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## REVIEW ARTICLE

# MINERAL NUTRIENT CONTENT OF BUCKWHEAT (*Fagopyrum esculentum* Moench) FOR NUTRITIONAL SECURITY IN NEPAL

Bikram Nepali<sup>1</sup>, Devashish Bhandari<sup>1</sup>, Jiban Shrestha<sup>2</sup>

<sup>1</sup>Agriculture and Forestry University, Rampur, Chitwan, Nepal.

<sup>2</sup>National Commercial Agriculture Research Program, NARC, Pakhribas, Dhankuta, Nepal

\*Corresponding author email: [bikramn25@gmail.com](mailto:bikramn25@gmail.com)

ORCID: <https://orcid.org/0000-0001-9566-291X>

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## ARTICLE DETAILS

## ABSTRACT

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Buckwheat (*Fagopyrum esculentum* Moench) is grown primarily to produce grains for human consumption because of its nutritive and health promoting value. Buckwheat is the sixth staple food after rice, wheat, maize, finger millet and barley in Nepal. This study principally focuses on the mineral nutrient content of buckwheat and their role in human health and nutrition. Buckwheat is used as basic food, animal feed, vegetable, soup, beverage and medicine. It is rich source of proteins, starch, antioxidants, dietary fibre and trace elements. It is rich in minerals like Zn, Cu, Fe, Mn, Se, K, Na, Ca and Mg. It is rich in fats, flavonoid and vitamin especially B groups. Buckwheat proteins contain amino acid which is well balanced and is of a high biological value. Buckwheat is rich source of rutin. The high level of rutin is extracted from the leaves for medicine to treat high blood pressure. This review serves as a useful tool to researchers and nutritionist who are working in food and nutritional security in Nepal.

## KEYWORDS

Common Buckwheat, Nutrient value, Food security, Nepal

## 1. INTRODUCTION

In Nepal, buckwheat is a sixth staple food crop after rice, wheat, maize, finger millet, and barley. It is considered as poor man's crop and is an alternate cereal that represents an important food supply in remote places of Himalayas. Both species of buckwheat species namely *Fagopyrum esculentum* Moench and *F. tataricum* Geartn are grown in Nepal. It is staple food crop in high hills where it is grown as the major summer crop. In colder areas Tataricum type is more common where common buckwheat cannot be cultivated [1]. Common Buckwheat (*fagopyrum esculentum*) is grown throughout the country, whereas bitter Buckwheat (*fagopyrum tatricum*) is grown in the hilly area of Nepal. Hill Crops Research Program (HCRP), Dolakha, Nepal has 495 accessions of buckwheat that includes common and tataricum type from local and exotic sources [1]. Relatively wide adaptability has been observed in tataricum type than in common buckwheat.

It is the best crop in higher altitude in terms of adaptation to different climatic variables and easily fitted to different cropping patterns due to short duration. It is cultivated on marginal land in 61 out of 75 districts of Nepal from some 60 m to 4500 m above sea level, especially hilly and mountain districts like Rukum, Rolpa, Jajarkot, Dolpa, Humla, Jumla, Kalikot, Kavre, Dolakha, and Okhaldhunga, Mustang, Solukhumbu, and Taplejung districts regularly since time immemorial [2]. Recently it has been grown in some Terai districts like Chitwan, Jhapa, and Nawalparasi for commercial purposes especially for green vegetable which has very high demand due to rutin contents. Every family grows Tartary buckwheat

in upper Mustang and Dolpa districts and diversity of buckwheat is very high in Manang, Dolpa, Mustang, Jumla, and Solukhumbu [2,3].

Grain and other tissues of buckwheat contain many nutraceutical components and rich in vitamins, especially B groups [4,5]. The amino acid composition of buckwheat proteins is well balanced and has a high biological value, although protein digestibility is relatively low [6]. The microelements, such as Zn, Cu, Mn, Se can be achieved from buckwheat grains and and microelements: K, Na, Ca, Mg [7,8]. Rutin, catechins and other polyphenols and their significant antioxidant effects the dietary value [9,10]. Buckwheat grain is a rich source of TDF (total dietary fiber), soluble dietary fiber (SDF), and is used in the prevention of obesity and diabetes [11].

