Research Article

Biochemical and trace elements composition of faba bean (*Vicia faba* L.) cultivated in Panjgur and Kech districts of Balochistan

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Abstract

Legumes have a very important place in human food. Historically they have been grown since antiquity. Due to high nutritive value they are recommended in daily intake diet. The present study was conducted to determine the biochemical profile and assessment of trace elements in faba beans (*Vicia faba* L.) from two districts of Balochistan. Biochemical studies indicated that they have different moisture content (7.5 % and 9.5 %), ash content (3.7 % and 3.8 %), fat content (2.07 % and 1.73 %) and protein content (21.62 % and 22.44 %) for samples collected from both locations Panjgur and Kech districts. Trace elements analysis showed the concentration of manganese (Mn) 0.127 and 0.129 µg/g, zinc (Zn) 1.132 and 0.951 µg/g, copper (Cu) 0.57 and 0.60 µg/g, Iron (Fe) 0.07 and 0.09 µg/g respectively, in samples from both districts. The concentration of chromium (Cr) and Nickel (Ni) were not detected in samples from Panjgur district, whereas, their concentrations in samples from Kech district were found 0.01 µg/g. The study concludes that the faba beans grown in Balochistan have high nutritive value and low trace metallic content profile which makes it fit for food and feed. Moreover, a significant correlation was found by comparing obtained profiles of faba beans from both districts. The study suggests that faba beans genotypic evaluation and soil analysis is required for better crop production.

Keywords: Faba bean; Chemical composition; Trace element; Balochistan

Introduction

Legumes are very important for human consumption due to its high protein content [1]. Legumes, generally described by their unusual podded fruit [2]. Globally, 800 million people are malnourished [3].

Unfortunately, advances in legume crop in term of yields have not kept back pace as compare to cereals [2]. In local market various wild species are available. The scientific data available is very limited on potential plants [4]. Origin of faba beans is

reported from North Africa and West Asia [5]. These legume seed beans are grown globally on 2.5 million ha of land, with 36% in Central and East Asia and about 21% in Sub-Saharan Africa under its cultivation [5]. Faba bean is considered one among the best crop has grain legume with over 7.0 grain yield potential with an advantages of addition of atmospheric nitrogen to the soil. Faba bean is very important cash and food crop. It is high in protein (23–26%) and composes plentiful of health-benefiting antioxidants [6]. Being so important crop, there is a need to enhance faba bean cultivation [7]. Pakistan has an agro-based economy, a producer of diverse kinds of legumes like lentil, chickpea, broad and kidney beans etc. Consumption of legumes in food as a source of protein is increasing with the passage of time [8]. Therefore, pulses are considered as the most significant source of vegetable protein in Pakistan and are cultivated on 5% of the total cropped area [9]. The local people living in both districts have wealthy culture which as a treasure for the ethnographers and botanist, plant has significant place in their culture [10]. District Kech (Turbat district) is in the south west of Balochistan [10]. It produces many vegetative products suitable in the warm climate. The climate in this area is so warm that the temperature sometime increased up to 50°C, the climate and environment are the most influence factors in the agricultural growth of an area [10]. Panjgur has a warm climate in the summer and cold weather in winter. In winter, season faba beans sown normally and eaten as a delicious food [10, 11]. Faba beans locally known as “Bakalink” and are one of the major grown vegetable. People in this area use it as a food throughout the year. It is cooked and served in the restaurant as a good source of nutrition. Most of the people living in Panjgur, Kech and nearing districts eat “Bakalink” as delicious food during its

winter season in green formation and rest of the year as dry legume [11]. There is no data available regarding biochemical value of faba beans as a cultivated crop in Balochistan. Moreover, lack of knowledge among local people regarding its nutritive value [10] strongly pushes the work towards assimilation and assessment of biochemical value of faba beans. Keeping in view of the nutritive importance of the legume, this study was conducted to explore the biochemical composition and trace elements content of faba beans (*Vicia faba* L.) from Panjgur and Kech districts of Balochistan, Pakistan.

Materials and methods

Faba beans locally known as Bakalink were purchased from Panjgur and Kech district headquarters at the time of a market day when farmers and consumers come from different parts of the district for trade. During the purchase, information regarding the origin was recorded. Cleaned Faba bean seeds were sun dried, and stored in airtight polythene bags until required for analysis. It was difficult to removed seed skin on dry seeds, for this purpose the seeds were soaked in distilled water until the skin burst and was removed manually. After peeling the seeds were dried in an oven at 70°C to remove moisture. Then the seeds were crushed and screened with sieve mesh 60. The crushed material was stored in desiccators for analysis of biochemical profile. The samples were divided into two broad categories i.e. from Panjgur and Kech.

