

**DEVELOPMENT AND STORAGE STABILITY (SHELF LIFE) OF BUCKWHEAT BISCUITS**Nigar Naqvi<sup>1</sup>, Zeba Siddiqui<sup>2</sup>, Arvind Km Srivastava<sup>3</sup> and Tabrez Jafer\*<sup>4</sup><sup>1</sup>Consultant Dietician, ERA'S Lucknow Medical College, ERA University, Lucknow-226003, Uttar Pradesh, India.<sup>2</sup>Department of Medicine, ERA'S Lucknow Medical College, ERA University, Lucknow-226003, Uttar Pradesh, India.<sup>3</sup>Department of Food and Nutrition, Era University, Lucknow-226003, Uttar Pradesh, India.<sup>4</sup>Department of Personalized and Molecular Medicine, Era University, Lucknow-226003, Uttar Pradesh, India.**\*Corresponding Author: Tabrez Jafer**

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**ABSTRACT**

Biscuits are one of the popular convenient, ready to eat, ready to carry, ready to store, bakery products consumed by all age groups and a better vehicle for fortification and enrichment with macro and micro nutrients. The data of the current study indicates that 25 percent buckwheat flour (BWBS2) incorporated biscuit had better sensory properties (colour, appearance, aroma, texture, taste etc. as compared to 100% wheat flour biscuits. These optimized buckwheat biscuits were kept at room temperature (29-30 °C) for 3 months and analyzed for their shelf life at 0, 15, 30, 45, 60, 75 and 90 days and sensory characteristics by using the Nine-point hedonic scale and microbiological analysis by using Pour Plate Technique. The result showed that optimized buckwheat biscuit can be consumed up to 75 days of storage. However, the microbial load of buckwheat biscuits was within the acceptance range for 3 months of storage i.e they can be stored up to 3 months and are also safe for consumption.

**INTRODUCTION**

Buckwheat (*Fagopyrum esculentum*) also known as common buckwheat or Kuttu Ka Attais rich in complex carbohydrate therefore, it is also referred to as pseudocereal. Buckwheat is a broad-leafed herbaceous annual, which belongs to the Polygonaceae family. The nutritional profile of buckwheat is very good. The amino acids in buckwheat protein are well balanced & rich in Lysine, Methionine, Histidine & Tryptophan which are limiting amino acid in wheat & barley. (Przybylski, R. 2009).<sup>[1]</sup> Moreover, buckwheat is a rich source of vitamins, has large quantity of phenolic compounds along with high protein content with a well-balanced amino acid composition (Mota C et al. 2016).<sup>[2]</sup> Replacement diets with buckwheat products exert a protective effect on the development of cardiovascular disease by reducing risk factors, including blood pressure, blood glucose, insulin, lipids etc. (Sofi F et al. 2016).<sup>[3]</sup> Health benefits attributed to buckwheat include plasma cholesterol level reduction, neuro-protection, anticancer, anti-inflammatory, anti-diabetic effects, and improvement of hypertension conditions (Bastida et al. 2015)<sup>[4]</sup>, (Zhang Z et al. 2012).<sup>[5]</sup> Buckwheat have lot of therapeutic importance that's why current study was designed and composite buckwheat biscuits were prepared and stored for shelf life testing.

The Institute of Food Technologists (IFT) in the United States has defined shelf life as "the period between the manufacture and the retail purchase of a food product,

during which time the product is in a state of satisfactory quality in terms of nutritional value, taste, texture and appearance" (Anon., 1974). Moreover, the Institute of Food Science and Technology (IFST) in the United Kingdom has defined shelf life as "The period of time during which the food product will remain safe; be certain to retain desired sensory, chemical, physical, microbiological and functional characteristics; and comply with any label declaration of nutritional data when stored under the recommended conditions" (Anon., 1993).

Buckwheat is of great therapeutic importance. Buckwheat based food product should be prepared in such a way so that it can be preserved for longer duration, taking its benefit as ready to eat and ready to carry at all time. In the present study buckwheat based biscuits were prepared and their shelf life was tested to see if it can be stored for long period and can be consumed without any negative effect.

**MATERIALS AND METHODS****Procurement of raw materials**

The authenticated Buckwheat grains were purchased from local market, washed many times with tap water dried for 2-3 days in sun light and powdered in small scale flour mill in our organization. However, refined wheat flour, sugar, oil, milk were purchased from local market of Lucknow.

### Formulation of Storable Products

The composite flour was prepared by mixing refined wheat flour and buckwheat flour in various proportions i.e. 3:1, 2:2 and 1:3 keeping sugar (30 g), milk (10g) and oil (20 g) amount constant in a total of 100 g powder. Fat and ground sugar was mixed in a mixer with a flat beater

for 2 min at low speed. The biscuits were cut to desired diameter of 50 mm and transferred to a lightly greased aluminum baking tray. The biscuits were baked at 190°C for 12 min in a baking oven. The baked biscuits were cooled and stored in an air tight container for further use.

