

# Comparative Nutritional Assessment Of Cookies Prepared By Whole Buckwheat Flour

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## Abstract

*Buckwheat is a cereal crop which is grown extensively in Russia and China. It has high medicinal importance and considered as good source of important bioactive compounds. It can be used in porridge, cakes, noodles and cookies. In this study cookies were formulated by adding different concentration of buckwheat flour at 0g, 25g, 50g, 75g and 100g substituting the all-purpose flour. The cookies were investigated for phytochemicals, physicochemical and acceptability for consumers. Highly significant ( $p \leq 0.05$ ) results were found for antioxidants activity, phenolic, flavonoids, protein, ash, fat, fiber and moisture. The antioxidants were increased with the addition of buckwheat flour. While some difference found in physicochemical characteristics of cookies. All-purpose flour had lower content of protein and ash as compared to buckwheat flour, moisture and protein contents were reduced as the concentration of buckwheat flour in the cookies was increased. There was no significant difference among the diameter of all cookies but a slight variation was observed in the thickness. The spread ratio of cookies was increased with increasing the ratio of buckwheat flour. T<sub>3</sub> (with 150g buckwheat flour) had higher values for taste, flavor and color with overall acceptability score recommended by panelist for consumers.*

## INTRODUCTION

Buckwheat (*Fagopyrum esculentum*) is cultivated as a minor crop in Gilgit-Baltistan a region of Pakistan. The traditional farmers grow buckwheat to assure food security and for medicinal purposes under subsistence farming. This crop is characterized as semi wild Buckwheat and it does not require any specific conditions such as specific type of soil or fertilizer for its production (Hussain et al., 2017). In the global market of pro-biotic food product, buckwheat is considered as an increasingly attractive material. It contains lipids rich in unsaturated fatty acids, protein of high biological value as well as B vitamins such as vitamins B1, B2 and B6. Buckwheat is also a good source of valuable bioactive compounds, e.g. poly-phenols with high antioxidant activity. These compounds are beneficial for the human organisms to combat chronic diseases (Christa and Maria, 2008). The major nutrients found in buckwheat grains are polyphenols, polysaccharides, proteins, dietary fiber, lipids, micro nutrients and macro nutrients (Christa and Smietana, 2008). It is also a good source of micro and macro nutrients.

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Micronutrients are Mn, Se, Cu, Zn and macronutrients are Na, Ca, K, Mg (Krupa –Kozak et al., 2011). It is consumed as, fresh noodles, pancakes fried dough, flakes, boiled porridge and popped groats, rye and buckwheat crackers (Andrea et al., 2010).

Cookies are highly consumed due to their good eating quality, easy for protein enrichment or fortification and other dietary improvements. In the bakery industry the latest trend is the development of fortified cookies, demand for multiple flour based cookies and biscuits or other bakery products. The addition of buckwheat can be suitable in combination of flour based cookies as it has high nutraceutical properties. Most importantly buckwheat is gluten-free in nature and it plays a vital role in preventing celiac disease with the addition of important bioactive and nutritional components.

It is a good substitute for gluten intolerance people. It causes thinning of small intestines where nutrients are absorbed by the body and makes the body unable to absorb nutrients. In celiac patients' nutrients such as calcium, iron, fat and folate are not absorbed in small intestine and may lead to weight loss and leads to malnutrition. There is increasing demand for gluten free substitute (Biney, & Beta, 2014). This requires a real technological challenge with a broad prospect for investigation. Therefore, its dire need to produce various food stuffs to fulfill the demand of consumers and to fulfill their dietary requirements such people having allergies to combat dreadful diseases (Dinu et al., 2017). Moreover, numerous studies agreed consumer's acceptability of buckwheat-based foodstuffs (Przygodzka et al., 2015). Buckwheat grains were found to be a prebiotic, because it could raise lactic acid bacteria in rat intestine. It provides valuable health effects and avoids oxidation of food during processing (Beitane et al., 2014). With the wonderful nutritional effect of the buckwheat the study is designed to prepare the buckwheat cookies with the following objectives.

- To study the nutritional, functional (physicochemical) properties and mineral analysis of buckwheat cookies.

To aware the people of GB about the utilization of local raw material to value added products.

