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Medicinal Potentials and Health Benefits of Black Mulberry

Muhammad Yasir Naeem[1], Sumayya Rani[2]

[1]Faculty of Agricultural Sciences and Technologies, University of Nigde Omer Halisdemir, Nigde, 51240, Turkey

[2]Department of Agriculture, The University of Swabi, Swabi, 23430, Pakistan

Corresponding Author: yasir.naeem91@yahoo.com

Abstract

People across the globe still use plants as medicinal source due to its easy access and at low cost availability. Among the genus Morus species *Morus nigra* (black mulberry) are used in traditional remedies since ancient time. As they are rich source of a great variety of various amounts of nutritive and biologically active components like vitamins, proteins, minerals, anthocyanin, polysaccharides, quercetin etc that are mainly linked with the possible effective pharmacological actions and also play an important role against various disorders. Moreover, extracts from these fruits also confirmed several biological activities including antimicrobial activity, anti-Alzheimer's activity, anti-tumor and anticancer activity, because of which different medicinal companies and researchers paying great attention to this plant fruits. Human research on the medicinal activities of this black mulberry fruit is limited. Therefore, more study is needed to explicate the compounds present in it and their possible effect on human health. This review will reveal the broad spectrum of its medicinal importance, antioxidant potential, pharmacological uses and the phyto-chemical compositions.

Keywords: Blackberry, biological activities, human health and pharmacological actions.

Review article

INTRODUCTION

Fruits and vegetables are the rich source of valuable bioactive constituents playing a vital role in many traditional remedies and the basis for several synthetic drugs. These biological compounds from plants used in cure of various health disorders for long time. Consumption of fresh fruits and vegetables on daily basis maintain good health, reduces the risks of some serious health hazards such as cardio-vascular illness, gastrointestinal disorders, improvement in eyesight and also helpful to decrease the threat of diseases like cancer, diabetes, various strokes and persistent complaints (Golberg, 2003).

The phytochemicals available in these plants have got more consideration due to its economic importance and potential strategy and its antioxidant functions (Ma & zhang 2017; Cao et al., 2018; Veeresham, 2012). Almost 50% of the medicines are attainable from natural products. Around 80% of people in developing countries across the globe mainly depend on folk remedies and the plant-derivative drugs market to be nearly $35 billion in 2020 [Veeresham, 2012; Gryn-Rynko et al., 2016]. The efficiency and safety of therapeutic plants have been well recognized because of these bioactive containing plants become an integral portion of basic health system (Thaipitakwong et al., 2018).

Amongst the classes of various plants used for medicinal reasons from those of genus Morus, commonly known as black mulberry (*Morus nigra*), belongs to the family Moraceae. It is an important medicinal plant known by various names across the globe as moreira in Portuguese, murier in French, morera in Spanish, tut in Urdu, sahtut in Hindi and karadut in Turkish. As the leaves of this plant are the main nutritional source of for silk worm therefore Asian countries, mainly grows these plants for the production of silk worms (Bombyx mori L.) (Vijayan et al., 1997). While, the European region uses this fruit plant in the preparation of various food products as marmalades, jams, juices, vinegars, wine, and some cosmetic products also (Natic et al., 2014). Besides this various parts of the plants have also been used as traditional herbal medicines (Sánchez-Salcedo et al., 2016). In Turkey, *Morus nigra* is mainly cultured for fruit production and also for shade purpose in hot areas (Yaltirik, 1982). While in Pakistan the black mulberry is mainly is used for fuel purpose, for shade purpose and in herbal medicines for various disorders. Black mulberry is significantly valued for its delicious fruits (2-3cm in length) with an approximately weight of 4-6 grams. The fruits are black purple in color (Koyuncu et al., 2004). The harvesting of black mulberry fruits is not an easy task. The fruits can be collected in nets by spreading under the tree and carried by a tree shaking then followed by hand sorting. Its fruit can be taken as fresh, cooked and dried, while in Japan its leaves are used for powder juice and tea purpose. (Gerasopoulos et al., 1997; Ercisli et al., 2007) Mulberry fruits are the rich source of various phytochemical including phenolic compounds, a series of vitamins, high amount of anthocyanin and it has been also reported that it contains hypoglycemic and antioxidant activities which are broadly used in traditional medicines for the cure of various health illness. Recently, black mulberry has gained a significant place in the local soft drink market. The main aim of this review is to documentary the medicinal and pharmacological potential of Black mulberry in human diseases.

