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Nutritional Profile and Mycotoxin Load on Stored Barley (*Hordeum vulgare L.*) at Hyderabad Division

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Abstract: Barley is the most imperative cereal crop and ranks on 4th around the world after wheat, corn and rice. The aim of present research work to determine the Nutritional, phytochemical and Mineral profile and mycotoxin load, 05 barley samples were collected from Hyderabad Division. The nutritional, phytochemical and mineral profile indicate that the barley contain significant level of carbohydrates, protein, Alkaloids, Flavonoids, tannins, saponins and antioxidants, the trace and mineral profile of the barley samples indicates the nutrient potential, in the present study the significant quantity of metals (Co, Ni, K, N, Mg, Zn, Ca and Fe) was observed in all barley samples of the Hyderabad division. The mycotoxins load (total aflatoxin) on the barley samples were estimated in ng/g , the highest load 47 ng/g of total aflatoxin was observed in the TA samples and level, the lowest level of the total aflatoxin was observed in the samples of MPK.

Therefore it was concluded on presents facts that barley is nutrient rich cereals but due to the presence of mycotoxin the quality of nutrient present in barley has lost and can leaving the severe health effect on human when consumed aflatoxin contaminated barley chronically.

Keywords: Mycotoxin, Nutritional Profile, Hyderabad, Barely

1. INTRODUCTION

Cereals are the most abundant source of nutrition around the world and Barley (*Hordeum vulgare L.*) from family *Poaceae* (*Gramineae*)is ranked on fourth, after wheat, corn and rice as the supremevital cereal crop globally. Barley can substitute wheat in feeds as it contains more fiber and less protein, it is easily digestible (due to low gluten contents) and has superior nutritional qualities, high concentrations of lysine, thiamine and riboflavin (Marwat, *et al.,* 2012). Furthermore barley grain is an excellent source of vitamins and minerals (Alijious *et al.,* 2002). Moreover grains of barley, wheat, oat and maize having advantages of balancing the nutrition as low-fat diet. Due to improper storage, post-harvest practices, handling and or transportation produces the favorable condition fortoxin (mycotoxin) production and multiplication, despite the mold growth also upsurges in extreme weather change (temperature and humidity) which again rises deadly toxin production that become harmful for human and animal using as food and feed respectively (Channa *et.al;*2016).These mycotoxin are stable against various processing methods and are responsible for 25% loss of the world crops the Mycotoxins are the responsible for this damage annually and produce many adverse effects when reach to human or animal body by natural food chain source, even the low concentration of these deadly toxins can be able to produces severe toxicity (FAO, 2003; Randhawa, 2002). It was also published in hitherto researches that chronic aflatoxin exposure is indirectly associated with cancer of liver (Nizami *et. al.,* 1977). (Munir *et al*. 1989) reported that the maize and red chillies were found contaminated with aflatoxin with the range 11.12 µg/Kg to 82.33 µg/Kg of AFB1, whereas in red chillies the AFB2 was detected 41.67 µg/Kg which was above the aflatoxin permissible limit in cereals that is 20 µg/Kg.

Quality of food decreases with the increase in growth these mycotoxins along with this the quality of cereals also deteriorate by the presence of some wide biologically-active constituents distributed throughout the plant kingdom, particularly in plants using as human food animal feeding stuff. These biological active compounds are Phytochemicals which are known as chemical compounds produced by plants (Cheeke and Shull, 1985). Whereas *phytochemicals* include plant compounds that are beneficial as well as those that are detrimental consequently these are known as anti-nutrients or anti-nutritional factor and pose potentially toxic effect on public health (D'Mello, 2000).

Food safety has been increasingly focussed on finished goods. This attention is particularly applied to the cereal sector in Pakistan, because Pakistan is an agro based country, with this the research work has been carried out to provides cientificfacts for determination ofdouble menace load of food insecurity upon human through inherent toxin like aflatoxin and phytochemicals in barley crop.

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2. MATERIALS AND METHODS

Sample Collection and Preparation: 05 barley samples were collected from stored houses of Hyderabad(HYD), Tando Muhammad Khan (TMK), Tando Allahyar (TA), Badin (B) and Mirpur Khas (MPK), collected samples were grinded and fine powder was stored in anhermetic polyethylene bags and used for further phytochemical and nutritional Profile estimation. Extract was Prepared by dissolving 10g of powdered plant sample and in 100 ml of deionized water consequently set aside at room temperature on shaking bath for 1 day. After this the solution was filtered and by using muslin cloth. For proper separation the filtrate was centrifuged for 20 minutes at 6000 RPM and preserved in oven at 4^0 C for auxiliary investigation.

Nutritional and Phytochemical Analysis: Ash was carried out in Muffle Furnace at 510 ºC, Carbohydrates was estimated by anthrone method, Total Protein by lowery method, Alkaloids, Flavonoids, Tannins and Saponins were analyzed followed by (Channa *et al.,* 2016). The samples were prepare and digested in Concentrated nitric acid (HNO_3) for metal estimation, minerals and medically important heavy metals i.e. Na k, Ca, Mg, Ni, Zn, Co, Cd, Cu and Fe were estimated by Perkin Elmer's Atomic absorption spectrometer Analyst 800 at IARSCS(Institute of Advanced Research Studies in Chemical Sciences) University of Sindh, Jamshoro.

Sample preparathion total Aflatoxin Determination:

The AF was determined by the method reported by Channa *et al.* (2015) and Ghanghro *et al.* (2016) with using Enzyme linked immunosorbent assay (ELISA) technique following the method reporte by Channa *et. al.,* (2016).

