VOL. 8, NO. 3, MARCH 2013 ISSN 1990-6145
ARPN Journal of Agricultural and Biological Science

www.arpnjournals.com

NUTRITIONAL EVALUATION OF COMMON BUCKWHEAT OF FOUR DIFFERENT VILLAGES OF GILGIT-BALTISTAN

Faizullah Khan, Muhammad Arif, Tariq Umar Khan, Muhammad Iqbal Khan and Javed Abbas Bangash
Pakistan Council of Scientific and Industrial Research Laboratories, Skardu, Gilgit-Baltistan, Pakistan
E-mail: faizkarinasbt@gmail.com

ABSTRACT

Chemical and mineral evaluation of buckwheat (*Fagopyrum esculentum*) obtained from four different villages of Gilgit-Baltistan was carried out at the PCSIR Labs Peshawar, Pakistan. For this purpose samples of common buckwheat (*Fagopyrum esculentum*) from different altitudes of Gilgit-Baltistan were analyzed. The results of the present investigation showed that buckwheat of high altitude (both Gilgit and Baltistan region) was high in protein, fat, and ash, and low in nitrogen free extract and fiber, while the buckwheat of lower altitude (both Gilgit and Baltistan region) was high in nitrogen free extract and fiber and low in protein, fat, and ash. Gluten content was not detected in all the samples. Similarly high concentration of Potassium almost three times of sodium was recorded, indicating a good source for patients with hypertension. However other minerals like calcium, zinc, iron, copper, manganese, and chromium were also detected in appreciable amounts. From the present study it can be concluded that the buckwheat cultivated on high altitude is more ideal for incorporation in diet formulation of baby foods, especially gluten sensitive patients and hypertensive people.

Keywords: buckwheat, nutritional, mineral composition, high and low altitude, gilgit-baltistan.

INTRODUCTION

Buckwheat (*Fagopyrum esculentum*) belongs to the Polygonaceae family, is usually considered a cereal in agriculture and food technology because of its usage and the cultivation techniques used. Originating from Asia and introduced into Europe around the 15th century, the cultivation of buckwheat has spread to Canada, the United States of America and to certain areas of Africa and Latin America, with an annual yield, worldwide, of approximately one million tons. The agricultural features which have first and foremost encouraged its cultivation in such varied regions are primarily that buckwheat is semi-wild, does not have particular soil or fertilization requirements and can, furthermore, grow at high altitudes (above 3, 000 meters in Nepal and Bhutan).

In comparison with traditional cereals, buckwheat proteins are high in lysine, which makes it interesting from a nutritional point of view and also gluten free. It could therefore be used as a substitute for wheat in gluten-free diets for celiac patients [1-2]. Buckwheat flour contains some essential nutrients at a high level. Therefore, buckwheat can be a potential source of such essential nutrients. In view of its beneficial effects on human health [3-4-5], increasing attention to buckwheat as a functional food [6, 7] has been currently paid. It is considered that buckwheat flour and its products can be totally a food with high nutritional value.

Buckwheat products are important source of trace elements [8] and dietary fiber [9]. Buckwheat proteins have a high biological value [10]. Buckwheat protein products have been associated with preventive nutrition [11]. Buckwheat has no gluten, so it is safe for patients with celiac disease [12]. Buckwheat may be a valuable source of minerals for the people who consume it. It is a good source of dietary zinc, copper, and manganese [13-14].

The aim of the present work was to nutritionally evaluate the buckwheat grown at different high altitudes of Gilgit/Baltistan. As the research team carried out this study is involved in preparation and formulation of value added products from natural resources of the country, therefore it was a sort of screening of buckwheat.

MATERIALS AND METHODS

Four samples of common buckwheat (*Fagopyrum esculentum*) were obtained from four different areas namely Ghancha Baltistan (7500 feet), Kashubagh Baltistan (6950 feet), Astore Gilgit (7540 feet) and Harcho Gilgit (6700 feet) of Gilgit Baltistan. The husks of the samples were removed manually and dehulled buckwheat samples were milled using laboratory mill 3100 Finland. The samples were analyzed in triplicate for their proximate composition, mineral contents as per standard procedures.

Proximate composition

Proximate composition includes moisture, Crude protein, ether extract, Crude fiber, Ash, and Nitrogen free extract. Moisture was determined by oven dehydration method at 105°C up to the constant weight. Crude protein was determined by using Kjeldhal method, Crude fat was determined by ether extraction method using sohxlet. Crude fiber was determined by Acid digestion and Alkali digestion method. Ash content was determined in muffle furnace at 550°c for 6 hours. For all these determinations powdered sample were used in triplicate in accordance with [15]. NFE was calculated by difference.

Determination of minerals

For minerals determination 0.5g of each sample was wet digested with HNO_3: $HClO_4$ (2:1) for 2-3 hours on heating mantle [16]. Digested samples were filtered through 0.45 µm pore size Millipore filter and volume was

made to 100 ml with distilled water. Concentration of Ca, Fe, Cu, Zn, Mn and Cr was determined on Hitachi Zeeman Japan Z-8000, Atomic Absorption Spectrophotometer equipped with standard hallow cathode lamps as radiation source and air acetylene flames, while Na and K concentration was determined on Flame Photometer.