Medicinal Properties

The fruit leaves are the rich source of various compounds rutin, sugars, quercetin, volatile oil, amino acid, vitamins and some micro elements that have pharmacological actions, which shows that it can enhance the lifespan of humans (Zou & Chen, 2003). It has been also reported that the fruits contain high pharmaceutical functions as many researchers stated the compounds such as Albafuran, Moranoline, Albanol, Calystegine, Morusin and Kuwanol. Therefore, it attracted the attention of many pharmaceutical industries and scientists (Andallu et al., 2001; Singhal et al., 2010). In herbal remedy different parts of the plant (flowers, stem, bark, roots, and even leaves) can be used to cure a number of disorder conditions related to human health. These various parts of the plants are helpful against diseases like diarrhea, constipation, intestinal worms, urinary tract infections, fever, asthma, diabetes, kidney complaints, migraines and depression (Song et al., 2010; Naowaboot et al., 2009). They are also beneficial in heart problems and prevents stroke. The vision can be straightened by drinking mulberry juice. Moreover, the fruit is also rich source of different nutritious vitamins and minerals.

Antimicrobial Activity

The black mulberry is an active and strong activity against four different bacterial strains *Escherichia coli, Bacillus subtilis, Staphylococcus aureus* and *Streptococcus mutans* (Tahir et al., 2017). Mazzimba et al., 2011 conducted a research showing that six isolated components (namely oxyresveratrol, moracinM, cyclomorusin, morusin, kuwanon C, and a derivative of kuwanon C from aerial parts of mulberry shows antibacterial actions against *S. aureus, B. subtilis, Micrococcus flavus, S. faecalis, Salmonella abony, and P. aeruginosa,* with the most effective activity against *B. subtilis* (MIC value 3.91 g/mL).

Anti-Alzheimer's Activity

This disorder particularly creates mental debilitate and loss of memory, research shows that compound amyloid beta peptide present in mulberry fruits in the etiology of this problem, it inhibit the weakening of neurotoxicity and fibril formation (Iyengar, 2007).

Anti-obesity mulberry fruit Juice

A UK fruit juice company named "Fairjuice" has launched a super fruit drink prepared from pure fresh mulberry fruits which is rich source of antioxidants, which is considered to be helpful for heart health also. It also overwhelms the hunger that is why it has been stated as a useful drink against obesity (Fairjuice, 2008).

Anti-Tumor Activity

Helicobacter pylori are known as one of the most well-known factors in activating the gastric carcinogenesis problems (Nishizawa and Suzuki, 2015). Huang et al., 2011 showed that anthocyanin rich fruits from the black mulberry fruits can be used to stop the formation of gastric carcinoma.

Protection against Brain Damage

Kang et al., 2006 mentioned that a compound C3G extracted from mulberry fruit shown a cyto-protective result on PC12 cells exposed to hydrogen peroxide and also helpful in neuroprotective effect on cerebral ischemic damage caused by oxygen glucose deprivation (OGD).

Anticancer Activity

Ahmed et al., 2016 studied the anticancer effect of black mulberry of fresh and dried fruits which shows that it slows down the activity of MCF-7 cells and it results the cell death of infected cells and causes morphological changes in cytoplasmic membranes. It converts the DNA into single strand which results to decrease the level of mitotic activities in the cell which results the good pharmacological functions.

