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RESEARCH ARTICLE

Nutritional Composition and Minerals content of five Species of Wild Edible Mushroom, Brought from UAE: Mushroom considered as protein source.

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Abstract

This is carried out in Department of Biochemistry , Al-Neelain University. An aim of this experiment is assessed the nutritional composition and ash composition of five types of mushroom brought from AUE, July 2015. The nutritional that thr composition moisture content of 5 type of mushroom varied from 10.46-17.79 %. وAsh content 5 type of mushroom varied from 5.67-10.48 %. وProtein content of 5 type of mushroom varied from 28.55-58.05 %. وOil content of 5 type of mushroom varied from 2.37-4.33 %. و Fiber content of 5 type of mushroom varied from 44.8-71.51%. شدي Carbohydrates content of 5 type of mushroom varied from 52.9-77.79%.ز. While ash composition of mushroom the Sodium content of 5 type of mushroom varied from 19.62-340.99%., Potassium content of 5 type of mushroom varied from 189.63-201.56%., Calcium content of 5 type of mushroom varied from 8.79-45.59%., Magnesium content of 5 type of mushroom varied from 35.92-81.40%. and Iron content of 5 type of mushroom varied from 10.51-22.59%.

Introduction:-

The standard for the name "mushroom" is the cultivated white button mushroom, *Agaricus bisporus* ; hence the word "mushroom" is most often applied to those fungi Basidiomycota and Agaricomycetes that have a stem (Stipe), a cap (Dileus), and gills (lamellae, sing. Lamella) on the underside of the cap. Mushrooms have been used as food and medicine in many parts of the world since time immemorial. Although mushrooms are often grouped with vegetables and fruits, they are actually fungi. It is evidently clear that the growing interest in the cultivation of mushrooms can help in solving many problems of global importance such as protein shortage as well as improving the health and well being of people, considering that mushrooms are valuable health foods which are low in calories and provide essential minerals. Nutritionally, mushrooms provide essential nutrients and contribute significantly to man's diet. Vitamin B12 & folate are often said that mushrooms have vitamin B12, a vitamin commonly found in animal foods. Although mushrooms provide a modest amount of vitamin B12, they are not a major source of B12. A serve provides no more than 5% of the daily needs for this vitamin. However, this still makes the mushroom the only non-animal fresh food source of B12. If you are vegetarian, you will also get B12 from milk, yogurt, cheese and eggs. Some soy beverages are fortified with B12.

The consumption of wild edible mushrooms is increasing due to a good content of proteins (Ogundana and Fagade, 1982; Senatore, 1990; Thimmel & Kluthe, 1998). The amino acid compositions of mushrooms are comparable to animal proteins (Gruen and Wong, 1982).

The fat level in mushrooms is almost negligible. There is some fat in the cell walls, and this is sufficient fat to store vitamin D that mushrooms naturally generate after they have been exposed to sunlight. The fat that is present is mainly the healthy unsaturated fat (Breene, 1990).

Mushrooms are good sources of some B vitamins like Riboflavin (Vitamin B2), Pantothenic acid (Vitamin B5), and Niacin (Vitamin B3). These B vitamins play an essential role in the nervous system and provide energy by breaking down carbohydrate, fat, and protein (Bárbara, *et al.2008*).

Mushrooms naturally produce vitamin D when they see sunlight (or another source of UV light). Through the action of sunlight, they convert their abundant ergosterol to ergocalciferol (vitamin D2). Wild mushrooms in Europe commonly have 2-40 mcg vitamin D/100g (Mattila 1994; Mattila 2002; Teichman 2007). Store-bought mushrooms are able to generate over 20 mcg vitamin per100 g that after being placed in sunlight for a couple of hours in the midday sun (Phillips, 2013).. The vitamin D in mushrooms is easy to absorb and effective in improving vitamin D status (Urbain, 2011).

Many of mushroom have been used in folk medicine for thousands of years. Some of them are nutraceuticals (natural food having potential value in maintaining good health and boosting immune system of the human body) while others can produce potent nutriceuticals which compounds that have medicinal and nutritional attributes and are consumed as medicines in the form of capsules or tablets but not as food (Elmastas, *et al.* 2007).

Mushrooms are known to be rich sources of various bioactive substances like antibacterial, antifungal, antiviral, antiparasitic, antioxidant, antiinflammatory, antiproli-ferative, anticancer, antitumour, cytotoxic, anti-HIV, hypo-cholesterolemic, antidiabetic, anticoagulant, hepato-protective compounds (Ajith and Janardhanan, 2007).

Mushrooms have been reported as therapeutic foods useful in preventing diseases and they exhibit varied biological properties such as antibacterial, antimutagenic, antitumoral and antiviral activities (Schillaci, D. et al. 2013).

