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## Nutritional and antioxidant composition of buckwheat (*Fagopyrum esculentum* and *fagopyrum tataricum*)

**Sagun Pathania and YS Dhaliwal**

**Abstract**

Pseudocereal buckwheat is primarily grown in the Himalayan regions and possesses excellent nutritional and nutraceutical qualities. In the present study, two varieties of buckwheat i.e., USDA<sup>-1</sup> (*F. esculentum*) and UDAY (*F. tataricum*) were used and procured from Highland Agricultural Research and Extension Centre Kukumseri, Lahaul & Spiti. The physical, functional, nutritional, mineral, and antioxidant qualities of both the varieties of buckwheat, USDA<sup>-1</sup> (*F. esculentum*) and UDAY (*F. tataricum*), were evaluated. The formulations containing different proportions of buckwheat flours obtained from USDA<sup>-1</sup> (*F. esculentum*) and UDAY (*F. tataricum*) have been standardized for preparation of bakery (bread), confectionery (*Ladoo*) and extruded (pasta) products and further assessed for nutritional, minerals, antioxidant and sensory attributes/ parameters. Result of study showed that USDA<sup>-1</sup> (*F. esculentum*) and UDAY (*F. tataricum*), the values of moisture (11.3% and 10.7%), crude protein (12.44% and 11.61%), crude fat (2.64% and 2.25%), crude fiber (2.83% and 3.12%), and total ash (2.27% and 2.06%) contents, respectively. It was found that USDA<sup>-1</sup> (*F. esculentum*) variety had the highest amounts of iron (4.47 mg/100 g), zinc (2.82 mg/100 g), and magnesium (236.6 mg/100 g), respectively and whereas UDAY (*F. tataricum*) variety had the greatest levels of total flavonoid content (204 mg/100 g) and antioxidant activity (63.50%), respectively.

**Keywords:** Antioxidant, *Fagopyrum esculentum* and *fagopyrum tataricum*

**Introduction**

Buckwheat has been classified as a pseudocereal and is a member of the Polygonaceae family. The two primary species of buckwheat that humans eat are common buckwheat (*Fagopyrum esculentum* Moench) and tartary buckwheat (*Fagopyrum tataricum* L. Gaertn). Buckwheat cultivation in North- Western Himalayan region is more common as a pure crop is differ to mixed cropping which is generally practiced for other crops. Buckwheat is mostly grown in J&K, Himachal Pradesh and Uttarakhand and in some Northern state of India i.e, Sikkim, Assam, Arunachal Pradesh, Nagaland, and Manipur also cultivated in Nilgiri and Palni Hills in Southern India (Dubey *et al.* 2021) [4].

According to Bhinder *et al.* (2021) [2], people with celiac disease can accept the buckwheat proteins more readily because they are gluten-free. Buckwheat proteins are high in leucine, asparagine, phenylalanine, lysine, and trienine. They are also rich in isoleucine and cysteine. Though antinutritional elements (tannins and proteases) linked to buckwheat proteins reduce their protein digestibility, buckwheat proteins have exceptional biological properties. The bioactive components in buckwheat that boost its nutraceutical potential are polyphenolic chemicals, which include flavonoids and phenolic acids. Rich in flavonoids, buckwheat contains isoorientin, vitexin, rutin, quercetin, and isovitexin. Rutin, which has stronger antioxidant, anti-inflammatory, and anticancer effects among all pseudocereals, is exclusively found in buckwheat. Buckwheat contains flavonoids, which provide several health benefits, including medicinal ones (Raguindin *et al.* 2020) [8].

According to Chan *et al.* (2023), the food industry is investigating the creation of functional foods, and because of buckwheat's high bioactive content, it shows potential for use in energy bars, noodles, confections, and honey. Because of its nutritional value, affordability, ease of preparation, extended shelf life, and variety, pasta is a popular cereal food. Its reduced salt, fat content, glycemic index, and complex carbohydrate content are the reasons behind its rising demand.