CONCLUSION

The black mulberry is the rich source of nutraceutical compounds, particularly its various parts of the plants exhibited numerous pharmacological properties including antimicrobial, anti-tumor, antidiabetic, protection against brain damage, anticancer activities and anti-Alzheimer's activity. M. nigra also presented the defensive and therapeutic properties on the central nervous system, liver, kidney and gastrointestinal tract. Therefore, these results and conclusions propose that the black mulberry can be used as a promising nutraceutical resource and an alternative for various medicinal products relayed on medicinal plants in order to prevent and control and numerous chronic ailments.

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Emerging Role of Edible Mushrooms in Food Industry and Its Nutritional and Medicinal Consequences

Muhammad Yasir Naeem[1*], Senay Ugur[1], Sumayya Rani[2]

[1]Faculty of Agricultural Sciences and Technologies, University of Nigde Omer Halisdemir University Nigde, 51240, Turkey.

[2]Department of Food Science and Technology, The University of Swabi, Swabi, 23430, Pakistan.

**Corresponding Author: yasir.naeem91@yahoo.com*

Abstract

Topical investigations on applications of mushroom their role in the food industry and as medicine and food were carried out. This present paper, review numerous considerations of edible mushrooms as a therapeutic and food source. Mushrooms as a raw material are problematic in processing in the food industry. Therefore, mushroom powder has been analysed for nutritional purpose and formulated in different products. Currently, attention has been increased in mushroom processing and cultivation because of the availability of bioactive components which own various medicinal properties (anti-viral, anti-cancer, and anti-oxidative etc). Edible Mushroom is rich in nutritional point of view with higher contents of protein, vitamin, mineral, fibres, microelements and little calories level. The biologically active components extracted from edible mushrooms may increase the immune system of human and provide quality diet as well. To increase quality features mushrooms are added to numerous products directly, and indirectly they are added to as a substitute of different functional ingredients and enzymes as well.

Keywords: Edible Mushrooms, food industry, medicinal properties and nutritive value.

Review article

INTRODUCTION

Different species of the fungus are represented by the word 'mushroom' which belong to the Basidiomycete's order. Mushrooms are considered as one of the greatest sources of nutrition in the world. After heavy rain or an abrupt change in temperature, Basidiomycete's or Ascomyecetes are seen almost all over the places in soil excess in humus, organic matter, moisture content, woods or leftover of animals. But after some time, it vanishes and remaining behind mycelium only (Zeid *et al.*, 2011). Various researchers reported the presence of over 70,000 species of fungi in the world, among which 2000 species belongs to edible mushroom and about 10 % of 30 species belongs to poisonous mushroom while a few species are considered mortal (Yenealem *et al.*, 2013). Mushrooms have a prominent role in the restoration of nutrients in forest ecosystem because they have a unique ability to break down complex cellulosic substrates like leaves, wood and other organic matter into simpler compounds. Pleurotus species are famous across the globe particularly in Asian and European areas due to little charge cultivation practices and high organic efficiency (Alemu, 2015).

Since ancient times, mushrooms are being used as food supplements and have a significant role in our fitness, highly nutritive and illnesses (Chang, 1996). They can produce high quantity protein with better quality from useless agricultural residues (Chadha and Sharma, 1995). As compared to other crops, mushrooms can be used to combat with malnutrition, as they are produced in high quantity per unit area in a short time with the high amount of protein (Gupta, 1986). They have low calories, carbohydrate, Ca (calcium) and Na (sodium) and the maximum quantity of unsaturated fats with no destructive lipids. They contain a high percentage of vits. like vitamin B complex (0.013 to 0.060g) Vitamin C (0.092 to 0.144 g), and Folic acid (0.012-0.014 g) on a dry weight basis (Hossain *et al*., 2007). Mushrooms are rich in minerals such as Ca, Fe, Mn, Mg, Zn and Se (Alam, 2007). They are used as a substitute basis of meat, fishes, vegetables and fruits (Kakon, 2012).

Mushrooms have high medicinal value as they reduce the risk of hypertension, hypercholesterolemia, atherosclerosis and cancer (Ashagrie, 2015). They have antioxidant activities and also help to reduce total blood cholesterol, lipoprotein cholesterol and blood glucose level (Daba *et al*., 2008). The main aim of this work is to provide the basic knowledge of mushroom in the field of the food industry and also to explain its significant role in nutrition and its health aspects.