The objectives of the present study are:

1. To determine the chemical composition (Moisture, ash, protein, tat and carbohydrates) of five types of Mushrooms ; *lentinus edodus* (Shitake), *Boletus.sp* (Portabella) , *Flammulina ventutipes , Agaricus bioprus* (fresh white mushroom*) , Pleurotus eryngii* (King oyster).
2. To assess ash composition (K, Na, Ca, Mg, and Fe) of five types of Mushrooms.
3.

Material and Methods:-

Materials:-

The five types of edible mushroom (*Agaricus bisporus, Pleurotus ostreatus , Pleurotus eryngii*, *Lentinula edodes* and *Flammulina velutipes*) used in this study were obtained from (UAE).

Preparation of samples:-

Fresh samples of the mushroom were collected from the supermarket in July 2015. These samples were carefully cleaned and freed from foreign materials. The collected materials were dried at 65°C in oven until their weight became stable and powdered

Methods:-

Moisture; fat, protein, ash, crude fibre, non and carbohydrates were determined according to methods described by AOAC(1990), Extraction of ash composition of five types of mushroom was determined to method described by Pearson.1960). Then atomic absorption was used to assessed the Ca, Na, K, Mn and Fe,

Statistical analysis:-

The collected data was analysis according to the stander statistical procedure describe by (Gomez and Gomez, 1984).

Results:-

Nutritional composition:-

Table (1) indicated that moisture content of fresh *lentinus edodus, Boletus* sp, *flammulina ventutipes, Agaricus bisporus* and *pleurotus eryngii* are 10.46, 14.94, 15.03, 17.79 and 15.59 %, respectively. There are significant differences in moisture content in *lentinus edodus* and *pleurotus eryngii* ($P \leq 0.05$), but there no significant between *Boletus sp, flammulina ventutipes, and Agaricus bisporus*. Ash content of lentinus *edodus, Boletus* sp, *flammulina ventutipes, Agaricus bisporus* and *pleurotus eryngii* is 5.67, 10.31, 10.3, 10.48 and 10.073%, respectively. There is

significant differences in ash between lentinus *edodus* and other sample (P≤0.05), but no significant between *Boletus* sp, *flammulina ventutipes, Agaricus, bisporus and pleurotus eryngii* with each other. The oil content of *lentinus edodus, Boletus* sp, *flammulina ventutipes, Agaricus bisporus,* and *pleurotus eryngii* is 2.37, 2.49, 4.33, 3.94 and 3.68% respectively. And there are significant differences in oil content between the sample at (P≤0.05) except *lentinus edodus, Boletus sp*. Protein content of the fresh *lentinus edodus, Boletus* sp, *flammulina ventutipes, Agaricus bisporus, and pleurotus eryngii* are28.55, 35.84, 36.55, 58.05 and 42.23%, respectively. There are significant differences in protein content between the samples at (P≤0.05) except there is no significant between *Boletus* sp, *and flammulina ventutipes*. Fiber content of fresh *lentinus edodus, Boletus* sp, *flammulina ventutipes, Agaricus bisporus* and *pleurotus eryngii* are 44.8, 61.68, 66.35, 71.51 and 63.44%, respectively. There are significant differences in fiber content between the samples at (P≤0.05). Carbohydrate content of *lentinus edodus, Boletus sp, flammulina ventutipes, Agaricus bisporus* and *pleurotus eryngii* are 52.9, 69, 74, 78.24, 57.88 and 78.24% respectively. There are significant differences in carbohydrate content between the *lentinus edodus, Boletus* sp, *flammulina ventutipes, Agaricus bisporus,* and *pleurotus eryngii* at (P≤0.05) except between carbohydrate content *flammulina ventutipes* and *pleurotus eryngii* is not significant.

Mineral Content:-

Table (2) indicated that sodium content of fresh *lentinus edodus, Boletus* sp, *flammulina ventutipes, Agaricus bisporus and Pleurotus eryngii* are 340.99, 90.04, 46.84, 39.78 and 19.62%, respectively. There are significant differences in sodium content between five samples (P≤0.05). Potassium of fresh *lentinus edodus, Boletus* sp, *flammulina ventutipes, Agaricus bisporus and Pleurotus eryngii* 193.41, 189.64, 189.94, 194.94 and 201.56% respectively. There is significant differences in potassium between five samples (P≤0.05. The calcium content of *lentinus edodus, Boletus* sp, *flammulina ventutipes, Agaricus bisporus, and Pleurotus eryngii* is 45.59, 8.79, 26.86, 22.16 and 22.42%, respectively. And there are significant differences in calcium content between the five samples at (P≤0.05). Manganese content of the fresh *lentinus edodus, Boletus* sp, *flammulina ventutipes, Agaricus bisporus and Pleurotus eryngii* are 81.40, 71.57, 35.92, 58.25 and 52.57%, respectively. There are significant differences in manganese content between the five samples at (P≤0.05). Iron content of fresh *lentinus edodus, Boletus* sp, *flammulina ventutipes, Agaricus bisporus* and *Pleurotus eryngii* are, 22.59, 10.95, 12.42 and 12.29% respectively. There are significant differences in iron content between the five samples at (P≤0.05).