Proximate analysis

Faba beans collected from both locations were subjected to analyses in triplicate. Moisture, ash, fat and crude fiber contents were determined by using methods described in [12]. The percentage of nitrogen was measured by Kjeldahl system and conversion factor 6.25 was employed for calculation of crude protein.

Trace elements determination

The samples were wet digested for elemental analysis which involve the chemically degradation of sample matrices in solution, generally with a mixture of acids in order to enhance solubility. Each sample was digested in triplicate and three repeated measurements were performed on each sample by atomic absorption spectrophotometer (AAS) equipped with an air-acetylene burner. Trace elements Mn, Zn, Cu, Fe, Cr and Ni were determined by using a hollow cathode lamp at the recommended conditions and currents.

Statistical analysis

The values of biochemical as well as trace element content of seed samples collected from both areas Panjgur and Kech were analysed. Finally, the results obtained were analyzed by using specific version of SPSS v 22 and statistical assessments. The values of biochemical markers i.e. moisture content, ash content, fat content and total nitrogen were presented in their percent per 100 grams of the seed. After determination of trace element, contents are presented in microgram per gram ($\mu\text{g/g}$).

Results and discussion

The present study was conducted to determine the biochemical and mineral traces profile of faba beans grown in districts Panjgur and Kech of division Makran, Balochistan. The statistical test was applied to complete data comparisons between the samples from both sites. The data obtained regarding biochemical profile are given in Table 1. Figure 1 show the chemical compositions of faba beans samples investigated. The results showed that the collected samples contain abundantly water and Protein. The moisture contents of samples were 7.5% and 9.5% while protein contents of samples were 21.62% and 22.44%. The result also showed that the analyzed samples were low in ash and fat content. The ash contents of samples

were 3.7% and 3.8% whilst fat contents of samples were 2.07% and 1.73%. Significant difference was observed in moisture content, which was also reported by Gasim *et al.* [13]. The obtained values of the present study regarding moisture contents were in agreement and/or closed with that of the range 8.25 to 8.84% reported by Ali and Ahmed [14], range of 5 to 7.1% reported by El Tinay *et al.* [15] and range from 7.09 to 7.59% reported by Alghamdi [16]. Slightly lower value as that of the range of 11.01 to 11.23 reported by Hossain and Mortuza [17]. These values were in disagreement with those mentioned by Elsayed [18] who has reported a range of less than 4.5%. The obtained values also differ with those determine by Osorio-Diaz *et al.* [19] they reported a range of 4.44 to 7.12%. The ash content of faba beans was 3.7 % for samples collected from Panjgur district and 3.8 % for samples collected from Kech district. No significant difference was observed in ash content of both sample which was also observed by Gasim *et al.* [13]. The results are in agreement with previously reported values by different authors. The reported values were 2.7 to 7.4% by El Tinay *et al.* [15], 3.6% by Elsheikh *et al.* [20], 3.6% by Abdul Rahaman [21], and 3.8% by Costa *et al.* [22]. The obtained values disagree with those reported by Rehman and Shah [23] they found a value of 2.81% for raw faba bean and Hossain and Mortuza [17] they found values of 5.46 to 5.67%. The fat content of faba beans was 2.07 % for samples collected from Panjgur district and 1.73 % for samples collected from Kech district. Significant difference was observed in fat content of samples obtained from both places and this was also observed by Gasim *et al.* [13]. The obtained results of the present study were in concurrence with previously reported values 0.7% to 1.36% by Ali and Ahmed [14], 1.1 to 2.2% by El Tinay *et al.* [15], 1.08 to 2.12% by Elsheikh