Applications of Mushroom as Food

Human has been following for the wild mushroom since ancient times as a source of food (Cooke, 1977). Through, the initial time of evolution, the mushroom was used mostly due to its deliciousness and exclusive flavours (Rai, 1994). Current consumption of mushrooms is entirely dissimilar from folk one as, most of the investigation has been carried out on its chemical content, which exposed that mushrooms can be consumed as food to struggle against a series of illness. The initial antiquity concerning the usage of mushroom in various countries across the globe has been studied well by the sum of investigators (Abou *et al.*, 1987; Buller, 1915; Rolfe and Rolfe, 1925; Jandaik and Kapoor, 1975; Singer, 1961; Atkinson, 1961; Houghton, 1995: Bano *et al*., 1964; Bano and Rajarathnam, 1982). The history of mushroom in Asia is aged than in Europe (Lambert, 1938).

Rolfe and Rolfe (1925) stated that the mushrooms like *Agaricus campestris, Morchella esculenta, Helvella crispa, Hydnum coralloides, Hypoxylon vernicosum* and *Polyporus mylittae* were consumed in considerable amount in past across the different countries. Bano *et al.*, (1963) mentioned the nutritional quality of *Pleurotus flabellatus* as 0.97% ash, 1.08% crude fibre, 0.10 % fat, 90.95% moisture, 0.14% non-protein nitrogen and 2.75% protein. According to Bano (1976) that diet worth of mushroom intermediate vegetables and meat. Moreover, Crisan and Sands, (1978) detected that mushroom comprises water and dry matter 90 % and 10% respectively. While the level of protein fluctuates ranging from 27 % to 48%, lipids between 2 to 8% and carbohydrates are fewer than 60%. According to Orgundana and Fagade, (1981) a normal mushroom is around 16 % dry matter out of which 14.6% is crude protein, 7.4% is crude fibre, and 4.48% is fat and oil. Gruen and Wong (1982) showed that mushrooms are extremely nutritive, can be compared positively with eggs, meat, and milk foodstuff. As the statement of (Barros et al, 2008), more than 2500 mushroom species largely for eatable purpose. While, almost 90 mushroom species are cultured on large scale, with 8 to 10 species used at industrial purpose production and its financial and world-wide worth is now growing gradually because of an upsurge in its worth as a food as well as therapeutic and highly nutritive. There is also an important argument in the nutritional content of pileus verses stalks (Latifah *et al.*, 1996; Zakia *et al.*, 1993). Mushrooms have an exclusive texture with pleasant aroma, taste and flavour that makes mushrooms different from further foodstuff and yields (Fekadu, 2014). Mushrooms are extremely nutritious with low calories food and quality protein, minerals and vitamins. Mushroom is also considered a significant and ordinary source of diets as well as remedies. In the feature of owing high fibre, low starch and fat, the mushroom has been measured as a perfect diet for overweight peoples and also for diabetic's patients to avoid hyper-glycaemia. Similarly, recognised to own capable anti-oxidative, cardio-vascular, anti-microbial and anticancer effects (Selima et al., 2012).

Vitamins Source

Mushrooms are known as the finest sources of vitamins particularly wild mushrooms comprise considerable volumes of vit. (D2) than shady cultured *Agaricus bisporus*. They comprise of vit. B complex and ascorbic acid in minor quantities as well, while not rich in vit. A, D, and E contents (Heleno *et al.*, 2012).

Mineral Elements

The mineral components of mushrooms are mainly depending on the choice of specie, phase and the length of the bear fruit form of mushrooms. Similarly based on the form of the substratum that is provided for its cultivation. The Key minerals component in mushrooms are potassium, phosphorus, sodium, calcium and essentials like Copper, Zinc, Iron, form minor section (Table 1 and 2). They have capability to accrue heavy metals (Malinowska *et al.*, 2004). The content of mineral in wild eatable mushrooms are maximum than cultivated ones (Rudawska and Leski 2005). K, P, Na and Mg make near 55 – 70 % of the total ash contents of mushroom (Li and Chang, 1982) while only K constitute about 45 % of the ash content.