Discussion:-

Nutritional composition:-

Mushrooms generally are classified into four groups: edible, medicinal, poisonous and magic or hallucinogenic mushrooms. Edible mushrooms are ideal healthy foods. They may contribute enormously to the supply of both macro and micro nutrients in our diet. They are considered to be the potential source of carbohydrates, proteins, fat, and minerals. All of which contribute to the food value. However, it is known that the protein contents of mushrooms are affected by a number of factors, namely the type of mushrooms, the stage of development, the part sampled, level of nitrogen available and the location (Flegg and Maw, 1977).

All the species seem to have a normal chemical composition compared with other edible mushrooms (Agahar-Murugkar and Subbulakshmi, 2005).

Lentinula edodes (Shiitake) revealed the lowest moisture (10.46 g/100 g) ,ash (5.67 g/100 g), protein (28.55),Fiber(44.8 g/100 g), oil (2.37 g/100 g) contents and carbohydrates (52.9 g/100g) ; *Agaricus bisporus (*brown mushroom) gave the highest moisture (17.79 g/100 g), ash (10.48g/100g), protein (58.05g/100g) , Fiber (71.51g/100g) In general, mushrooms are low calorie foods since they provide low amounts of fat (Die´z and Alvarez, 2001). The main constituents in the ash are potassium and, phosphorus according to type of mushroom (Mattila et al., 2001) or magnesium (Manzi et al.,1999), in addition to calcium, copper, iron and zinc (Guillamón et al., 2010). Carbohydrates, calculated by difference, were also an abundant macronutrient that ranged from 52.9 g/100 g in *lentinus edodus*, 69.74 g/100 g in *Boletus sp, 78.24g*/100g *Flammulina ventutipes* and 57.88g/100 in *Agaricus bisporus.* And the highest levels of carbohydrate were also found in *Pleurotus eryngii* (king oyster) (77.79 g/100).

Carbohydrates content includes also fiber such as the structural polysaccharides β- glucans, chitin, hemicelluloses and pectin substances (Kalač, 2009). Although, an extraordinarily high or appreciable level of total fiber was reported for, *A. bisporus, P. seryngii* and *P. ostreatus* (Manzi et al., 2004), herein *pleurotus eryngii* (king oyster) it

was that gave the highest carbohydrates levels, as mentioned above.. Ash content varied between, (5.67g/100 for *lentinus edodus*, 10.31g/100 for *Boletus* sp, 10.3g/100 for *flammulina ventutipes*, 10.48g/100 for *Agaricus bisporus*, 10.073g/100 for *pleurotus eryngii*). All the species seem to have a normal chemical composition compared with other edible mushrooms (Agahar-Murugkar and Subbulakshmi, 2005).

The major compounds of mushrooms are proteins and carbohydrates. It is reported that the protein contents of mushrooms are affected by a number of factors, namely the type of mushrooms, the stage of development, the part sampled, level of nitrogen available and the location (Flegg et al., 1977). Total protein content, varying between 21-50%, can be accepted high when compared with meat, milk, egg, fish such as some commercially important fish species form the Black sea region (Güner et al.,1998) and some other mushroom species (Agahar-Murugkar and Subbulakshmi ,2005). In this study, the highest protein content was found for *Agaricus bisporus* (58.05%) and the lowest was found for (23.55%). The Fat content of edible mushrooms consists mostly of unsaturated fatty acids, which are less hazardous to the health than the saturated fatty acids of animal fats (Breene, 1990)