RESULTS AND DISCUSSIONS

Chemical composition

The data related to proximate composition of buckwheat samples is shown in Table-1 and mineral content in Table-2. The moisture, protein, fat, fiber, ash and nitrogen free extract were found in the minimum and maximum range of (9.30±0.20-11.73±0.23), (13.9±0.02-16.52±0.03), (0.92±0.05-1.45±0.08), (0.75±0.01-0.96±0.02), (1.14±0.03-1.62±0.04) and (68.03±0.22-73.59±0.22) percent, respectively. The gluten was below detection limit. Buckwheat flour contains from 8.5% to near 19% of proteins depending on the variety, pesticides used, and fertilization that are likely to affect the total concentration of buckwheat proteins [17]. Buckwheat grains contain from 1.5% to 4% of total lipids [9], but the content of raw fat in buckwheat flour exceeds 3% [18]. Moreover, buckwheat grains are a rich source of TDF (total dietary fiber), soluble dietary fiber (SDF), and are applied in the prevention of obesity and diabetes [19].

Similarly the minerals K, Na, Ca, Fe, Cu, Zn, Mn and Cr were found in the minimum and maximum range of (2425±0.15-2613±0.17), (690±0.02-1020±0.01), (210±0.5-260±0.2), (178±0.2-243±0.9), (18.3±0.14-20.2±0.21), (30.51±0.04-38.1±0.12), (9.8±0.03-12.9±0.002) and (6.8±0.01-7.9±0.003) ppm, respectively. Buckwheat is rich in potassium (K), magnesium (Mg), calcium (Ca), and sodium (Na). Buckwheat may be an important nutritional source of such microelements as iron (Fe), manganese (Mn), and zinc (Zn) [20]. Trace elements, e.g. chromium (Cr) or selenium (Se), are occasionally detected at very low levels [21].

The results of the present investigation showed that buckwheat of high altitude (both Gilgit and Baltistan region) was high in protein, fat, and ash, and low in nitrogen free extract and fiber while the buckwheat of lower altitude (both Gilgit and Baltistan region) was high in nitrogen free extract and fiber and low in protein, fat, and ash. Gluten content was not detected in all the samples. Similarly high concentration of Potassium almost three times of sodium was recorded, indicating a good source for patients with hypertension. However other minerals like calcium, zinc, iron, copper, manganese, and chromium were also detected in appreciable amounts.

Table-1. Chemical composition of buckwheat of four different villages of Gilgit-Baltistan.

S. No.	Chemical composition	Sample 1	Sample 2	Sample 3	Sample 4
1	Moisture (%)	11.73±0.23*	10.08±0.21	10.96±0.22	9.30±0.20
2	Protein (%)	16.4±0.02	14.1±0.01	16.52±0.03	13.9±0.02
3	Fat (%)	1.45±0.08	0.95±0.05	1.32±0.06	0.92±0.05
4	Fiber (%)	0.77±0.02	0.84±0.04	0.75±0.01	0.96±0.02
5	Ash (%)	1.62±0.04	1.14±0.03	1.53±0.04	1.33±0.02
6	NFE (%)	68.03±0.22	72.89±0.26	68.92±0.21	73.59±0.22
7	Gluten (%)	ND	ND	ND	ND

*Average of triplicate determinations ± SD (standard deviation)
Sample 1= Ghancha Baltistan, Sample 2= Kashubagh Baltistan, Sample 3= Astore Gilgit, Sample 4= Harcho Gilgit

Table-2. Mineral content of buckwheat (ppm)

S. No.	Mineral composition	Sample 1	Sample 2	Sample 3	Sample 4
1	Potassium (k)	2425±0.15*	2468±1.1	2613±0.17	2438±0.23
2	Sodium (Na)	788±0.01	1020±0.01	690±0.02	979±0.01
3	Calcium (Ca)	260±0.2	210±0.5	240±0.15	218±0.03
4	Iron (Fe)	203±0.15	178±0.2	243±0.9	190±0.24
5	Copper (Cu)	19.71±0.21	18.3±0.14	20.2±0.21	20±0.13
6	Zinc (Zn)	33.51±0.11	30.51±0.04	38.1±0.12	32.4±0.05
7	Manganese (Mn)	10.84±0.01	10.99±.02	9.8±0.03	12.9±0.002
8	Chromium (Cr)	7.89±0.01	6.8±0.01	7.81±0.02	7.9±0.003

*Average of triplicate determinations ± SD (standard deviation)
Sample 1 = Ghancha Baltistan, Sample 2 = Kashubagh Baltistan, Sample 3 = Astore Gilgit, Sample 4 = Harcho Gilgit

CONCLUSIONS

The results of the present investigation revealed that buckwheat of high altitude is high in protein, fat, and ash content and low in fiber and nitrogen free extract. Thus on the basis of our findings the buckwheat of high altitude is ideal for incorporation in diet formulations. The high concentration of protein, fat, ash and low concentration of fiber and nitrogen free extract may be due to cooler atmosphere. The chemical composition and mineral content of buckwheat of Gilgit Baltistan have not been previously reported. The results in this research confirm that buckwheat of Gilgit Baltistan is a good source of many important nutrients that appear to have very positive effect on human health.

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