 100 g of the sample (Raghuramulu *et al.*, 1993).
% Carbohydrate = 100 - (%Moisture +% Protein + % Fat +% Ash + % Crude fiber)

Total Phenol Content
Total phenol content was determined according to the method given by Zhishen *et al*. (1999) using Folin- Ciocalteu's reagent.

Principle
Polyphenol in sample extract reacts with specific redox reagent (FC reagent) to form blue chronophers constituted by a phosphor-tungstic phosphor-molybdenum complex which is measured at 650nm.

Reagents
1. 80% Ethanol.
2. Folin-Ciocalteau Reagent.
3. Na_2CO_3, 20%.
4. Standard Catechol solution (0.1% in distilled Water).
5. Dilute 10 times for a working standard.

Procedure
Weigh exactly 0.5 to 1.0g of the sample and grind it with a pestle and mortar in 10-time volume of 80% ethanol. Centrifuge the homogenate at 10,000 rpm for 20 min. supernatant. Re-extract the residue with five times the volume of 80% ethanol, centrifuge and pool the supernatants.
1. Evaporate the supernatant to dryness.
2. Dissolve the residue in a known volume of distilled water (5mL).
3. Pipette out different aliquots (0.2 to 2mL) into test tubes.
4. Make up the volume in each tube to 3ml with water.
5. Add 0.5mL of Folin-Ciocalteau reagent.
6. After 3 min, add 2mL of 20% Na_2CO_3, solution to each tube.
7. Prepare Blank 1.5ml of distilled water was taken and treated same as sample.
8. Mix thoroughly. Place the tubes in a boiling water for exactly one min, cool and measure the absorbance at 650nm against a reagent blank.
9. Prepare a standard curve using different concentrations of phenol



Graph 1: Standard curve using different concentration of phenol

Calculation
From the standard curve find out the concentration of phenols in the test sample and express as mg phenols/100g material.

Reducing sugar and Total sugar
Reducing sugar and Total sugar was estimate by Shaffer – somogyi micro method as described in Ranganna (1991) [11].

Reagents

1. Copper sulphate solution ($CuSO_4.5H_2O$): 100ml ($CuSO_4$+.$5H_2O$).
2. 0.1N Potassium iodate solution: 3.567ml of (KIO_3).
3. Shaffer-Somogyi carbonate reagent: 25g anhydrous sodium carbonate (Na_2CO_3), Rochelle salt (potassium sodium tartrate), add with stirring 75ml of copper sulphate solution and 20g sodium bicarbonate. 250ml of 0.1NKIO_3solution. Iodide – potassium oxalate solution: 2.5g potassium iodide (KI) and potassium oxalate ($K_2C_2O_4$).
4. 0.005 N Thiosulphate standard solution:
5. 2 N Sulphuric acid solution.

Preparation of sample

Weigh 2.5 – 5.0 g of sample, transfer to a 250ml beaker. Add about 50 ml water, heat to boil, cool and transfer to a 250 ml volumetric flask. Add lead acetate solution, shake and let stand for 10 min. Precipitate the excess of lead using necessary amount of potassium oxalate solution (22% in water). Make up to volume with water and filter.

Procedure

Reducing sugar: Pipette 5ml solution containing 0.5 – 5.5 mg dextrose into 25 × 200 mm test tube. Add 5ml of the Shaffer – Smoggy reagent and mix well by swirling. Prepare the blank using 5ml of water and 5ml of Shaffer – Smoggy reagent. Place the tubes, capped with funnels, in a boiling water bath for 15 min. Remove the tubes carefully without disturbing and cool in running water for 4 min. Remove the funnel and add down the side of each tube, 2ml of iodide-oxalate solution and then 3ml2NH_2SO_4. Do not agitate the solution. Mix thoroughly to ensure that all cuprous oxide is dissolved and let these stand in cold water bath for 2 min mixing twice during that time. Titrate with 0.005 N thiosulphate solution using starch as indicator.

Total sugar: To 25 ml of the filtrate in a 50 ml volumetric flask, add 5.0 ml of HCL (1+1). Allow to stand for 24 hr at room temperature. Neutralize exactly with sodium hydroxide and make up to volume with water. Take an aliquot and determine the total invert, sugar as in reducing sugar.