## Rational of study

Human daily basis consumption of food were Rice, Maize, and wheat in Nepal. The ratio of cultivation and consumption of those food crop was increasing annually, whereas these crop does not provide ample nutrition for pregnant women and children. However, underutilized crop like: Buckwheat, finger millet, prosomillet, and amaranthus which contain high nutrition value are in the looming stage. If such production trend of major crops spike, it would threat the food basket of Nepal. This review assesses the nutrition value of Buckwheat, so that it can be an informative paper to every viewer.

## 2. Growth value of buckwheat

Buckwheat is a multipurpose crop and is grown for use as basic food, animal feed, vegetable, soup, beverage and medicine [2,12]. All parts of buckwheat plants are used in various ways. The rutin produced by leaf is an important pharmaceutical product used to brew tea for the treatment of hypertension. About a month, blooming flowers produce high-quality nectar for honey; grains are the basic food; hulls of grains are used to make pillows; straw is a good source for livestock; green plants are used as green fertilizers [2, 13].

In Nepal there is a list of 34 dishes prepared with buckwheat, such as such as dhindo (thick porridge), roti (bread), momo (Chinese pancake), lagar (very thick bread), dheshu (thicker than lagar), fresh vegetables, dried vegetables, Kancho pitho (raw flour), chhyang or jaand (local beer), raksi (alcohol), salad (leaves), pickle (fresh and dry leaves), soup, ryale roti, Noodle, sel roti, bhat (rice), sausage, dorpa dal, tea, vinegar, jam, macaroni, biscuit, cakes, mithai (sweet), haluwa, puri, puwa, bhuteko Phapar (roasted grain), satu, phuraula, porridge, and pakauda. Nepalese people from mountain region prefer dhindo than other items due to their specific taste [2,3].

### 3. Health benefits of buckwheat

Buckwheat is a very nutrient-rich, gluten-free plant source for a wealth of health benefits, including a boost in heart health, reduction in blood pressure, aid in weight loss, prevention of certain cancers, management of diabetes, improved digestion and cholesterol levels, and stronger immune system. Buckwheat gives higher calories and carbohydrates than the widely consumed wheat. It can easily serve as an excellent alternative to the traditional wheat [14]. Buckwheat is a great source of dietary fibre, with 10g per 100g [15]. It is another gluten-free food source. The grains compose of several polyphenolic antioxidant compounds such as rutin, tannins, and catechin. The rutin (extracted from the buckwheat leaves) is used as medicine to treat high blood pressure. Buckwheat is a good source

of protein with 13.2g per 100g [15]. The protein it contains is of a very high quality, the amino acids are well balanced. It is particularly high in lysine and arginine [16]. It is a very good source of the mineral magnesium (231mg per 100g) [15]. Buckwheat is a great source of manganese, phosphorous, copper [17]. For the production of red blood cells copper is necessary. Magnesium make relaxes blood vessels leading to brain and found to have healing effects on depression, and headache. Buckwheat is rich in Folate, it helps your body produce and maintain new cells, especially red blood cells. It is particularly important for pregnant women to have enough folate. They must start having folate rich foods like Buckwheat even while they are planning to conceive. Consuming enough folate before and during pregnancy helps to prevent major birth defects concerning the baby's brain. Buckwheat grains have more B-complex group of vitamins, especially riboflavin (vitamin B2) and niacin (vitamin B3).

### 4. Nutritional and chemical components of buckwheat grains

Buckwheat protein is rich in arginine and lysine, which constituent about (13.36%) [10,18]. The amino acid composition of buckwheat proteins is of a high biological value and is well balanced [19]. Buckwheat products is an important source of retrograded starch [18]. It also contains some healing component and biologically active properties, such as flavonoids and flavon, condensed thanins, phenolic acid, phytosterols and fagopyrins in grain and hulls. Flavonoids are phytonutrients which act as antioxidants and having chelating properties [20]. Flavonoid compound is effective for the reduction of blood cholesterol and helping the reduction of blood pressure.

Rutin was the essential and beneficial component from health point of view especially found in the Buckwheat. It was a flavonol glycoside composed of flavonol quercetin and disaccharide rutinose. It has a ability to generate reactive oxygen due to antioxidant power. Rutin was found to possess highest antioxidant activity of all the identified phenolics in buckwheat.

