

NUTRITIONAL AND MINERAL CONTENT OF THREE WILD *AGARICUS* SPECIES OF DISTRICT MASTUNG BALOCHISTAN, PAKISTAN.

ZAHOOR AHMED PIRKANI, MUDASSIR ASRAR, SAADULLAH KHAN LEGHARI,
MUHAMMAD ALI DASHTI AND MADIHA MANZOOR

Department of Botany, University of Balochistan, Quetta, Pakistan.
Corresponding author's email: zahoor.elahi56@gmail.com.

خلاصہ

زیر نظر تحقیق میں بلوچستان کے ضلع مستونگ سے اکھٹی کی جانے والی خوردنی کھبھی اگاریکس کی تین مختلف اقسام (اگاریکس ہائی سپورس، اگاریکس ہائیپور کی اور اگاریکس کمپیسٹرس) کے غذائی اجزاء کی جانچ کی گئی۔ نتائج سے پتہ چلا کہ تینوں اقسام میں لحمیات کی وافر مقدار پائی جاتی ہے جبکہ تینوں اقسام میں نشاستہ بہت کم مقدار میں پایا جاتا ہے۔ علاوہ ازیں تینوں اقسام کا کیمیائی تجزیہ بھی کیا گیا۔ تمام نتائج سے یہ اخذ کیا گیا کہ اگاریکس کھبھی کی یہ تینوں اقسام انسانی غذائی ضروریات کو بخوبی پورا کر سکتی ہیں اور متبادل غذا کے طور پر استعمال کی جاسکتی ہیں۔

Abstract

Three edible wild mushrooms (*Agaricus bisporus*, *Agaricus bitorqui* and *Agaricus campestris*) belonging to genus *Agaricus*, class *Agaricomycetes* were collected during 2017-18 from Mastung district of Balochistan, Pakistan. These species were analyzed for their nutritional contents. The results showed that high concentration of protein was found in all three species but maximum protein was recorded from *A. bisporus*. Whereas very low amount of carbohydrates, fat and fiber was recorded from all species. Besides this, mineral composition of all species under investigation were also determined. The mushrooms have high macro and mineral content. Maximum K, high Ca, and Mg were recorded while Zn, Cd, Cr, and Ni were in negligible amounts. It was concluded that being rich in proteins and low in carbohydrates, these mushrooms can serve as high nutritional diet for human beings.

Keywords: Wild Mushrooms, Mastung, Balochistan, Nutritional value, Mineral composition.

Introduction

Edible wild mushrooms belonging to fungi, class *Agaricomycetes* were collected during 2017-18 from Mastung district of Balochistan, Pakistan. Mushrooms are beautiful structures found growing at moist shady places on organic matter and agricultural waste as decomposer or scavengers. These mushrooms are edible and are also used for medicinal purposes by the local community. Mushrooms are used as food because they have high nutritional value and are rich in amount of protein and minerals (Beluhan and Ranogajec 2011; Manzi *et al.*, 1999). It is observed that people do prefer and are shifting on natural diet as compare to the processed food (Ogazi, 2010 and Ihehanma *et al.*, 2014). Nutrition in wild mushroom have been found to provide rich addition to diet in from of carbohydrate, fat, protein, vitamins and mineral (Manzi *et al.*, 1999).

A large number of wild mushrooms are found growing in the province of Balochistan during spring and autumn seasons, they usually appear immediately after rain fall. The species grow overnight and cover the entire area due to this the term is used as mushroom growth. Sometimes the species are short lived and disappear in a day or so. The identification of mushrooms is mostly done through their color, size, stipe, ornamentation, gills and spores. The identification can also be done through chemical tests or by molecular techniques. Some mushrooms are poisonous while some are non-poisonous and edible. Therefore, care should be taken to identify and document these species because eating poisonous specie could be fatal for humans and animals. Some mushrooms are medicinally important and are used to cure different diseases including cancer (Borchers, *et al.*, 2008). Mushrooms are considered as high nutrition diet for human beings rich in protein, amino acids, fibers and vitamins which is available at low cost (Kulshreshtha, *et al.*, 2014).

Lots of work on mushrooms of Pakistan has been carried out (Khan *et al.*, 1980, 1982; Sultana and Qureshi, 2007). Little work on mushrooms of Balochistan has been carried out, so far only 04 species have been reported by (Sultana and Qureshi 2007), *Agaricus bisporus* was reported earlier however other species are reported here for the first time. Therefore, there was a need to collect, identify and document mushrooms of Balochistan up to species level. Awareness about poisonous species should also be created in the masses identification was done by the help of available literature (Largent and Stuntz 1973, Hall. *et al.*, 2003). The nutritional and anti-nutritional value of mushrooms of Balochistan was checked.



Fig 1. Map of study area. Map taken from district development profile 2011.

Materials and Methods

This is the first study to check the nutritional status of wild mushrooms of Balochistan, Pakistan. Three species *Agaricus bisporus*, *Agaricus bitorquis* and *Agaricus campestris* were first time collected during 2017-18. The nutritional status of these mushrooms was analyzed by using following methods.