Table 1. According to Kaul (1978) *M. esculenta* Mineral content

Minerals	Mg per Kg fresh weight
calcium	0.57 mg
phosphorus	3.31 mg
Iron	1.21 mg
potassium	3.83 mg

Table 2. According to Varo et al. (1980) *A. bisporus* Mineral content

Minerals	mg per Kg of fresh weight
calcium	40.00 mg
Manganese	16.00 mg
phosphorus	75.00 mg
Iron	7.8 mg
Copper	9.04 mg

Mushroom as Protein Source

Protein is a vital component of mushroom. The level of proteins in mushroom-based upon the configuration of the base, pileus dimensions, harvesting period and mushroom classes (Bilal *et al.*, 2010). Proteins in *A. bisporus* lies between 33 to 43% on the DW basis. In over-all, mushrooms contain maximum proteins level than the maximum of further vegetables and wild plants. Mostly, on DW the protein content in the mushroom range from 20 to 30 %. The two main vital amino acids which are absent in cereals but present in mushrooms on a high level are lysine and tryptophan. Mushroom consists completely of the vital amino acids mandatory for an adult (Anon, 2007).

According to the Samajipati (1978) showed that the protein level in the dried mycelium of *M. delicious,* A. *arvensis*, *M. esculenta* and *A. campestris are* 29.16, 28.16, 34.7 30.16 % respectively. The sum of crude proteins in mushroom ranked lower than animal meat while above the utmost other diets including milk. Rai and Saxena (1989a) 31 noted a decrease in mushroom protein level upon storage. Some important essential amino acids are mentioned in Table 3.

Table 3. Vital Amino Acid in 100 gm Dry Mushroom

Mushrooms	Essential Amino Acids	Per 100 gm Dry Mushroom	Total Essential
Agaricus bisporus	Histidine	2.7	38.9
	Methionine	0.9	
	Phenylalanine	4.2	
	Threonine	5.5	
	Lysine	9.1	
	Tryptophan	2.0	
	Valine	2.5	
	Isoleucine	4.5	
	Leucine	7.5	
Agaricus edodes	Histidine	1.9	36.0
	Methionine	1.9	
	Phenylalanine	5.9	
	Threonine	5.9	
	Lysine	3.9	
	Tryptophan	-	
	Valine	3.7	
	Isoleucine	4.9	
	Leucine	7.9	
Volvereilla volvacea	Histidine	3.8	32.9
	Methionine	1.1	
	Phenylalanine	2.6	
	Threonine	3.5	
	Lysine	7.1	
	Tryptophan	1.5	
	Valine	5.4	
	Isoleucine	3.4	
	Leucine	4.5	
Pleurotus sajorcaju	Histidine	2.2	37.6
	Methionine	1.8	
	Phenylalanine	5.0	
	Threonine	5.0	
	Lysine	5.7	
	Tryptophan	1.2	
	Valine	5.3	
	Isoleucine	4.4	
	Leucine	7.0	
Pleurotus ostreatus	Histidine	1.7	33.4
	Methionine	1.5	
	Phenylalanine	3.7	
	Threonine	4.6	
	Lysine	4.5	
	Tryptophan	1.3	
	Valine	5.1	
	Isoleucine	4.2	
	Leucine	6.8	
Pleurotus florida	Histidine	2.8	46.0
	Methionine	3.0	
	Phenylalanine	3.5	
	Threonine	6.1	
	Lysine	9.9	
	Tryptophan	1.1	
	Valine	6.9	
	Isoleucine	5.2	
	Leucine	7.5	

Fibre

The fat content level as compared to proteins and carbohydrate is low in mushroom. However, the fibre quality in the mushroom is good. According to Hugaes (1962) that linolenic acid level is high than other components. Singer (1961) stated that the fat contents in some mushrooms like *Suillus granulatus* (2.04%), *Suillus luteus* (3.66%) and *A. campestris* (2.32%). According to the investigation of (Yilmaz *et al.*, 2006) and (Pedneault *et al.*, 2006) informed, fats fraction in the mushroom are mostly calmed of unsaturated fatty acids. Fresh mushroom contains (soluble and insoluble) fibre.