**Table 1:** Amount of proteins contents in buckwheat grains [18]

N (% d.m.) × 6.5	Authors
12.0 – 13.0	[21]
12.11	[5]
13.30 – 15.55	[8]
8.51 – 18.87	[22]
12.02	[23]

**Table 2:** Amino acid content of buckwheat grain (%w/w) [18]

Aminoacids	[8]	[24]	[25]
Lysine	4.9	6.17	5.68
Histidine	1.4	2.44	2.52
Arginine	5.4	8.85	11.16
Glutamic acid	9.7	15.37	19.38
Aspartic acid	5.2	9.10	9.54
Threonine	1.9	4.04	3.5
Serine	2.4	4.89	4.61
Proline	2.6	4.57	7.93
Glycine	4.2	6.23	5.66
Alanine	3.0	4.82	3.89
Valine	3.4	4.97	4.26
Isoleucine	2.6	3.41	3.12
Leucine	2.8	6.12	5.94
Methionine	1.6	0.99	2.3
Tyrosine	1.5	1.94	3.03
Phenylalanine	2.0	4.42	4.3
Tryptophane	1.5	2.14	2.0

**Table 3:** Nutrient content in Buckwheat.

S.No.	Component	Amount	Cited
1.	Content of phytosterols	250 mg/day	[26]

2.	Protein content	11.5g/100g	[27]
3.	Lipid content	3.45g/100g	[27]
4.	Carbohydrate content	6.4g/100g	[28]
5.	Vitamin B6 content	0.61mg/100g	[29]

Buckwheat was used for making bread, chapati, biscuits, cakes, dhindo, wine, buckwheat tea etc. Thus, it can be used as staple diet in our country. Consumption of bread with 30% added buckwheat increases antioxidant capacity of serum [2]. Buckwheat kernel was rich in soluble protein, but it has leucine as a first limited amino acid [8]. Flavonoids biosynthesis in buckwheat makes it a health promoter food [30]. Buckwheat kernel was rich in K, Fe and Zn in albumin, Ca, Mg and Mn in globulin and Na in prolamin and glutelin [8]. Buckwheat protein has one of the highest amino acid scores of protein in plant food stuffs [31]. Buckwheat products have high level of resistant starch [32]. Buckwheat is rich source of phytosterol mainly sitosterol and campesterol [27]. Plant sterols have positive correlation with lowering blood cholesterol level [22]. Cycloartanol was identified as unique sterol in raw and roasted buckwheat products [27].

### 5. Role of buckwheat in nutritional security in Nepal

Buckwheat can be used as a staple diet in Nepal by substituting highly polished rice. Buckwheat higher nutritional value and medicinal value acts as a food guard in the food security of Nepal. It has a multiple use thus providing hub for agrobased industry. It is grown in marginal lands with harsh environmental conditions thus being friendlier with farmers. But its cultivation is decreasing, and its landraces are deteriorated due to various factors. Preserving germplasm and planting local landraces helps for long term sustainable agriculture in Nepal. It has an allelopathy effect thus we do not have to deal with weed problems like in other crops. It can easily cope with changing climate. Buckwheat flowers are very fragrant and are attractive to bees thus they can be used to produce special, strong, dark honey (Up2018). Buckwheat can be served as an alternative to rice (Up2018). Buckwheat should be introduced in our daily diet to overcome various health problems. Raw buckwheat groats are rich source of lipid, protein and sterol in comparison to roasted buckwheat groats [27]. Buckwheat contains high level of starch similar to many cereal grains [31]. Components responsible for technological products may be concentrated or regulated to obtain a desired product [32]. It grows well in areas with less fertile soil and little rainfall. Leaves and shoot of common buckwheat is used as leafy vegetable in Himalayan region [33]. Emphasis has to be given on conservation and utilization of various genetic resources of this multipurpose crop for economic and food security [33,34].

### 6. CONCLUSION

Increased production of major cereals undermined the production of highly nutritious crop like Buckwheat. Lack of Proper extension and knowledge regarding the nutrition value of underutilized crops has caused increased obsession with major crops. Buckwheat is rich in retrograded starch, well balanced proteins, fats and vitamin especially B groups. Rutin acts as a good antioxidant and sterols are positively associated with health benefits. It is rich in minerals like Ca, Mg, Zn, K and Na. Buckwheat can be used as nutritious and energizing food which contribute food and nutritional security in Nepal.

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