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DEVELOPMENT AND QUALITY ANALYSIS OF BUCKWHEAT FLOUR BISCUITS

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ABSTRACT

A study was undertaken to develop biscuits incorporated with buckwheat flour (*Fagopyrum esculuntum*.). Biscuits were prepared using refined wheat flour with incorporation of buckwheat flour at 25, 50, 75 and 100% levels. Color, texture, flavour, taste, and general acceptability of biscuits were assessed using a 9-point hedonic rating scale. The sample with 25% buckwheat flour obtained the top overall acceptance rating. The proximate analysis showed that buckwheat flour contained lower amount of moisture content and carbohydrate than refined wheat flour, but higher amount of fibre, protein and fat than refined wheat flour. Bulk density values were found to be 810 kg/m^3 and 730 kg/m^3 for buckwheat flour and refined wheat flour respectively. Buckwheat flour had water and oil absorption capabilities of 138.7% and 120.64 percent, respectively, which were greater than refined wheat flour (74.5 percent and 88 percent).. In considering the economy, nutritional value and consumer acceptance, the developed biscuits containing buckwheat flour are better than the biscuits made solely with refined wheat flour. As a result, buckwheat flour could be used in the bread and confectionery industries.

INTRODUCTION

Buckwheat (Fagopyrum esculentum) is a Polygonaceae family annual crop that is farmed for its grain-like seeds and as a cover crop. Buckwheat grains are a good source of micronutrients such as potassium, salt, calcium, and magnesium, and contain 80 % unsaturated fatty acids, with polyunsaturated fatty acids accounting for more than 40 % (PUFA) **(Wei *et al.*, 2003 and Stabilj *et al.*, 2004).** Buckwheat grains are also high in TDF (total dietary fibre) and soluble dietary fibre (SDF), which may help to avoid obesity and diabetes **(Brennan, 2005)**. Since, buckwheat is not a cereal, it is acceptable for consumption during Hindu fasting days, Buckwheat has a very low prolamin concentration in its grain. Buckwheat grains and hull include therapeutic and biologically active components such as flavonoids and flavones, phenolic acids, condensed tannins, phytosterols, and fagopryins. **(Kreft *et al.*, 1999)**. Depending on the buckwheat species and growth conditions, their content and composition change. The flavonoids concentration of F. tartaricum (about 40mg/g) is often higher than that of F. esculentum (around 10mg/g). Rutin, quercetin, orientin, vitexin, isovitexin, and isoorientin are six

flavonoids extracted from buckwheat grains. The predominant flavonoid was Rutin **(Oleszek, 2001)**. For celiac sufferers, buckwheat flour can be an important ingredient in their meals or as a food product. Celiac disease (also known as gluten-sensitive enteropathy) is a small intestinal disease caused by a genetic mutation that causes gluten sensitivity. Incidence of so-called possible celiac disease is also on the rise, particularly among adult patients. **(Ciacci *et al.*, 2015).** Because of the well-balanced amino acid makeup, buckwheat proteins may have a powerful supplementary impact alongside other vegetable proteins.

II. MATERIALS & METHODS

2.1 Material Required

The biscuits were made with buckwheat flour, refined wheat flour, and other materials sourced from a local store.

2.2 Proximate Analysis of Flour

Determination of Moisture Content, Ash Content, Crude Fiber, Fat Content determination was done by the method of A.O.A.C, 2005. Protein was calculated using Kjeldhal method, N×6.25. Carbohydrate was calculated using formula: % Carb = 100 - (Ash + Fiber + Protein + Fat + Moisture) and Energy was calculated by: Energy = 4(carbohydrate + Protein) + 9(Fat)

2.2 Functional Analysis

The ***(Sosulski et al., 1976)*** method was used to determine the water absorption capacity and oil absorption capacity of refined wheat flour and buckwheat flour. ***Narayana and Rao (1982)*** used a technique to evaluate the foam capacity and stability. A pH meter was used to check the pH.

2.3 Product Development

The recipe used in this study was based on the method given by **Simona *et al.*, (2014).** Buckwheat flour was substituted for refined wheat flour in the following proportions: 25, 50, 75, and 100 %. As a control, 100 % refined wheat flour was used. The standard formulation contained 100 g flour, 47 g sugar 32 g dalda, 1g salt and 1 g sodium bicarbonate. For 3 minutes, the sugar and fat were mixed together. The composite flour was then added, along with baking powder, and well combined until dough was created. The obtained dough was rested for about 3-4 min at room temperature. After that, the dough was rolled into a sheet of approximately 0.7 cm thickness. The biscuits of desired shape were obtained using a cutter. The biscuits were baked for fifteen minutes at 180°C. The biscuits were baked and then chilled to room temperature before being packed.