The soluble fibre is largely composed of beta-glucans and chitosan's, that are the ingredients of the cell wall. Soluble fibre exposed to avert and accomplish from cardiac diseases by dropping down the total and LDL cholesterol levels. Thus, the mushroom is virtuous for fitness as it comprises zero Fat, low Calories, low Carbohydrate, low Sodium and no Cholesterol level.

Mushroom as Carbohydrate Constituent

The carbohydrates content of mushroom signifies the majority of fruiting bodies contributing 50 to 65% on DW basis. Free sugars quantity approximately 11%. Florezak *et al*., (2004) stated, *Coprinus atramentarius* consist of 24 per cent of carbohydrates on DW source. The mannitol, too known as mushroom sugar establishes nearby 80 per cent of the total free sugars, (Wannet *et al.*, 2000).

Singh NB and Singh P (2002) described that fresh mushrooms comprise hemicellulose, glycogen, reducing sugar and mannitol, 0.91, 0.59, 0.28 and 0.9 % respectively. The major carbohydrate of *Agaricus bisporus* is Raffinose, xylose glucose, sucrose and fructose.

Applications of Edible Mushrooms in Food Industry

Edible mushrooms can be employed in both direct way (as an ingredient) and indirect way (as a source of fermentation) in processed foodstuffs.

Direct Considerations

Initially, the mushroom was consumed in a direct means to yield numerous foodstuffs. Mushroom are useful constituents in several cooked things. Investigators have attempted to yield nutrient efficient bread through a mushroom, that takes valuable fitness possessions (Lin *et al*., 2008; Tseng *et al.*, 2008). The adding of 10 to 12 per cent *G. frondosa*, *H. marmoreus* and *P. nameko* mushroom reduced dough bulk, exactly dough size of the bread. Though, the addition of *Grifola frondosa* enhanced alcoholic fermentation via providing carbohydrate to the bakery yeast.

Same research carried out by (Lin *et al*., 2008) showing that by replacing shiitake mushroom stalk for 2 to7 per cent of cereal powder, the 5% shiitake stalk bread displayed maximum fibre content utilizing no interfering by the bread exact size. Additionally, customers satisfactoriness was higher for regular wheat flour and shiitake stalk bread was recorded lower. While, microbial counts and moisture loss through storing process remained fewer for wheat bread (Yen *et al*, 2011).

Almost, in every time mushroom can be supplemented to bread in powder system (Jeong and Shim, 2004; Lee *et al.*, 2004, 2009; Okafor *et al.*, 2012), while *G. lucidum* can be supplemented as an extract (Chung et al, 2004). According to (Kim *et al.*, 2010; Kim and Joo, 2012) the powder of *L. edodes* and *P. eryngii* employed to yield well muffins and cookies.

As functional constituent mushrooms were also been added to the pork patties. The powder of Shiitake (*L. edodes*) mushroom was added into pork patties to upsurge its texture and juiciness (Chun *et al.*, 2005). As a whole, the adding of mushroom powder improved consumers acceptance by refining its texture and juiciness. To improve the oil-holding ability of pork patties white jelly mushrooms were used (Cha *et al.*, 2013).

Utilizing a flavouring mediator, mushroom employed to yield powder stuff, counting soup mixes and seasonings. Mushrooms whey soup salt form ready to enhance the value of *A. bisporus* whey soup powder of mushroom was prepared (Singh *et al.*, 2003). Another research was made to yield natural flavours with sea tangle and P. ostreatus and L. edodes, which has savoury flavour due to its nucleotides (Park *et al.*, 2001). These outcomes presented potential aimed at mushroom as constituents in natural flavours. According to (Han *et al.*, 2006). *L. edodes* was effectively employed as a flavouring element in the brown sauce as an alternative of *A. bisporus*.