Determination of total Protein: The crude protein in three mushroom samples was determined by using Kjeldahl method (1883).

Determination of total Carbohydrates: The simple method for carbohydrate content is by subtracting the contents of ash, crude fat, crude fibre and protein from its dry weight. Soluble sugars were determined by the phenol–sulphuric reaction as given by (Wolfrom, *et al.*, 1964).

Determination of total Crude Fat: The crude fat content was evaluated by using Soxhlet apparatus. The fat product was determined according to the method of AOAC (2003) The crude fat was calculated by using this formula.

$$\text{Fat content} = \frac{(W1 - W2) \times 100}{W3}$$

Where

W1 = wt. of flask (g)

W2 = wt. of flask containing fat (g)

W3 = wt. of sample (g)

Determination of Fibre Content: The crude fiber contents were determined using slightly modified method of (Alam *et al.*, 2008). The crude fiber was calculated based on following equation.

$$\text{Crude fibre (g / 100 g of sample)} = [100 + (\text{moisture} + \text{fat})] \times (W. \text{ initial} - W. \text{ final}) / \text{total weight of sample}$$

Determination of Mineral: To determine mineral content of dry mushroom samples was carried out after acid digestion with HNO_3 and perchloric acid (Ojeka and Ayodele, 1995). The supernatant was decanted and the liquid is analyzed for measuring the levels of Nitrogen, Potassium, Magnesium, chromium, Manganese, cadmium, Zinc and Nickel present using standard procedures using Atomic Absorption Spectrophotometer (AAS).

Results and Discussion

Fig. 1 shows map of the study area. This is the first study to check the nutritional status of wild mushrooms of Balochistan, Pakistan. Three species *Agaricus bisporus*, *Agaricus bitorquis* and *Agaricus compestris* are reported for the first time from Mastung district, Balochistan, Pakistan. The nutritional value was determined by calculating the amount of proteins, carbohydrates, lipid, fiber, moisture and ash content (Table I).

Nutritional value

Table 1. Nutritional content of three species of edible mushrooms

Mushroom varieties	Nutritional variables (dry wt. %)					
	Moisture	Ash	Protein	Carbohydrate	Crude Fat	Crude Fibre
<i>Agaricus bisporus</i>	90.09 ±2.3	10.00 ± 0.7	29.5 ± 2.4	2.10 ± 0.5	0.10 ± 0.004	1.23 ± 0.03
<i>Agaricus bitorquis</i>	91.45 ±1.4	08.56 ± 0.1	23.2 ± 1.2	1.51 ± 0.3	0.08 ± 0.002	1.33 ± 0.01
<i>Agaricus compestris</i>	88.60 ±1.2	11.40 ± 1.3	25.7 ± 1.8	1.00 ± 0.1	0.04 ± 0.001	1.45 ± 0.02
P value (p≤0.05)	0.004*	0.013*	0.001*	0.012*	0.015*	0.073 ^{ns}

Each value is the mean of 5 replicates; ± Standard Deviation; NA= not detected

Table 2. Mineral content of three species of mushrooms (dry wt. %)

Mushroom varieties	Nutritional %							
	K	Ca	Mg	Zn	Mn	Cr	Cd	Ni
<i>Agaricus bisporus</i>	15.5 ±0.5	7.5 ±0.2	6.3 ±0.2	1.5 ±0.03	0.4 ±0.01	NA	NA	0.2 ±0.01
<i>Agaricus bitorquis</i>	14.6 ±0.2	5.9 ±0.1	7.3 ±0.4	1.8 ±0.02	0.5 ±0.02	0.01±0.002	0.01±.001	0.4 ±0.02
<i>Agaricus compestris</i>	16.3 ±0.3	6.0 ±0.3	5.5 ±0.1	1.2 ±0.01	0.6 ±0.04	0.05 ±0.001	NA	0.3 ±0.01
P value (p≤0.05)	0.031*	0.021*	0.032*	0.043 ^{ns}	0.040*	0.001**	0.000**	0.022*

Each value is the mean of 5 replicates; ± Standard Deviation; NA= not detected

Statistical data indicated that there was significant variation in Protein, Carbohydrate, Crude Fat, Moisture and Ash contents of three different mushroom at p≤0.05 significant level, however Crude Fibre was found to be non-significant among the 3 investigated mushroom. The variation of different nutritional contents in three species of wild edible mushrooms might be due to different environmental condition and due to difference in mushroom genotypes (Table 1).

The result shows that high concentration of protein in three species *Agaricus bisporus*, *Agaricus bitorquis* and *Agaricus compestris* was found (29%, 23%, 25%) respectively. Maximum protein was recorded from *A. bisporus*. Almost similar results were found by (Saiqa *et al.*, 2008 and Mohiuddin *et al.*, 2015). High amount of proteins were found in these wild mushrooms these are comparable with the amount of protein found in chicken (Petracci *et al.*, 2014).