## **MATERIALS AND METHODS**

### **Procurement of raw material**

=Whole buckwheat flour was purchased from local market of Gilgit-Baltistan. The study was carried out in the laboratory of Food Processing Unit of Agriculture Department Gilgit-Baltistan for the development of buck wheat cookies at different concentrations. The chemical and nutritional analysis of the developed cookies was carried out at the analytical laboratory of Department of Agriculture and Food Technology, Karakorum International University.

### **Preparation of blended biscuit**

Whole buck wheat flour and other ingredients were weighed accurately according to the formulation presented in Table 1 and dough for cookies was made. Samples were categorized into five groups according to the concentration of buck wheat flour. These cookies shaped dough was placed on a dish and baked in oven at 180 °C for 10 minutes. The dish was removed from the oven and placed at room temperature for cooling. After cooling the cookies were packed in polythene packaging material.

**Table 1: Formulation of cookies**

Ingredients	Treatments				
	T <sub>0</sub>	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>
All Purpose Flour	200g	150g	100g	50g	0g

Buck Wheat Flor	0g	50g	100g	150g	200g
Butter	100g	100g	100g	100g	100g
Eggs	4	4	4	4	4
Sugar	60g	60g	60g	60g	60g
Milk powder	10g	10g	10g	10g	10g
Salt	2g	2g	2g	2g	2g
Baking powder	2g	2g	2g	2g	2g

### Phytochemical analysis

The antioxidant activity of Buck wheat cookies was estimated by DPPH method as prescribed by Mercurieff et al., (2014). Flavonoids content was determined according to method proposed by Nikolovska-Čoleska et al, (1996) using quercetin as an internal standard. The samples were analyzed for total phenolics with the help of Folin-Ciocalteu's as mentioned by Keskin et al, (2014).

### Physicochemical analysis

The moisture content of buck wheat flour cookies was determined according to AOAC (2000) Method No. 44-15.02. Kjeldahl method was used to analyze total crude protein in cookies. The crude fat content in samples was estimated by Soxhlet apparatus method by running dried samples through Soxhlet apparatus by continuous refluxing using petroleum ether as a solvent according to the procedure described in AOAC (2000) Method No.30-10.01. The crude fiber in the samples was estimated according to the procedure as outlined in AOAC (2000), Method No. 32-10.01.

### Physical analysis

The diameter (D) and thickness (T) of the cookies were determined using the method of AOAC (2000). This involves arranging six cookies in a row and taking their average diameter using ruler and thickness using a Vernier caliper with 0.01 mm. The spread ratio (SR) was calculated as in the formula:  $SR = D/T$

### Sensory evaluation

The cookies of different treatments were evaluated using 9 points hedonic score by a panel of experts according to the method as described by Meligaard et al. (2007).

## RESULTS AND DISCUSSION

### Proximate Composition

The data in figure 1 shows the comparative proximate composition of Buckwheat flour and all purpose flour. In the all-purpose flour the values for protein and moisture remained high while fiber and fat contents were in lower side. The findings for proximate composition of all purpose flour and buckwheat flour are in accordance with Kaur et al. (2015) Who observed sensory and physiochemical analysis of gluten free biscuits made with the Buckwheat flour. He observed

that the antioxidant activity and the polyphenol activity of the biscuits made with the buckwheat flour was better than that of the biscuits made from all purpose flour. Hussain et al (2017) conducted a study on the use of buckwheat in the preparation of composite flour cookies and concluded that addition of buckwheat in the cookies significantly enhanced the proximate composition of cookies.