2.4 Physiochemical Analysis of Biscuits

The width was evaluated using Vernier caliper **(Nouma *et al.*, 2003).** The length of the biscuits was calculated by putting six biscuits side by side and calculating the average. Six biscuits were stacked on top of each other and the average thickness was taken (cm). With the use of a weighing scale, the weight of the biscuits was calculated as the average of the values of four individual biscuits. ***Akubor et al., 2003*** provided a method for calculating the spread ratio.

2.4 Sensory Analysis of Biscuits

Sensory Evaluation consisted of judging the quality of prepared biscuits by a panel of 5 judges. Biscuits were evaluated for overall acceptability, texture, colour, taste, and aroma. Hedonic rating test was used to measure on a scale of 9 points from “like extremely” to “dislike extremely”.

III. RESULTS & DICUSSIONS

Flours' Proximate Composition

Table 1 displays the proximate analysis of refined wheat flour and buckwheat flour. This study also revealed that the buckwheat flour biscuits have lower carbohydrate as compared to as compared to refined wheat flour which is (86.09%). The computed energy per 100g buckwheat was 387 Kcal in comparison with refined wheat flour which was calculated to 397 kcal per 100 g.

The results revealed that buckwheat biscuits have a higher ash load than biscuits made with refined wheat flour. The amount of protein, moisture, and carbohydrate in produced biscuits dropped as the amount of buckwheat flour was increased, but the amount of fat, crude fibre, and ash increased when the amount of buckwheat flour was increased. **Fig 1** shows the graphical representation of the given proximate analysis.

Functional Analysis of flour

Bulk density

Bulk density is dependent on the particle size of the samples. The bulk density values of refined wheat flour and buckwheat flour are virtually identical.. The graph of bulk density values are shown in **fig 2**. Bulk density values were found to be 673 kg/m^3 for refined wheat flour and 657 kg/m^3 for buckwheat flour. These values are in agreement with the work of other researchers; 680 kg/m^3 for buckwheat and 810 kg/m^3 for BWF and 730 kg/m^3 for RWF **(Baljeet *et al.*, 2010).** The bulk densities of buckwheat flour blends (25%, 50%, and 75%) ranged from 652 kg/m^3 to 655 kg/m^3. Bulk density increases with an increase in the blend percentage as compared to RWF.

Water Absorption Capacity

Capacity of water absorption of BWF and its blend are shown in **table 2**, which indicates the water absorption capacity for buckwheat flour was 133.7% and for refined wheat flour was 140.3% whereas for the blends 25%, 50%, and 75%, it goes on decreasing with supplementation. Buckwheat flour's water absorption capacity (WAC) was found to be substantially lower than wheat flour's. Buckwheat flour has a lower WAC than wheat flour due to the presence of fewer hydrophilic components in BWF. (**Akubor and Badifu, 2001).**

Oil Absorption Capacity

The oil absorption capacity of buckwheat flour was 120.64 %, which is higher than refined wheat flour, but it continues to rise in blends due to the existence of a non-polar side chain that links the oil's hydrocarbon side chain among the flours.. The result obtained shows that the buckwheat flour is a high flavor retainer.

Foam's Capacity and Foam's Stability

The Foam capacity of several buckwheat and refined wheat flour blends ranged from 13.02% to 14.13% whereas foaming stability for each type of flour were recorded as 11.87% to 7.58% for RWF, 12.05% to 8.25% for 25% blend of BWF in RWF,12.62% to 9.09% for 50% blend of the flours, 13.09% to 9.83% for 75% blend, and for buckwheat flour it was observed to be in the range of 13.98% to10.1% in the duration of 20 – 60 min as represented in **table.**

3.3 Physical properties of Biscuits

The biscuits' physical properties, such as weight, diameter, and thickness, were evaluated, and the weight ranged from 16.10 g to 16.15 g. The biscuit thickness increases from 0.77 cm to 0.83 cm. The result shows that T_4 has maximum thickness of 0.83 g followed by T_0, T_1, T_2 and T_3. The biscuit spread ratio dropped from 5.32 (T3) to 4.21 (T4) (T4).