Mushrooms are valuable sources of dietary fiber (Chandravadana et al., 2005). Dietary fiber content of mushrooms, in present study, was found to be in a range of 44.8 for *lentinus edodus*, 61.68 for *Boletus sp*, 66.35for *flammulina ventutipes*, and 71.51 for *Agaricus bisporus*, 63.44 for *pleurotus eryngii.* Ash content varied between, (5.67g/100 for *lentinus edodus*, 10.31g/100 for *Boletus* sp, 10.3g/100 for *flammulina ventutipes*, 10.48g/100 for *Agaricus bisporus*, 10.073g/100 fo *pleurotus eryngii*). All the species seem to have a normal chemical composition compared with other edible mushrooms (Agahar-Murugkar & Subbulakshmi, 2005). The major compounds of mushrooms are proteins and carbohydrates. It is reported that the protein contents of mushrooms are affected by a number of factors, namely the type of mushrooms, the stage of development, the part sampled, level of nitrogen available and the location (Flegg et al., 1977). Total protein content, varying between 21-50%, can be accepted high when compared with meat, milk, egg, fish such as some commercially important fish species form the Black sea region (Güner et al.,1998) and some other mushroom species (Agahar-Murugkar and Subbulakshmi ,2005). In this study, the highest protein content was found for *Agaricus bisporus* (58.05%) and the lowest was found for (23.55%). The Fat content of edible mushrooms consists mostly of unsaturated fatty acids, which are less hazardous to the health than the saturated fatty acids of animal fats (Breene, 1990) Mushrooms are valuable sources of dietary fiber (Chandravadana , et al., 2005). Dietary fiber content of mushrooms, in present study, was found to be in a range of 44.8 for *lentinus edodus*, 61.68 for *Boletus sp*, 66.35for *flammulina ventutipes*, and 71.51 for *Agaricus bisporus*, 63.44 for *pleurotus eryngii.*

Table (1) shows nutritional composition (Moisture, protein, fat, ash and carbohydrates) of five types of mushroom:-

Nutrients	*lentinus edodus*	*Boletus sp*	*Flammulina ventutipes*	*Agaricus bisporus*	*pleurotus eryngii*
Moisture	10.46^{abcd}	14.94^{ae}	15.026^{bf}	15.026^{bf}	15.59^{cg}
Ash	5.67^{abcd}	10.31^{c}	10.3^{b}	10.3^{b}	10.073^{a}
Protein	28.55^{abcd}	35.84^{aef}	36.55^{bgh}	36.55^{bgh}	42.23^{cegi}
Oil	2.37^{abc}	2.49^{def}	4.33^{cfhj}	4.33^{cfhj}	3.68^{adgh}
Fiber	44.8^{abcd}	61.68^{aefg}	66.35^{cfhj}	66.35^{cfhj}	63.44^{behi}
CHO	52.9^{abcd}	69.74^{behi}	78.24^{dgi}	78.24^{dgi}	77.79^{cfh}

Results were expressed as mean. This Figure indicates the number of sample analyzed. Values in the same row not sharing common superscript letter(s) are significantly ($P \leq 0.05$) different

Table (2) shows mineral contents (Na, K, Ca, Mn and Cu) of five types of mushroom:-

Minerals	***Lentinus edodus***	***Boletus. sp***	***Flammulina ventutipes***	***Agaricus bisporus***	***pleurotus eryngii***
Sodium	340.99^{dgij}	90.04^{cfhj}	46.84^{behj}	39.78^{aefg}	19.62^{abcd}
Potassium	193.41^{behi}	189.63^{abcd}	189.94^{aefg}	194.94^{cfhj}	201.56^{dgij}
Calcium	45.59^{dgij}	8.79^{abcd}	26.86^{cfhj}	22.16^{afhg}	22.42^{behi}
Manganese	81.40^{dgij}	71.57^{cfhj}	35.92^{abcd}	58.25^{behi}	52.57^{aefg}
Iron	22.59^{dgij}	10.95^{bcde}	12.42^{cfhi}	10.51^{abcd}	12.29^{behi}

Results were expressed as mean. This Figure indicates the number of sample analyzed. Values in the same row not sharing common superscript letter(s) are significantly (P≤ 0.05) different.

Conclusion:

Results from the study have clearly shown that all the five mushroom species used in the study contained considerable amount of proteins and minerals which are vital in supplementing nutrition to mankind. It can therefore be concluded from the study that differences and similarities in nutritive contents with respect to protein, carbohydrates, fat, fiber, calcium, iron, potassium, sodium and magnesium in the four mushroom species namely *lentinus edodus, Agaricus bisporus* (Portobello mushroom), *flammulina ventutipes, Agaricus bisporus*(white mushroom), *pleurotus eryngii* they exist. Mushroom can be considered as an alternative source of protein because it contains large quantities of essential amino acids and this can solve problems of vegetarian people all over the world who often suffer from protein deficiency. Being a good source of protein and carbohydrate, they fall between most legumes and meat and prove to be excellent foods that can be used in low caloric diets for their low contents of fat and energy. Nevertheless, the high nutritional quality and unique flavors of these mushrooms are likely to be lost if these wild edibles are not documented.

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