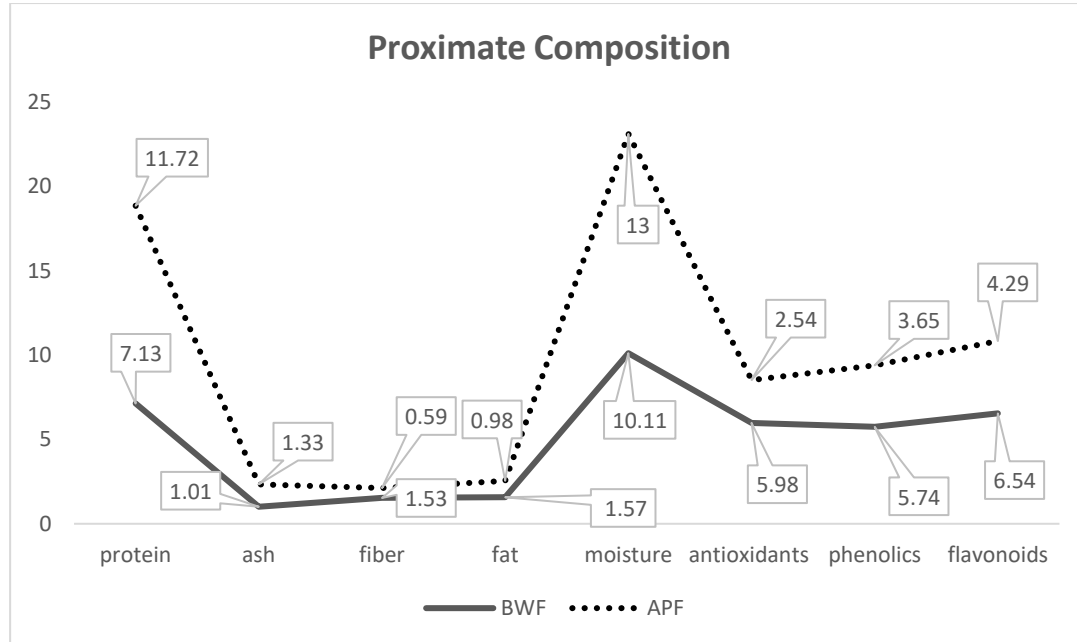


Figure 1. Proximate composition of Buckwheat flour (BWF) and all purpose flour (APF).

### Physical Properties of Cookies

The mean values and variance of physical properties of buckwheat cookies prepared with the addition of buckwheat flour substituting the all-purpose flour at different concentrations are presented in Figure 2. It was observed that weight and diameter of cookies was decreased as the buckwheat flour concentration in the cookies was increased 0g to 100g in the formulation. Thickness of the cookies remained non-significant and spread ratio of the cookies was reduced as the concentration of the buckwheat was increased in the formulation as T4(100g Buckwheat flour).

The results given by Baljeet et al., (2010) studied the effect of incorporation of Buckwheat in the production of Biscuits and observed by increasing the composition of buckwheat in the biscuits the spread ability of the biscuits was reduced, which correlates with our studies. Hooda and Jood (2005) reported that addition of fenugreek flour had adverse effect on the diameter, thickness and spread ratio of the supplemented cookies.

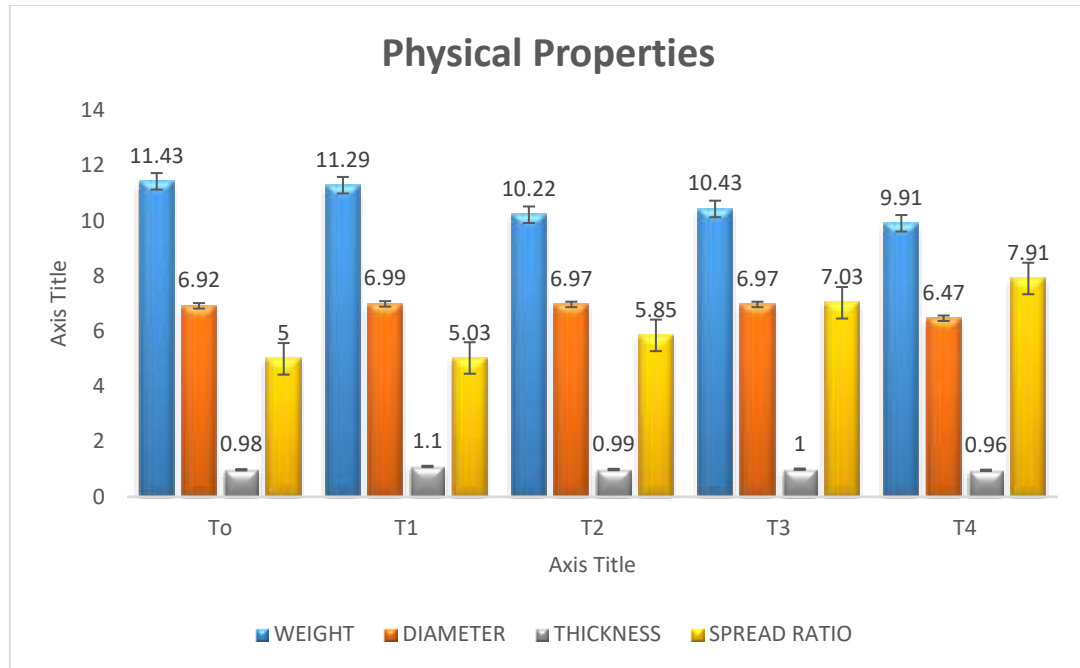


Figure 2. Physical properties of Cookies made with Buckwheat flour.