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Pasta is frequently enhanced nutritionally by adding other ingredients, such as hull-less barley and buckwheat, which are high in fiber, protein, and minerals (Kumari and Gupta, 2022) [6].

## Material and Methods

### Procurement of raw material

Two varieties of buckwheat i.e., USDA<sup>-1</sup> (*Fagopyrum esculentum*) and UDAY (*Fagopyrum tataricum*) were procured from Highland Agricultural Research and Extension Centre Kukumseri, Lahaul & Spiti

### Estimation of nutritional quality

Both buckwheat varieties were ground for further analysis and all the nutritional parameters were determined in triplicates. The values were reported as mean for individual parameters Moisture content, crude protein, crude fat, crude fiber and total ash content were analysed by the method by (AOAC 2010) [1].

### Mineral composition

Iron, zinc, and magnesium in both buckwheat varieties were estimated by using atomic absorption spectrophotometer. Ash solutions of sample were prepared by using wet ashing method as reported by (AOAC 2010) [1].

### Antioxidant properties

Total flavonoid content (TFC) was estimated by the method described by (Zhinshen *et al.* 1999) [11]. And the antioxidant activity was determined according to the method given by (Brand William *et al.* 1995) [10].

### Statistical Analysis

From the data obtained the mean values for each sample were calculated. The significant difference in nutritional parameters and sensory attributes of treatments were tested using the analysis of variance (F test and two way ANOVA).

## Results and Discussion

### Moisture content

Table 1 also indicates that the moisture content of both buckwheat varieties such as USDA<sup>-1</sup> and UDAY. In USDA<sup>-1</sup> the moisture content was (11.3%) and in UDAY the moisture content was (10.7%). The moisture content of USDA<sup>-1</sup> was significantly higher than UDAY. The findings of the current investigation were consistent with Khan *et al.* (2013) [5] who has reported that moisture content was (11.73%, 10.08%, 10.96%, 9.30%) buckwheat bought from different villages.

### Crude protein

Table 1 determines that the crude protein content of both buckwheat varieties i.e., USDA<sup>-1</sup> and UDAY. The crude protein content of USDA<sup>-1</sup> (12.44%) was significantly greater than UDAY (11.61%). Verma *et al.* (2020) [9] has reported that the crude protein content in common buckwheat (13.3%) and in tartary buckwheat (10.3%) respectively.

### Crude fat

Data presented in table 1 represents that crude fat content in both buckwheat varieties i.e., USDA<sup>-1</sup> and UDAY. USDA<sup>-1</sup> (2.64%) was higher than UDAY (2.25%). It was found that there was no significant difference between the crude fat content of both varieties of buckwheat. The results of this research coincided with Khan *et al.* (2013) [5], who reported

that the fat content of buckwheat purchased from four villages was 11.73%, 10.08%, 10.96%, and 9.30%.

### Crude fiber

Table 1 indicates the result of buckwheat varieties like USDA<sup>-1</sup> and UDAY. The crude fiber content in the variety UDAY (3.12%) was significantly higher than variety USDA<sup>-1</sup> (2.83%). The current study's findings aligned with Qin *et al.* (2010) [7], who observed fiber content in common buckwheat (2.30%) and tartary buckwheat (2.58%).

### Total Ash

Determination of total ash content in both varieties such as USDA<sup>-1</sup> and UDAY. The total ash content in USDA<sup>-1</sup> (2.27%) was highly significant than UDAY (2.06%) which were shows in table 1. The current investigation's findings were compatible with Verma *et al.* (2020) [9] report of ash content in common buckwheat (2.1%) and tartary buckwheat (1.8%).

### Minerals composition

**Iron content:** In the present study the iron content in both buckwheat varieties i.e., USDA<sup>-1</sup> and UDAY which shows in (table 2). The iron content present in USDA<sup>-1</sup> (4.47 mg/100g) was significantly greater than UDAY (4.25mg/100). The current examination findings concurred with Bonafaccia *et al.* (2003) analysis on the iron content of common buckwheat (90.6mg/kg) and tartary buckwheat (147 mg/kg).