Dextrose

Reducing sugar %=mg of Dextrose x Volume made up x 1005 x wt of sample taken x 1000

Storage studies of Burger Buns

Packaging Material

Different packaging materials *viz.*, silver aluminium foil, parchment paper and LDPE bag, was used to store the burger buns at ambient room temperature (27±5 °C) temperature for 05 days and samples were drawn randomly and evaluated for the nutritional, sensory, textural analysis of the optimized product.

Statistical analysis

Experimental plan and design

Analysis of different variables was carried out to know the degree of variation among all the treatments. The data were statistically analyzed by the method given by Panse and Sukhatme (1963). The analysis of variance has been give in appendix and the skeleton of ANOVA for Completely Randomized Design was presented as below:

Skeleton of analysis of variance

Source of variation	Df	SS	MS	F cal.	F tab. Value	
					5%	1%
Treatment	t-1(3)	SSt	Mst	Mst/Mse		
Error	n-t(8)	SSe	Mse			
Total	n-1(11)					

n = Total number of observation t = Number of treatments

Results and Discussion

The use of ragi flour and moringa leaf powder in food products is an area of current interest due to the nutritional awareness of the consumer. The nutritional value of foods, especially baked products such as burger buns, can be improved by fortification of ragi flour and moringa leaf powder because ragi contains non glutinous protein, carbohydrate and dietary fiber whereas Moringa along with proteins fats and fiber also contains micronutrients and amino acids in abundance. Ragi is a whole grain. It's considered a "good" carb, so it's easily digestible, it's also gluten-free, it is a great alternative for people living with celiac disease or gluten sensitivity. Ragi millet contains low glycemic index which checks the rise blood sugar level

Proximate composition of composite flour made from combination of refined wheat flour, ragi flour and moringa leaf powder.

Moisture

The effect of different ingredient and their combination on moisture content of composite flour made from combination of refined wheat flour, ragi flour and moringa leaf powder is given in (Table 1). It varied from 11.97 to 13.75 percent. The minimum and maximum moisture content in composite flour was recorded at Treatment T2 and Treatment T0 respectively. These experiments represented the combination of ingredients as 80:15:05, 05, 1.75 g and 100:0:0, 07, 1.5 g per 100g of RWF: RF: MLP, sugar and yeast respectively. The findings of proximate composition of burger bun reveals that the range of moisture content (18.45-22.51%) in burger buns sample is similar as recommended in commercially branded bakery products, Croitoru *et al*., (2018) [7]

Protein

The protein content of composite flour made from combination of refined wheat flour, ragi flour and moringa leaf powder varied from 8.08-9.88 per cent (Table 1). The minimum and maximum protein of composite flour was obtained at Treatment T_1 and Treatment T_8respectively. These experiments represented the combination of ingredients as 85:10:05, 04, 1.5 g and 75:15:10, 05, 1.75 g per 100g of RWF: RF: MLP, sugar and yeast respectively. Effect of levels of ragi flour and moringa leaf powder has negative significant effect at 5% level of confidence on protein content of resultant composite flour. Abulkadir *et al*., (2015) determined percentage of crude protein, which were in range from 11.70–26.57%, espectively in different parts of moringa plant.

Fat

The Fat content of composite flour made from combination of refined wheat flour, ragi flour and moringa leaf powder varied from 0.4-1.8 per cent (Table 1). The minimum and maximum fat content in composite flour was at Treatment T_0 and Treatment T_4respectively. These experiments represented the combination of ingredients as 100:0:0, 07, 1.5 g and 82.5:10:7.5, 04, 1.5 g per 100g of RWF: RF: MLP, sugar and yeast respectively. The analysis shows that levels of refined wheat flour, ragi flour and moringa leaf powder had positive linear significant effect at 5% level of confidence on fat content of resultant composite flour. Abulkadir *et al*., (2015) determined percentage of crude fat which were in range from 11.82–20.19 respectively in different parts of moringa plant.