### Phytochemical Composition

The mean values for phytochemical composition of buck wheat incorporated cookies are revealed in figure 3. Highly significant results were found for antioxidant, total phenolics and flavonoid contents ( $p \leq 0.05$ ). The phytochemical content was increased by adding buck wheat flour. A gradual increase in antioxidant, total phenolics and flavonoids was observed from control to T<sub>4</sub> (100g buckwheat flour) was recorded. The mean value for antioxidant increased from control T<sub>0</sub>  $3.17 \pm 0.1$  to T<sub>4</sub>  $6.09 \pm 0.26$ , total phenolic ranged from  $5.42 \pm 0.39$  to  $6.09 \pm 0.20$  and results for flavonoids were between  $6.49 \pm 0.26$  to  $8.46 \pm 0.24$  respectively. Sakač et al., (2015) also reported enhances results for antioxidants and phenolic compound in buckwheat enriched cookies. Chlopicka et al., (2012) evaluated the antioxidant, phenolics and flavonoids in the Buckwheat and they found similar results for antioxidant and phenolics. Qin et al. (2010) analyzed different varieties of Buckwheat for physiochemical and phytochemical in China, they observed that higher contents of flavonoids and quercetin was found in the Tartary Buckwheat and their products.

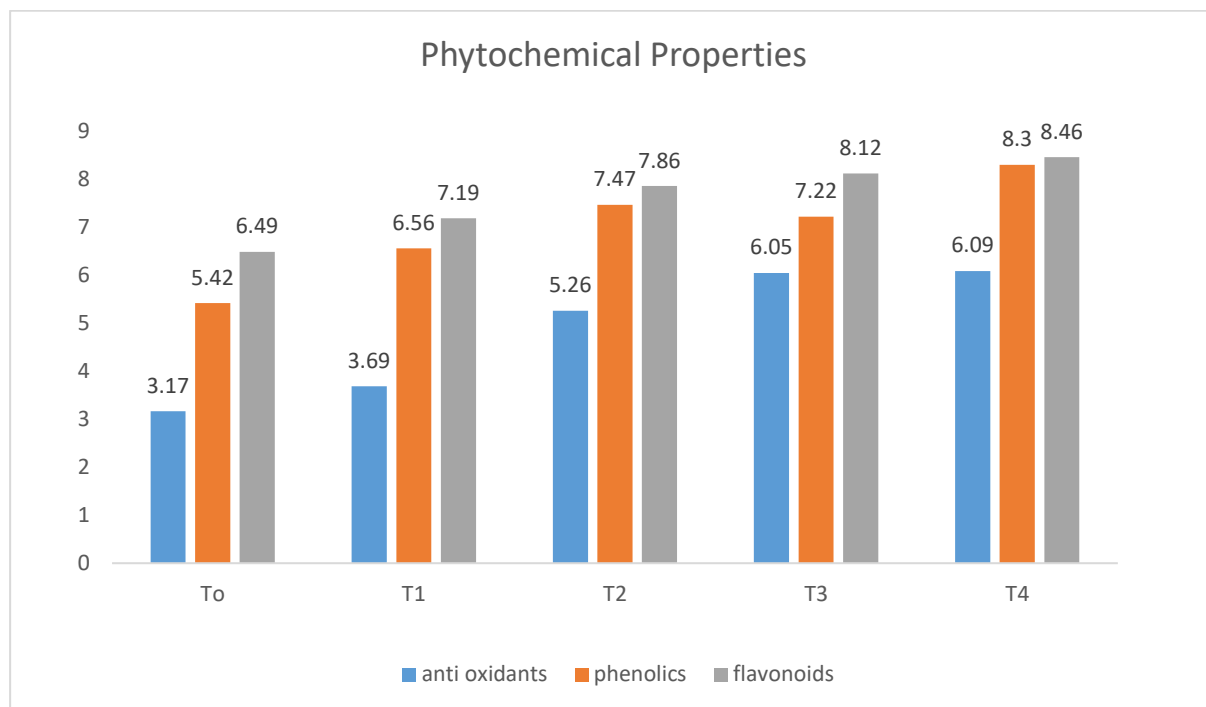


Figure 3. Phytochemical properties of Cookies made with Buckwheat flour.