Indirect Consideration

Another class of mushroom consumption is a secondary method is to yield fresh foodstuffs. i-e, the stipe of shiitake mushroom, that is a mainly cultured mushroom in Taiwan, classically rejected due to its rough quality (Lin *et al.*, 2010). Though, shiitake stipes can be employed a substitute nitrogen basis in alcoholic fermentation due to its maximum proteins level (Lin *et al.*, 2010). The basidiomycete of G. lucidum (therapeutic fungi) employed for soy-milk fermentation, and exhibited a healthier satisfactoriness and also improved fitness belongings later to fermentation (Yang and Zhang, 2009). Occasionally, the mushroom was replaced for S. cerevisiae in beer and wine fermentation. A. blazei, F. velutipes and P. ostreatus might be employed in wine fermentation instead of S. cerevisiae, T. matsutake. A. blazei, F. velutipes and P. ostreatus likewise confirmed its capability to yield alcoholic in beer fermentation (Okamura-Matsui *et al.*, 2003). Detailed considerations of Edible Mushroom are mentioned in Table 4.

The enzymatic actions of mushroom have been also employed to produce a novel means to make familiar products. A folk alcoholic drink in Japan called “Sake” formed through various mushroom (Okamura-Matsui *et al.*, 2003). Traditionally, sake was prepared by a two-step procedure: (i) saccharification and fermentation by an act of amylases (ii) Alcohol dehydrogenase, as mushroom has mutually alcohol dehydrogenase and amylases action, (Okamura-Matsui *et al.*, 2003). They projected mushroom immunization in rice and water as a modest means to yield sake (Okamura-Matsui *et al.*, 2003).

Table 4. Applications of Edible Mushrooms

Application	Products	By-Products	Functions	Mushrooms	References
	Baked goods	Bread	Increased loaf volume	*Lentinus tuber-regium*	Lee *et al.,* (2004)
			Functional bread (beneficial health effects)	*Ganoderma lucidum*	Chung et *al.,* (2004)
			Accelerated alcohol fermentation by yeast	*Grifola frondosa*	Okamura-Matsui *et al.,* (2003)
			Increased protein content and nutritional quality	*Pleurotus plumonarius*	Okafor *et al.,* (2012)
			Increased umami taste,	*Agaricus blazei, Antrodia camphorata*	Ulziijargal *et al.,* (2013)
			Reduced moisture loss, beneficial health effects	*Lentinula edodes*	Yen *et al.,* (2011)
		Cookie	Beneficial health effects	*P. eryngii*	Kim *et al.,* (2010)
		Muffin	Beneficial health effects,	*Lentinus edodes*	Kim and Joo, (2012)
Direct	Pork patty	-	Increased texture and juiciness; functional ingredients	*Lentinus edodes P*	Chun *et al.,* (2005)
	Meat analog	-	Textural properties	*Agaricus bisporus*	Kim *et al.,* (2011)
	Sauce	Apple dressing	Flavouring agent; beneficial health effect	*Tricholoma matsutake* Sing	Hong *et al.,* (2009)
		Brown sauce	Flavouring agent	*Lentinus edodes*	Han *et al.,* (2006)
	Powdered product	Seasoning	Flavouring agent; increased functionality	*Lentinus edodes*	Yoo *et al.,* (2007)
		Seasoning	Flavouring agent	*Pleurotus ostreatus*	Park *et al.,* (2001)
	Soup	-	Flavouring agent; increased postharvest life	*Agaricus bisporus*	Singh *et al.,* (2003)
	Drink	Beer	Increased biological activities	*G. lucidum*	Leskosek *et al.,* (2010)
		Yakju	Increased biological activities	*G. lucidum*	Kim *et al.,* (2004)
Indirect	Fermentation	Alcoholic beverages	Used as a nitrogen source	shiitake	Lin *et al.,* (2010)
		Sake	Alcohol dehydrase and amylase activity	*A. blazei*	Okamura-Matsui *et al.,* (2003)
		Wine	Used in place of *S. cerevisiae*	*A. blazei; F. velutipes;*	Okamura-Matsui *et al.,* (2003)
		Beer	Used in place of *S. cerevisiae*	*F. velutipes; T. matsutake*	Okamura-Matsui *et al.,* (2003)
		Cheese-like food	Lactate dehydrogenase Milk clotting activity	*Schizophyllum commune*	Okamura-Matsui *et al.,* (2001)
	Additive	Compound beverage	Beneficial health effects	Bachu mushroom	Hou *et al.,* (2008)
		Apple juice	Inhibition of browning in apple juice	*Flammulina velutipes*	Jang *et al.,* (2002)
		Processed fish meat	Colour stabilizer in processed fish	*F. velutipes; L. edodes P. eryngii*	Bao *et al.,* (2010)