Total Carbohydrates content

The effect of different ingredient and their combination on carbohydrates content of composite flour made from combination of refined wheat flour, ragi flour and moringa leaf powder is given in (Table 1). It varied from 73.12 and 77.08 percent. The minimum and maximum carbohydrate content of composite flour was observed in Treatment T8 and Treatment T2 respectively. These experiments represented the combination of ingredients as 75:15:10, 05, 1.75 g and80:15:05, 05, 1.75 g per 100g of RWF: RF: MLP, sugar and yeast respectively. The finding indicates non-significant impact of various combinations of ingredients on total carbohydrates content of the formulations. Saleh *et al*., (2013) [12] reported that Finger millet contains carbohydrate 81.5%, dietary fiber 18% to 20%, starch 65% to 75%, protein 9.8%, fat 1% to 1.7%, minerals 2.7% and crude fiber 4.3% that is equivalent to other millets and cereals.

Fiber

The Fiber content of composite flour made from combination of refined wheat flour, ragi flour and moringa leaf powder varied from 0.95-4.87 percent (Table 1). The minimum and maximum fiber of composite flour was found at treatment T1 and T9 respectively. These experiments represented the combination of ingredients as 85:10:5,04,1.5 g per 100gm of RWF: RF: MLP, sugar and yeast respectively. It indicates that model has significant effect at 5% level of confidence on fiber content.

Table 1: Proximate composition of composite flour made from combination of refined wheat flour, ragi flour and moringa leaf powder.

Proximate composition of composite flour (%)					
Treatments	Moisture	Protein	Fat	Ash	Carbohydrates
T_0	13.75	9.28	0.4	0.62	75.95
T_1	12.38	8.08	1.48	1.44	76.62
T_2	11.97	8.22	1.14	1.59	77.08
T_3	12.65	9.17	1.76	1.86	74.56
T_4	12.91	9.76	1.81	1.81	73.71
T_5	12.58	9.19	1.73	1.77	74.73
T_6	12.72	9.4	1.76	1.87	74.25
T_7	13.13	9.42	1.44	1.61	74.4
T_8	13.17	9.88	1.7	2.13	73.12
T_9	12.66	9.57	1.81	2.23	73.73
SE(m)	0.011	0.080	0.006	0.003	0.081
CD @ 5%	0.047	0.018	0.031	0.011	0.233

Total sugar

The effect of different ingredient and their combination on total sugar of composite flour made from combination of refined wheat flour, ragi flour and moringa leaf powder burger bun is given in (Table 2). The Total sugar content of composite flour varied from 3.33-4.02 mg/100g. The minimum and maximum total sugar of burger bun was from Treatment T5 and Treatment T9 respectively. These experiments represented the combination of ingredients as 77.5:15:7.5, 05, 1.75 g and70:20:10, 06, 2.0 g per 100g of RWF: RF: MLP, sugar and yeast respectively. The analysis of model shows that levels of sugar have positive linear and interaction between sugar-fat and on sugar content of burger bun at 5% level of confidence.

Reducing sugar

The effect of different ingredient and their combination on reducing sugar of composite flour made from combination of refined wheat flour, ragi flour and moringa leaf powder is given in (Table 2). The reducing sugar content of composite flour varied from 9.65-11.80 mg/100g. The minimum and maximum reducing sugar of burger bun was at Treatment T0 and Treatment T5 respectively. These experiments represented the combination of ingredients as100:0:0, 07, 1.5 g and77.5:15:7.5, 05, 1.75 g per 100g of RWF: RF: MLP, sugar and yeast respectively. The level of ragi flour and moringa flour powder had significant effect at 5% on reducing sugar of prepared burger bun.

Phenols

Table 2 describe the results of phenols content of composite flour, which ranged from 0.829 to 2.651mg/100g. The minimum and maximum phenols content in composite flour made from refined wheat flour, ragi flour and moringa leaf powder was observed in treatmentsT0 and T6 respectively. Interaction between refined wheat flour, ragi flour, moringa leaf powder had significant effect at 5% on phenol content of prepared composite flour.

Table 2: Chemical composition of composite flour made from combination of refined wheat flour, ragi flour and moringa leaf powder.