### Physico-Chemical Composition

Figure 4 depicts the mean values of replication of fat, fiber, protein, ash and moisture which showed highly significance value of physio-chemical properties of the cookies prepared with the buckwheat and the wheat flour ( $p \leq 0.05$ ). The graph shows that fat, ash and fiber are increased with the addition of buckwheat flour as compared to the control value. Increase in fat content shows the oil retention capacity of buckwheat flour is more as compared to the wheat flour, as oil retention capacity of the cookies with higher proportion of the buck wheat is more. Protein in the moisture contents of the cookies was reduced as the concentration of the buckwheat was increased in the formulation. Hussain & Kaul (2018) incorporated barley and the buckwheat flour in the biscuits and concluded that the blended samples exhibited good physio chemical properties, with high fiber, ash, mineral, carbohydrates and fats compared to the samples which were prepared with the composite wheat flour alone. Jan et al. (2015) also got the similar results on investigating the effect of the blended flour on the different properties of the cookies. They concluded that the incorporation of buckwheat in the cookies not only improved the physio chemical properties but also improved keeping and nutritional properties of the cookies.

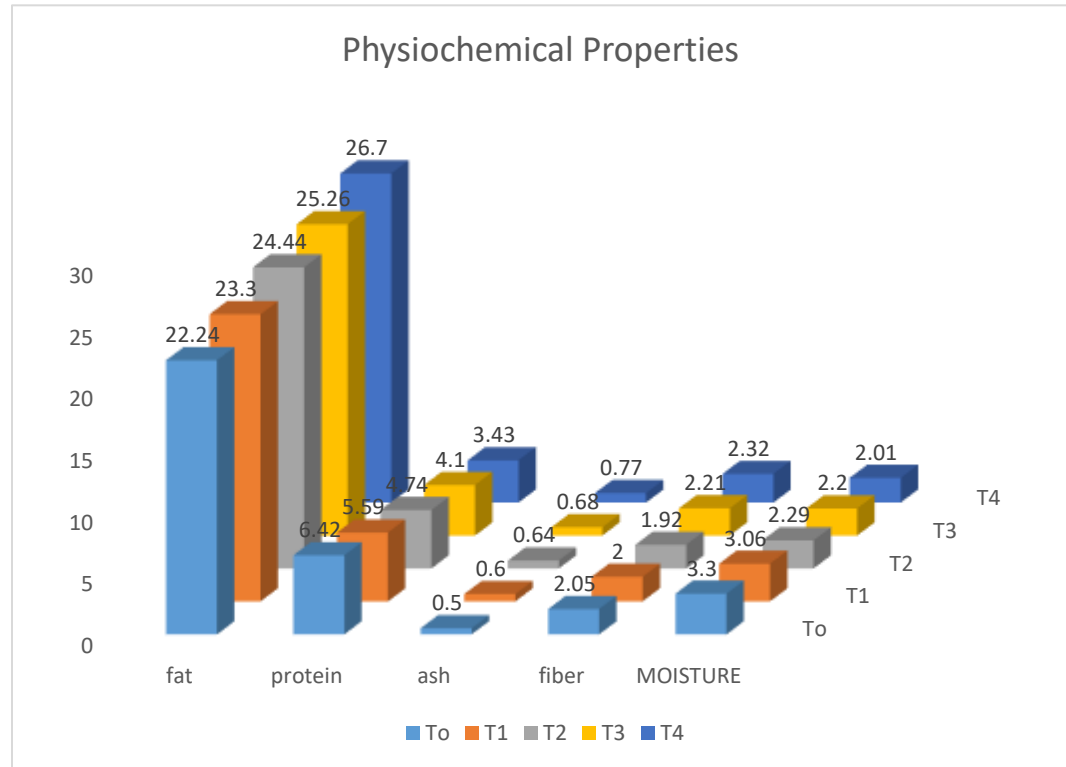


Figure 4. Proximate composition of Buckwheat incorporated cookies.