### Zinc content

Data presented in table 2 indicates that the zinc content in both buckwheat varieties i.e., USDA<sup>-1</sup> and UDAY. USDA<sup>-1</sup> contain (2.82 mg/100 g) zinc content whereas UDAY contain (2.67mg/100g). So that USDA<sup>-1</sup> was highly significant than UDAY. The current study findings concided with Bonafaccia *et al.* (2003) reported on the ash content of common buckwheat (30.2 mg/kg) and tartary buckwheat (78.8 mg/kg).

### Magnesium content

Data in table 2 reveal the values of both buckwheat varieties such as USDA<sup>-1</sup> and UDAY. The magnesium content present in both USDA<sup>-1</sup> and UDAY 236.6 mg/100 g, 210.4 mg/100 g respectively, this result shows that the USDA<sup>-1</sup> was significantly greater than UDAY. Qin *et al.* (2010) [7] found a similar magnesium content in buckwheat, ranging from 254 mg/100 g to 274 mg/100g, despite the fact that the buckwheat was obtained from various growers.

### Antioxidant Properties

**Total Flavonoid Content:** The table 3 indicates that the total flavonoid content in both buckwheat varieties i.e., USDA<sup>-1</sup> and UDAY. In variety UDAY (204 mg/100g) was highly significant than USDA<sup>-1</sup> (197 mg/100 g). Chlopicka *et al.* (2012) [3] analysed the total flavonoid content of buckwheat purchased from farmers was determined to be 153µg/g respectively.

### Antioxidant activity

Table 3 also shows antioxidant activity in both varieties i.e., USDA<sup>-1</sup> and UDAY. UDAY (63.50%) was substantially higher antioxidant activity than USDA<sup>-1</sup> (62.59%). The antioxidant activity variation of both buckwheat varieties were determined to be statistically significant. Chlopicka *et al.* (2012) [3] analysed the antioxidant activity of buckwheat purchased from farmers was determined to be 8.80 mmol Trolox/kg respectively.

**Table 1:** Nutritional composition of buckwheat (USDA<sup>-1</sup> and UDAY)

Parameters	USDA <sup>-1</sup> ( <i>F. esculentum</i> )	UDAY ( <i>F. tataricum</i> )	CD (p≤0.05)
Moisture content (%)	11.3	10.7	0.19
Crude Protein (%)	12.44	11.61	0.27
Crude Fat (%)	2.64	2.25	0.49
Crude fiber (%)	2.83	3.12	0.12
Total Ash (%)	2.27	2.06	0.11

**Table 2:** Mineral composition of buckwheat (USDA<sup>-1</sup> and UDAY)

Parameters	USDA <sup>-1</sup> ( <i>F. esculentum</i> )	UDAY ( <i>F. tataricum</i> )	CD (p≤0.05)
Iron (mg/100 g)	4.47	4.25	0.30
Zinc (mg/100 g)	2.82	2.67	0.06
Magnesium (mg/100 g)	236.60	210.40	10.59

**Table 3:** Antioxidant properties of buckwheat (USDA<sup>-1</sup> and UDAY)

Parameters	USDA <sup>-1</sup> ( <i>F. esculentum</i> )	UDAY ( <i>F. tataricum</i> )	CD (p≤0.05)
Total Flavonoid Content (mg/100 g)	197.00	204.00	4.3
Antioxidant activity (%)	62.59	63.50	0.14

### Conclusion

The current study's findings indicate that two buckwheat varieties, USDA<sup>-1</sup> (*F. esculentum*) and UDAY (*F. tataricum*), have high nutritional values and sufficient amounts of protein, minerals, and constituents with antioxidant activity. As a result, they can play a significant role in the diet because of their numerous health-improving advantages.

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