Experiment	Sugars		Phenols (mg/100g)	Fiber (%)
	Total Sugar (%)	Reducing Sugar (%)		
T_0	3.99	9.65	0.829	0.95
T_1	3.90	10.24	1.538	3.85
T_2	3.66	10.55	1.879	4.37
T_3	3.53	11.19	2.047	4.65
T_4	3.72	10.71	1.303	4.12
T_5	3.33	11.80	1.934	4.36
T_6	3.47	11.04	2.651	4.74
T_7	3.55	11.24	1.609	4.11
T_8	3.71	10.66	1.910	4.55
T_9	4.02	9.74	2.663	4.87
SE(m)	0.047	0.073	0.016	0.059
CD @ 5%	0.913	1.206	0.053	0.174

Chemical composition of refined wheat flour burger bun fortified with ragi flour

The findings of chemical composition of burger bun reveals that the range of moisture content (18.45-22.51%) in burger buns sample is similar as recommended in commercially branded bakery products, Croitoru *et al*., (2018) [7]. The protein, fat, carbohydrates, crude fiber, total sugar, reducing sugar and phenol contentin products varied from 6.23-7.86, 1.23-2.63, 67.02-72.88, 2.15-4.20, 4.49-5.34mg/100g, 9.65-11.8mg/100g and 0.703 to 2.217 mg/100g respectively. The levels of ragi flour had significant effect at 5% level of confidence on moisture, protein, fat, and fiber while non-significant effect at 5% level of confidence on carbohydrates content of burger bun. The higher content of protein, carbohydrate and fat is due to use of nutrient rich ragi flour and moringa leaf powder at its highest level in product preparation. The crude fiber content is also increased due to the ragi flour and moringa flour fortification. The present findings of increase in nutritive value of burger buns due to fortification of ingredients are in conformity with the findings of Priya and Thorat (2019) [10].

Storage study of refined wheat flour burger bun fortified with ragi flour

To evaluate the shelf life of prepared ragi flour and moringa leaf powder fortified burger bun, the prepared products of each experiment were packed in three different packaging materials *viz*., HDPE bag, aluminum bag and parchment paper bag which was then stored for the period of 05 days under ambient condition. The stored burger bun was every day for sensory quality attributes on nine-point hedonic scale. A cursory review from the table 4.8 shows that product of Treatment T4 (Best product on sensory score) packed in HDPE bags received A score and can withstand 05 days of storage. However, in case of aluminum foil bag and parchment paper bag the product could be stored only up to 03 days and 02 days respectively. On 05th days product stored in Aluminum Foil bag and Parchment Paper bag showed drastic change in quality due to which it received D(hard and not palatable) and E(Very hard, crumbly and not palatable at all) score. Thus, from above findings it can be concluded that best packaging material for storage of burger bun is HDPE bags and can be packed and stored for the period of 05 days.

Table 3: Storage study of refined wheat flour burger bun fortified with ragi flour and moringa leaf powder

Treatments →			**T_0**	**T_1**	**T_2**	**T_3**	**T_4**	**T_5**	**T_6**	**T_7**	**T_8**	**T_9**
Packaging Materials	H. D. P. E Bag	0 day	A	A	A	A	**A**	A	A	A	A	A
		1 day	A	B	C	B	A	B	B	B	B	B
		2 day	A	B	C	B	B	B	C	B	C	B
		3 day	A	B	C	C	C	C	C	B	C	B
		4 day	A	C	D	C	D	C	D	C	D	C
		5 day	B	C	E	D	E	C	D	C	E	C
	Aluminum Foil Bag	0 day	A	A	A	A	A	A	A	A	A	A
		1 day	A	B	C	B	B	B	C	B	B	B
		2 day	A	B	C	B	C	C	C	C	C	C
		3 day	A	C	D	C	D	C	D	C	D	C
		4 day	B	C	D	D	D	D	D	D	D	D
		5 day	B	D	E	D	E	D	D	E	E	D
	Parchment Paper Bag	0 day	A	A	A	A	A	A	A	A	A	A
		1 day	A	B	C	B	C	B	C	B	C	B
		2 day	A	C	C	C	C	C	C	C	C	C
		3 day	B	C	D	D	D	C	D	D	D	D
		4 day	B	E	E	E	E	E	D	E	E	E
		5 day	C	E	E	E	E	E	E	E	E	E
A	Perfect and very palatable											
B	Good and Palatable											
C	Slightly hard but Palatable											
D	Hard and not palatable											
E	Very hard, Crumbly and not palatable at all											