3. RESULTS AND DISCUSSION

The Nutritional, phytochemical and Mineral profile and mycotoxin load of barley samples are shown in **(Table-1 and 2),** the ash % was ranged from 17to 23% the minimum ash % was observed in tandoallahyar samples the 17%. Carbohydrates were ranged from 66.9 to 68.3g/100g, maximum carbohydrates was observed in the TMK samples, the highest 14.1 g/kg protein value of the barley samples of TMK and the minimum 11.9 g/kg was observed in the MPK samples. Alkaloids, Flavonoids, tannins and saponins were ranged (1.79-1.91), (0.11-0.19), (0.07-0.09), (0.2-0.29)g/100g respectively. The significant quantity of the antioxidants was observed in all samples the minimum concentration of antioxidant activity was observed in bad in district samples 0.28g/100g and the maximum level was observed in tandoallahyar samples 0.33g/100g.

Phenolic compounds are possessing different biological properties such as anti-atherosclerosis, anti-inflammation, cardiovascular protection, anti-apoptosis, anti-carcinogen, anti-aging and improvement of endothelial function, inhibition of angiogenesis and in cell proliferation activities (Ali *et al*., 2008). Natural antioxidant are Phenolic compounds such as phenolic acids, flavonoid, tocopherols are found to present in many plants (Marjrie, 1996). Tannins interfere with the protein synthesis and flavonoids are hydroxylated phenolic is synthesized by plants and having antimicrobial activities also possessing an anticancer and antioxidant activities (Salah *et al.,* 1995; Del-Rio *et al.,* 1997; Okwu, 2004; Antherden, 1969). It has been reported by many researchers that Alkaloids performing analgesic action, antispasmodic and antibacterial activities (Harborne, 1973; Stray, 1998; Okwu, 2004; Hasling *et al*., 1991).

Mycotoxin, Nutritional and Phytochemical profile of barley.

Sampling Area	Nutritional and Phytochemical Agents (g/100g)							Antioxidant Activity (g/100g)	Mycotoxin Load
	Ash %	Carbohydrates	Total Protein	Alkaloids	Flavonoids	Tannins	Saponins	Antioxidant Activity	Total Aflatoxin Load ng/g
HYD	21	67	12.7	1.83	0.13	0.08	0.23	0.29	29
TMK	23	68.3	14.1	1.91	0.11	0.09	0.21	0.31	45
TA	17	67.7	12.3	1.79	0.19	0.09	0.29	0.33	47
B	21	66.9	13.1	1.81	0.17	0.07	0.21	0.28	43
MPK	18	68.1	11.9	1.88	0.08	0.08	0.28	0.3	33

Trace elements and Minerals Content of barley (mg/kg)

Sampling Area	Trace elements and Minerals									
	Na	K	Ca	Mg	Fe	Zn	Co	Ni	Pb	Cd
HYD	2633	881	2903	233	133	33	13	3.3	BDL	BDL
TMK	2723	887	2903	223	123	35	15	3.5	BDL	BDL
TA	2739	893	2909	239	129	39	19	3.9	BDL	BDL
B	2689	885	2909	237	127	37	17	3.7	BDL	BDL
MPK	2691	883	2901	231	121	31	13.1	3.1	BDL	BDL

In the present research study the mycotoxins load (total aflatoxin) on the barley samples were estimated in ng/g, the highest load 47ng/g of total aflatoxin was observed in the TA samples and lowest level of the total aflatoxin was observed in the samples of MPK. During sampling it was observed that the grains of barley were not stored properly, hence unhygienic vicinity of the stored houses increases the risk of fungal/mycotoxin contamination.

Whereas the barley plants sample was also found contaminated Due to numerous risk factors of aflatoxin currently the Pakistan Standard and Quality Control Authority (PSQCA) has suggested standards for AF in some food commodities, that is maximum limit for chili powder, turmeric powder, curry powder and milk is recommended as 20µg/kg and 10µg/kg respectively, despite of this recommended levels the agricultural commodity still crossing the permissible level of aflatoxin. Due to the higher level of AF the European country has barred food transport from Pakistan because presence of AF have muddled the quality of food (Maken, 2010). The present results are also in resemblance with hitherto published research by Channa *et al*. (2016) showed that wheat were found with high aflatoxin again the level increases with rise of time and displaying direct proportionality with climatic change or storage conditions because high humidity and temperature was the most vital factor for mold multiplication and aflatoxin production.

Furthermore, as it is presented in **(Table 2)** the trace element and mineral profile of the barley samples indicates the nutrient potential, in the present study the significant quantity of cobalt (Co), Nickel (Ni), potassium (K), sodium (Na), magnesium (Mg), zinc (Zn), calcium (Ca) andiron (Fe) was observed in all barley samples of the Hyderabad division. On the other hand, the minerals (Na, K, Ca, Mg, and Fe) composition were ranged from (2633 – 2739, 893 - 881, 2909–2901, 223 – 239, 121- 133 mg/kg), the Zinc, Cobalt and nickel are trace elements, estimated in mg/kg which were ranged from (31 – 39), (13 – 19), (3.1–3.9) respectively. In another study, the zinc (Zn) and iron (Fe) contents of wheat were found to be 28.5 65.6 for Fe, respectively (Alijious *et al.,* 2002). The Lead (Pb) and Cadmium (Cd) were blow the detection limit. The highest minerals content was detected the samples of TA.

4. CONCLUSION

It was sum up from study that barley contain significant level of nutrients and phenolic compounds that is carbohydrates, protein, Alkaloids, Flavonoids, tannins, saponins and antioxidants. The trace element and mineral profile in grain samples indicates the nutrient potentiality of barley. Regardless of nutrient abundance the barley crop also carrying the load of mycotoxin that mimic the nutritional availability and its quality which subsequently effect on human health and marketability or import economy of the country as well. Therefore further researcher has been suggested on the decontamination approaches for mycotoxin from barley.

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