**Table 1: Different combination of biscuits.**

Ingredients	Refined Wheat flour (g)	Buckwheat Flour (g)	Sugar (g)	Oil (g)	Milk powder (g)
BWBS1	100	-	30	20	10
BWBS2	75	25	30	20	10
BWBS3	50	50	30	20	10
BWBS4	25	75	30	20	10

### Shelf life analysis of storable products

Optimized biscuit were stored in an airtight container, away from heat and light, at room temperature (29-30°C) for 3 months and then analyzed for their shelf life by sensory evaluation and microbiological analysis method.

### Shelf life by Sensory Evaluation

The sensory evaluation of buckwheat biscuits was evaluated by twenty panel list members from Era's Lucknow Medical Collage and Hospital at 15 days interval upto 90 days, according to the procedure described by Margaret et al 2009.<sup>[6]</sup> The panelists were asked to evaluate the optimized biscuits for different sensory attributes namely color, appearance, Aroma, Texture, Taste, and overall acceptability on 9 point hedonic scale (9 Like Extremely, 8 Like Very Much, 7 Like Moderately, 6 Like Slightly, 5 Neither Like nor Dislike, 4 Dislike Slightly, 3 Dislike Moderately, 2 Dislike Very Much, 1 Dislike Extremely).

### Shelf life by microbiological analysis

In microbiological analysis the shelf life of buckwheat biscuits were analyzed by using Pour Plate technique at Regional Food Research and Analysis centre, Lucknow at same interval. The TPC (Total Plate Count) and Y & M (Yeast and Mould) were analyzed by the method of Sumbali et al. 2009.<sup>[7]</sup>

### Reagents

Phosphate Buffer, PDA media and PCA media.

### Procedure

The molten media was cooled and poured into the Petri dish which contained the specified amount of diluted samples after addition of molten media. After that the plate was rotated in circular motion for achieving the distribution of microorganism. After the solidification of media the plate was kept in incubator for bacterial growth and the result was noted after two days. While for yeast and mould growth the plates were placed in BOD (Bio-Oxygen Demand) and maintained at a temperature 25°C and this result was noted after 5 days. The following formula was applied for calculation of the number of cells per gm.

$$\text{No. of cell per gm} = \text{No. of Colonies} \times \text{Dilution factor}$$

## RESULT AND DISCUSSION

In the present study optimized buckwheat biscuits were prepared and preserved at room temperature (29-30 °C) for three months and every 15 days of interval these biscuits were evaluated for their sensory attributes like colour, appearance, aroma, texture, taste and overall acceptability scores. (Table 2).

**Table 2: Statistical evaluation of control and buckwheat flour containing biscuits.**

Properties	Color		Taste		Flavor		Texture		Overall acceptability	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
BWBS1	8.00	0.00	8.00	0.00	8.00	0.00	8.00	0.00	8.00	0.00
BWBS2	7.80	0.45	7.40	0.89	7.20	0.84	6.60	0.89	7.40	0.89
BWBS3	7.00	0.71	6.40	1.14	6.40	0.89	6.80	0.84	6.80	1.30
BWBS4	6.20	0.84	5.80	1.30	6.00	1.41	5.80	1.64	6.20	1.64
Kruskal Wallis Test	13.34		10.54		11.45		9.76		6.59	
p-value	<b>0.004*</b>		<b>0.014*</b>		<b>0.010*</b>		<b>0.021*</b>		0.086	

P-value <0.05 is considered significant

We found significant differences in color (p <0.004), taste (p<0.014), flavor (p<0.010) and texture (p<0.021) when various types of buckwheat biscuits were compared with control biscuits containing only refined wheat flour. Furthermore, their overall acceptability did not show any significant difference (p<0.086) (Table 2).

On sensory evaluation of buckwheat biscuits the mean score of colour at 0 to 90 days of storage were in "moderately liked" category whereas at 60 days it was in "slightly liked" category. However, appearance at 0 to 45 days of storage was in "moderate liked" category and 60 to 90 days of storage it was in the "slightly liked"

category. Texture at 0 to 45 was in “moderate liked” category and at 60 to 90 days it was in “slightly liked” category. The taste and aroma both of the sensory

properties at 0 to 45 days were at “moderate liked” and 60 to 90 days were at “slightly liked” category. (Table 3)