### Sensory evaluation

Sensory evaluation is an important criterion to evaluate the acceptability and quality of new product development. Figure 5 depicts the sensory parameters of cookies made with different concentration of buckwheat. Control sample and 75g buckwheat incorporated cookies exhibited high color values while the texture of T<sub>3</sub> (75g buckwheat) was liked extremely by the panelists. The acceptability of taste, flavor and texture was increased with the increase in buckwheat concentration. The overall acceptability score of T<sub>3</sub> was highest amongst all samples and it was recommended as overall acceptable for consumers. The acceptability of color reduced with the addition of buckwheat flour because buckwheat flour had higher yellowness and redness value and lower lightness than control sample (Baljeet et al., 2010). It has been investigated by Bhavsar et al (2013) that incorporation of 10% buckwheat in the bread yielded a good quality product with best sensory characteristics. Baljeet et al (2010) studies the effect of buckwheat flour on sensory characteristics of the biscuits and concluded that with the increase of the buck wheat flour in the biscuit the color value was reduced while the biscuits with 20 and 30% buck wheat flour got maximum score for the sensory evaluation.

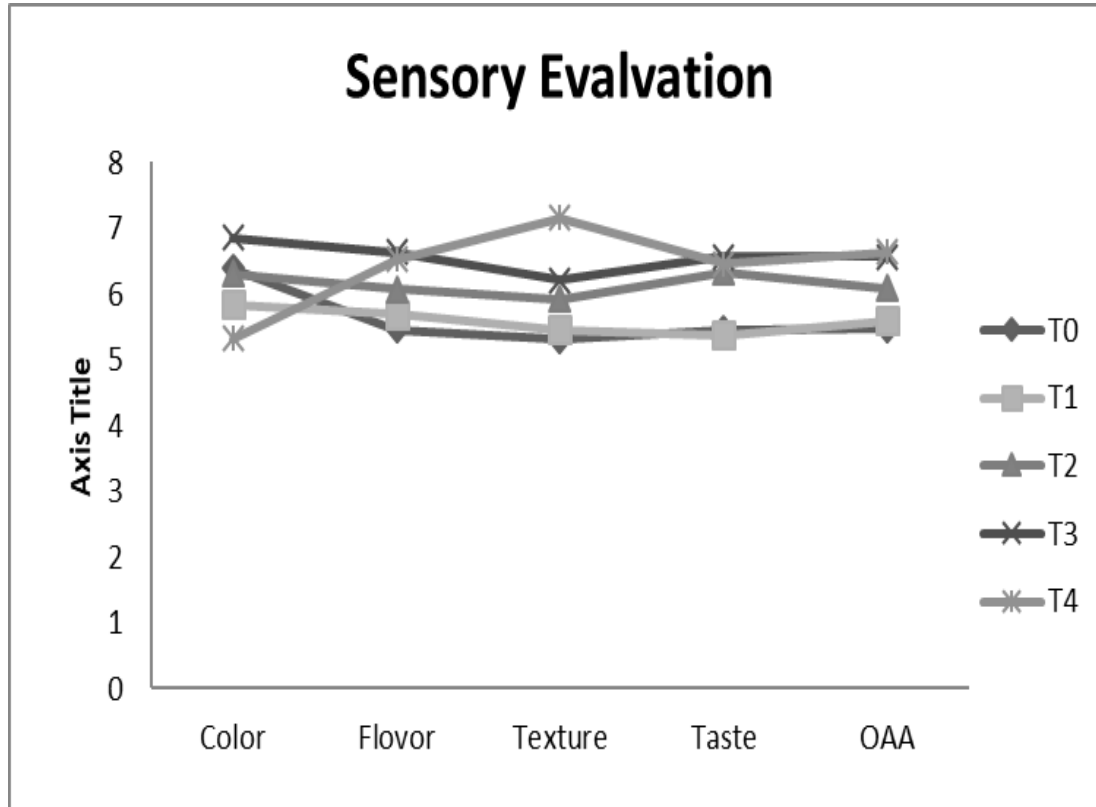


Figure 5. Sensory Evaluation of Cookies made with Buck Wheat Flour.

### Conclusion

Buckwheat is a minor crop grown in Gilgit-Baltistan, Pakistan. Its cultivation and utilization has become limited because of less value addition and less awareness in the public for its uses. It is highly nutritious pseudo cereal and it can be a better substitute of wheat flour in bakery products. Cookies made with 75g buckwheat flour were accepted by sensory judges. It contained remarkable amount of antioxidants and the compounds which have health benefits and have been used in the local community for years because of its benefits. It is gluten free therefore it can be a good substitute for people suffering from celiac disease.

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