et al. [20], 2.49% by Costa *et al.* [22] and 1.5 to 2.12% by Alghamdi [16]. The obtained results were lower than those reported by Hossain and Mortuza [17] who obtained a value of 3.12 to 3.29%. The protein content of faba bean was 21.62 % for samples collected from Panjgur district and 22.44% for samples collected from Kech district. Significant difference was also observed in protein content of both cities samples and this was also observed by Gasim *et al.* [13]. The results are in agreement with those values obtained by Welsch and Griffiths [24] who reported 21.9 to 29.1%, by Osorio-Diaz *et al.* [19] who reported 19.9%, and also in agreement with a value 20.9% reported by Costa *et al.* [22]. It is also evident in another studies that protein content was very high in almost all faba bean germplasms which ranges from 19.5 to 33.3 % on dry matter basis [25]. The results disagree and were lower than those found by Elsayed [18] who reported 28.0 to 37.8%, Elsheikh *et al.* [20] found 31.8%, Hossain and Mortuza [17] who obtained a value of 27.17 to 27.67% and Alghamdi [16] who obtained a value 31.8 to 39.7%. Faba beans are rich in protein contents which attributed to its significant nitrogen fixation property Cepeda *et al.* [26]. Moisture, ash, and fat contents and their values are in correlation with the values reported by Alghamdi [16]. Major nutrient composition of faba beans show that the seeds have high source of food and feed value.

Six trace elements (Mn, Zn, Cu, Fe, Cr and Ni) concentrations were determined from faba beans. Comparisons were statistically made between the samples collected from

two sites and mean values with standard deviations are listed in Table 2. Figure 2 shows the trace element concentration of analyzed samples. It was observed that the analyzed samples contained fairly low concentration of trace elements which varied between Mn 0.127 and 0.129 µg/g, Zn 1.132 and 0.951 µg/g, Cu 0.57 and 0.60 µg/g, Fe 0.07 and 0.09 µg/g in samples collected from two districts Panjgur and Kech. The concentration of Cr and Ni were not detected from Panjgur, whereas the concentrations of Cr and Ni in the samples from Kech district were 0.01 µg/g. The determined concentration of Mn, Cu, Cr and Ni in present study somewhat agrees with those observed by Rasheed and Awadallah [27] who reported Mn 0.09, Cu 0.21, Cr 0.01 and Ni 0.09 µg/g respectively. The current data showed that the levels of Mn, Zn, Cu, Fe, Cr and Ni in the analyzed samples were found to be well below the permissible limits [28, 29]. The obtained values presented in Table 2 of Mn, Zn and Cu were in disagreement with those values found in other work which ranged from 5.39 to 32.41 µg/g [17, 30-33]. The concentration of Fe also disagreed with the values obtained by Rashed and Awadallah [27] who reported 7.5 µg/g and a much higher concentration by obtained by Hossain and Mortuza [17] who reported a range of 61.68 to 63.25 µg/g. Trace element concentration of faba beans could vary to a great extent depending upon genotypes, kind and size of seeds and/or its geoclimatical location [32]. Overall, the obtained levels of trace elements studied during present study are generally well below the safe limits.

Table 1. Biochemical composition of faba bean on dry basis

Nutrient (%)	Panjgur	Kech
Moisture	7.5	9.5
Ash	3.7	3.8
Fat	2.07	1.73
Protein	21.62	22.44

Figure 1. Average moisture, Ash, Fat and protein content presented in faba bean

Table 2. Trace elements concentrations in faba bean

Element	Content ^a , µg/g Measured ^b	
	Panjgur	Kech
Mn	0.127±0.07	0.129±0.01
Zn	1.132±1.22	0.951±0.94
Cu	0.57±0.24	0.60±0.04
Fe	0.07±0.07	0.09±0.09
Cr	ND	0.01±0.01
Ni	ND	0.01±0.01

^a Dry weight, ^bMean ± SD, ND not detected

Figure 2. Concentration of Mn, Zn, Cu, Fe, Cr and Ni (µg/g) of trace elements in faba bean

Conclusion

There is no standard reference material to compare analytical data with reference material in order to validate the obtained results. By comparing the results of the present study with the investigations made in other countries by other researchers, the present study indicated that the faba beans grown in both districts of Balochistan province of Pakistan have rich nutritive value. Due to high protein content it can be replaced with a low protein diet and can also be helpful in overcoming nutritive deficiencies of the area. As far as to author's knowledge, no investigation is yet made on the assessment of major nutrients and trace elements in faba beans grown in Balochistan. Lower in fat contents and trace elements makes it a non-toxic safe food and feed for the local people as well as a source of revenue for the national and international market.

Authors' contributions

Conceived and designed the experiments: K Baloch, A Sajjad, S Rizwan & K Mahmood, Performed the Experiments: K Baloch, J Hussain, S Rizwan, I Khan & MH Jan, Analyzed the Data: A Sajjad, K Mahmood & A Shah, Contributed reagents/ materials/ analysis tools: Z Mahmood, M Azam & S Iqbal, Wrote the paper: K Baloch & A Sajjad.

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