3.4 Sensory evaluation of biscuits

The main method was to produce a desirable amount of buckwheat flour incorporated biscuits based on organoleptic features such as color and appearance, taste, scent, and general acceptability as assessed by expert and trained panelists on a 9-point Hedonic scale. The attributes on the basis of which the biscuit samples were tested were color, Texture, Taste, Flavor and Overall Acceptability. Among all the biscuit samples presented color of sample T_1 was found the best, in texture T_0 was found to be the best, the taste of sample T_1 was good as compared to all other samples, sample T_0 and T_3 were scored the highest and the overall acceptability of sample T_1 was considered. The sensory profiles of the tested biscuits samples are depicted in **table 3.**

IV. Conclusion

The study suggests that buckwheat flour can be successfully blended with refined wheat flour in the production of biscuits up to a 25% level while maintaining acceptable sensory properties. Incorporation beyond 25% reduced the desirability of the biscuits. 100 % buckwheat flour biscuits with lower desirability may be helpful for people suffering from celiac disease.

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Tables and figures

Table 1

Parameters	Buckwheat Flour (%)	Refined wheat Flour (%)
Moisture content	10.93±0.03	13.17±0.01
Ash content	1.38±0.02	1.26±0.01
Crude fiber	1.75±0.02	1.71±0.01
Protein	13.38±0.03	9.16±0.02
Carbohydrate	81.09±0.01	86.09±0.03
Fat	1.810.01	1.78±0.02
Energy(Kcal)	387	397

Table 1. Proximate composition of flours

Figure 1

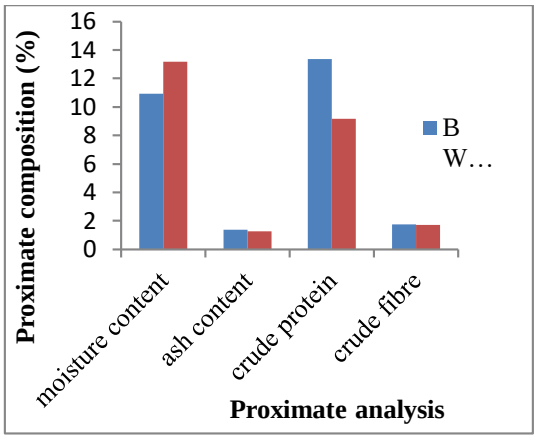


Table 2

TREATMENT	WAC (%)	OAC (%)	BULK DENSITY (kg/m^3)
100% RWF	74.5±0.02	88±0.01	730±1
25%BW+75%RW	78.40±.02	93.3±0.02	762±1
50% BW+50%RW	92.8±0.01	106.2±0.01	781±1
75% BW+25%RW	105.2±0.02	112.5±0.01	801±2
100% BWF	138.7±0.01	120.64±0.02	810±2

Table 2. Functional Properties of buckwheat (BW) and Refined wheat flour (RW)

Figure 2

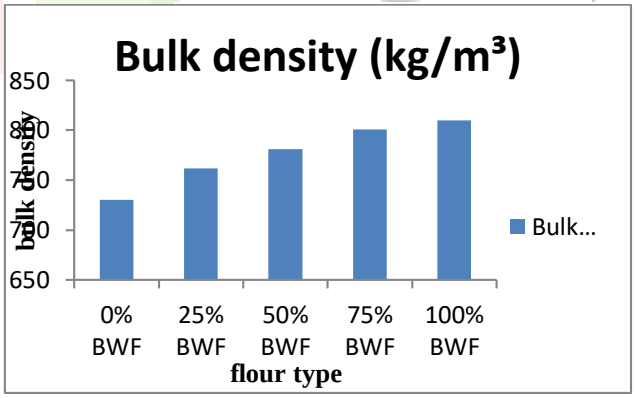
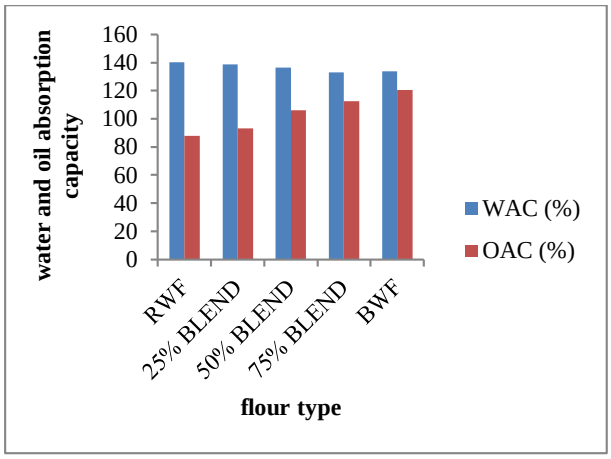


Figure3


water and oil absorption capacity
160
140
120
100
80
60
40
20
0
RWF
25% BLEND
50% BLEND
75% BLEND
BWF
flour type
WAC (%)
OAC (%)