**Table 3: Shelf Life of Optimized buckwheat biscuits by Sensory Evaluation.**

Days	Appearance	Colour	Texture	Taste	Aroma
0 Days	7.20+0.84	7.80+0.45	7.60+0.55	7.40+0.89	7.40+0.89
15 Days	7.20+0.84	7.40+0.89	7.60+0.55	7.20+1.10	7.40+0.89
30 Days	7.20+0.84	7.80+0.45	7.40+0.55	7.20+0.84	7.00+1.00
45 Days	7.00+0.71	7.60+0.55	7.20+0.45	7.00+0.71	7.00+0.71
60 Days	6.40+0.89	6.80+1.10	6.60+0.89	6.40+0.89	6.40+0.89
75 Days	6.60+0.55	7.20+0.45	6.80+0.45	6.60+0.55	6.60+0.55
90 Days	6.40+0.55	7.00+0.00	6.60+0.55	6.40+0.55	6.40+0.55
p-value	<b>0.102</b>	<b>0.046*</b>	<b>0.046*</b>	<b>0.102</b>	<b>0.102</b>

P-value <0.05 is considered significant

No significant change in appearance, aroma, taste were found from Day 0 to Day 90 (p=0.102) but, significant change in colour from Day 0 to Day 90 (p=0.046) and texture from Day 0 to Day 75 (p=0.046) were found.

The microbial count of stored buckwheat biscuits up to 90 days of storage period at room temperature in respect of Total Plate Count (TPC) and Yeast and Mould Count (YMC) were studied and the results are presented in Table 4. The result showed that in buckwheat biscuits

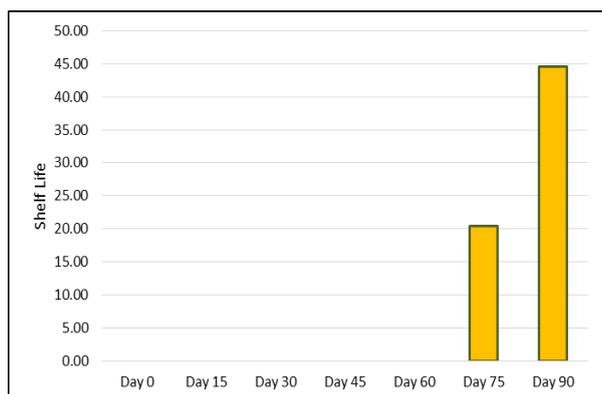
Total Plate Count (TPC) was zero upto 60 days. At 75 days of storage TPC value was found to be 20.07±5.77 cfu/g which became 45.23±7.50 cfu/g at 90 days of storage period. (Table 4)

**Table 4: Shelf Life of optimized buckwheat biscuits by Microbiological Analysis.**

Day	Shelf Life				Wilcoxon Test	
	Mean	SD	Min.	Max.	z-value	p-value
Day 0	0.00	0.00	0.0	0.0	-	-
Day 15	0.00	0.00	0.0	0.0	0.00	1.000
Day 30	0.00	0.00	0.0	0.0	0.00	1.000
Day 45	0.00	0.00	0.0	0.0	0.00	1.000
Day 60	0.00	0.00	0.0	0.0	0.00	1.000
Day 75	20.40	1.14	19.0	22.0	-2.03	<b>0.042*</b>
Day 90	44.60	1.14	43.0	46.0	-2.03	<b>0.042*</b>

P-value <0.05 is considered significant.

The significant change in shelf life was found from Day 0 to Day 75 (p=0.042) and Day 90 (p=0.042).



**Table 4: Nutrient contents of control and optimized biscuits.**

Nutrient content	Control (BWBS1)	Optimized (BWBS2)
Energy(kcal/100g)	487.9	594.12
Protein(gm/100g)	11.35	11.20
Fat (gm/100g)	11.34	12.43
Carbohydrate(gm/100g)	104.11	103.43

**Nutrient Content of Biscuits:** Energy content of control biscuits was 487.9% whereas in optimized biscuits the energy content was 594.12% energy, with 11.20%protein, 12.43%fat and 103.43% carbohydrate.

## DISCUSSION

The present study was in concordance with the study of Saeed *et al.* 2012<sup>[8]</sup> who reported gradual decreased in all sensory attributes of sweet potato flour incorporated biscuits during storage for 90 days. Dhumal *et al.* 2016<sup>[9]</sup> also reported that the sensory values of sweet potato flour incorporated biscuit were decreased due to increased in the non-enzymatic browning reaction during storage period. Furthermore, In present study the shelf life study of buckwheat biscuits by microbiological study was in concordance with the study of Seevaratnam *et al.* 2012<sup>[10]</sup> they noticed the similar trend in potato flour incorporated biscuits that after storage the bacterial count of biscuits were increased but they were lower than acceptable limit and the fungus growth were not observed during storage.

## CONCLUSION

Overall the result of the study indicates that the biscuits prepared with 25% incorporation of buckwheat flour had better sensory properties and can be consumed upto 75 days of storage. However, the microbial load of buckwheat biscuits was within the acceptance range for 3 months of storage period and they are safe for consumption.

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