The use of ragi flour and moringa leaf powder in food products is an area of current interest due to the nutritional awareness of the consumer. The nutritional value

Storage study of refined wheat flour burger bun fortified with ragi flour

The shelf life of ragi flour and moringa leaf powder fortified burger bun was evaluated in HDPE bag, Aluminum foil bag and parchment paper bag. The sensory evaluation study data shows that product of Treatment $T_4$was adjudged as the best. The sensory quality attributes of stored product of Treatment T_4shows that HDPE bags are best packaging material to pack fresh ragi flour and moringa leaf powder fortified burger bun. The product can be packed and stored for the period of 05 day. Similar findings of storage study of baked product were also reported by Chetana *et al*., 2010 [6].

Deterioration and the fungal growth after 8 days of storage period in the quality of finger millet flour fortified bun and same was seen after 6 days of storage period in the quality of foxtail millet flour fortified bun Tiwari (2013) [13].

Conclusion

It could be concluded that ragi flour and moringa leaf powder can be fortified up to the level of 10% and 7.5% respectively Treatment T4 (82.5:10:7.5:4:1.5) in refined wheat flour along with other baking ingredients *viz*. sugar 40 g, yeast 15 g for preparation of burger bun. It is inferred from above findings that the best product can be developed using above levels of ingredients at house hold and commercial scale bakery industry level. The HDPE bags are best packaging material to pack burger bun. The product can be packed and stored for the period of 05 days.

Declaration: The authors should declare that they do not have any conflict of interest.

Reference

1. AACC. Approved Methods of American Association of Cereal Chemists. Vol. I and II American Association of Cereal Chemists. Inc. Minnesota, U.S.A 1969.
2. AACC. Approved methods of the AACC.10th ed. Method.44-15A.St. Paul, Washington Dc 2000.
3. AOAC. Official Methods of Analysis, Association of Official Analytical Chemists 17th ed Washington DC 2000.
4. Abdulkadir AR, Zawawi DD, Jahan MS. Proximate and phytochemical screening of different parts of *Moringa oleifera*. Russian Agricultural Sciences 2016;42(1):34-

36.
5. Amerine MA, Pangborn RM, Roseller EB. Principles of sensory evaluation of foods. Academic Press, New York, 1965, 265.
6. Chetana, Sudha ML, Begum K, Ramasarma PR. Nutritional characteristics of Linseed/Flaxseed (Linumusitatissium) and its application in Muffin making J. Text. Stud.2010;41:563-578
7. Croitoru, Constantin, Mureșan, Claudia, Turturică, Mihaela *et al*. Improvement of Quality Properties and Shelf Life Stability of New Formulated Muffins Based on Black Rice. Molecules 2018;23(11):3047.
8. FAO Method of food analysis 2020, 2. www.fao.org. 2020-11-14. Archived from the original on 2020-11-14.Retrieved 2021-02-05.
9. Melanie Jed. Adoption of Moringaoleifera to Combat Under-Nutrition Viewed Through the Lens of the “Diffusion of Innovations” Theory, Ecology of Food and Nutrition 2009;48(3):212-225 DOI: 10.1080/03670 240902794598.
10. Priya T, Eliazer Nelson ARL, Ravichandran K. Nutritional and functional properties of coloured rice varieties of South India: a review. J Ethn. Food 2019;6:11.
11. Ranganna S. Handbook of Analysis and Quality Control for Fruit and Vegetable Products.2nd Edition. Tata McGraw Hill Publishing Company Limited., New Delhi 1991.
12. Saleh AS, Zhang Q, Chen J, Shen Q. Millet grains: nutritional quality, processing, and potential health benefits. Comprehensive reviews in Food Science and Food Safety 2013;12:281-295.
13. Tiwari N. Formulation, quality evaluation and therapeutic assessment of finger millet and foxtail millet flour incorporated buns for diabetics. PhD thesis G. B. Pant University of Agriculture and Technology, Pantnagar 2013.