Low amount of carbohydrates was recorded from three species of *Agaricus bisporus*, *Agaricus bitorquis* and *Agaricus compestris* (2.1%, 1.05%, 1.00% respectively). Mushrooms usually contain low carbohydrates therefore are suitable for obese people diet purpose. (Atila *et al.*, 2017) reported that good quality carbohydrates and fatty acids are found in mushrooms these have anticancer, antimicrobial and antihypertensive activities. (Sultana and Qureshi 2007) also found similar results while working on mushrooms of Pakistan, they have reported that these are used as perfect diet for heart and cardiovascular system because their fatty fractions contains unsaturated fatty acids such as linoleic acid. (Saiqa *et al.*, 2008) also found different species of *Agaricus bisporus* and *Agaricus bitorquis* have high market value. The mushrooms have high macro and micro mineral content. Both these *Agaricus bisporus*, *Agaricus bitorquis* mushrooms have good quantity of protein, lipids and carbohydrates (Zhang, 2016). Many mushrooms contain unsaturated fatty acids, polysaccharides, vitamins in addition to minerals. Many of these compounds are biologically active, they showed activities against many diseases, high antimicrobial, antioxidant, anti diabetic, hepatic protective activities are also reported by (Zhang, 2016).

A large number of edible species (54) of mushrooms have been reported from Pakistan including 04 from Balochistan, 03 from Sindh, 05 from Punjab and maximum species 44 were recorded from NWFP and Azad Kashmir. Some of species being commercially exploited in the world are *Agaricus bisporus*, *Auricularia* spp. *Coprinus comatus*, *Flammulina vellutipes*, *Lentinus edodes*, *Pleurotus ostreatus*, *Strophariarugoso annulata*, *Volvariella volvacea*. Some species are near extinction or threatened because of over collection, urbanization and deforestation, some of species are threatened of extinction (Sultana and Qureshi 2007). (Dashti *et al.*, 2019) worked on mushrooms of Khuzdar, Balochistan, Pakistan.

Fibre (1.23%, 1.33%, 1.45%), Fat (1.10%, 0.08%, 0.04%) were recorded from *Agaricus bisporus*, *Agaricus bitorquis* and *Agaricus campestris*. The amount of protein, carbohydrates and fibre recorded from wild mushrooms was almost similar to that report from cultivated mushroom *Pleurotussps* (Leghari *et al.*, 2017). Mushrooms are highly recommended as food for the people of developing countries like Pakistan with high rates of malnutrition where people do not afford to purchase meat on regular basis.

The chemical composition of these three species were also checked (*Agaricus bisporus* (K 15.5%, Ca 7.5%, Mg 6.36%, Zn 1.50% Cr 0.00% Cd 0.00%, Ni 0.2 and Mn 0.4%) *Agaricus bitorquis* (K 14.67%, Ca 5.9%, Mg 7.3%, Zn 1.8% Cr 0.01% Cd 0.001% Ni 0.4% and Mn 0.5%) and *Agaricus campestris* (K 16.30%, Ca 6.0%, Mg 5.5%, Zn 1.2% Cr 0.05% Cd 0.00% Ni 0.3 and Mn 0.6%). Chang (1982) harvesting found values of 4.4 g/100 g of moisture, 39.4 g/100 g of protein, 45.6 g/100 g of carbohydrate, 3.0 g/100 g of lipid, and 7.6 g/100 g of minerals. The difference is probably due to species and climatic and harvest conditions. The mushrooms contain high macro and micro mineral elements (Bano and Rajarathanam,1982). The mushrooms studied have good amount of minerals including trace minerals (K, Ca, Mg, Zn, Cr, Cd, Ni and Mn).

The values of *A. bisporus* was also compared with *Pleurotus spp* it was found that both have good nutritional value and can be used as alternative for healthy food. Therefore, it is recommended that *Agaricus bisporus*, *Agaricus bitorquis* and *Agaricus campestris* mushroom could be used as food in a mixed diet with other protein sources or be added to other foods in the for enriching the product, as suggested by Monteiro (2008) in adding the *A. brasiliensis* mushroom to tomato sauce. As they have high nutritional value, mushrooms have been identified as alternatives for a healthier diet rich in proteins.

Conclusion

In this study three edible wild mushrooms are first time reported *Agaricus bisporus*, *Agaricus bitorqui* and *Agaricus campestris* belonging to division Basidiomycetes, class Agaricomycetes were collected and identified during 2017-18 from Mastung district of Balochistan, Pakistan. These mushrooms were analyzed for their proximate and mineral contents. The results showed that high amount of protein was found in all three species but maximum protein was recorded from *A. bisporus*. Whereas very low amount of carbohydrates, Fat and Fiber was recorded in all species. The mineral composition of all species shows high levels of Ca, K, Mg, Mn and low concentration of Zn, Cd, Cr, Ni and Phenols. Therefore, it was concluded that these mushrooms are recommended as high proteins and minerals diet that can serve as a good source of food for human beings.

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