Processing and Storage applications of Mushroom

The mushrooms quality deteriorates directly after harvesting. Even, at room temperature, its shelf life is no more than 48 to 72 hours as they have no cuticle to defend them from environmental deviations. Temperature, relative humidity, respiration rate, browning and spoilage by bacteria are measured the most mutual aspects accountable for mushroom deterioration (Singh *et al.*, 2010). It is stated that 55 % of mushrooms yielded are processed primarily in canned form, while only 45% of them are consumed in the fresh form (Singh *et al.*, 2010). Consequently, investigation regarding processing thoughts for mushrooms have largely involved canned products.

Nutritive Value

The nutritive value of edible mushrooms is mainly because of its higher proteins, fibre, vitamins and minerals content, and low-fat levels (Mattila *et al.*, 2001; Barros *et al.*, 2008). They are valuable for vegetarian foods because they deliver all the essential amino acids required for an adult. Also, edible mushrooms consist of numerous different bioactive components with various human health assistances (Gruen *et al.*, 1982). It is significant to mention that the development features, phase and postharvest state may affect the chemical composition and the nutritional worth of edible mushrooms (Kala *et al.*, 2013). Mushrooms contain a high moisture proportion that lies between about 80g and 95 g per 100 g. Edible mushrooms are an excellent source of protein, 200g to 250g per kg of dry matter. Edible mushrooms comprise high sums of ash, 80g to120g per kg of dry matter (mainly potassium, phosphorus, magnesium, calcium, copper, iron, and zinc). Carbohydrates are available in high amounts in edible mushrooms, counting chitin, glycogen, trehalose, and mannitol; besides, they contain fibre, β- glucans, hemicelluloses, and pectic substances. Moreover, glucose, mannitol, and trehalose are plentiful sugars in cultivated edible mushrooms, but fructose and sucrose are in low quantities. Mushrooms are also a good source of vitamins with high levels of riboflavin (vitamin B2), niacin, folates, and traces of vitamin C, B1, B12, D and E. Mushrooms are the only non-animal food source that comprises vitamin D and therefore, it is the only natural vitamin D source (Guillamon *et al.*, 2010; Ribeiro *et al.*, 2009). Nutritional value of some edible mushrooms on a dry basis are mentioned in Table 5.

Table 5. Nutritional value of some edible mushrooms (dry basis) (Kalač 2013; Phan *et al.*, 2012)

Mushrooms	Energy kcal/kg	Ash %	Fat %	Carbohydrates %	Protein %
Hypsizigus marmoreus		8.26	5.62	65.6	21.0
Flammulina velutipes	467	7.2	2.89	85.99	3.87
Pleurotus sajor-caju		6.3	1.0	55.3	37.4
Pleurotus eryngii	421	6.2	1.5	81.4	11.0
Pleurotus ostreatus	416	5.7	1.4	85.9	7.0
Lentinus edodes	772	6.7	1.73	87.1	4.5
Agaricus bisporus	325	9.7	2.2	74.0	14.1

Medicinal Potential of Mushroom

The knowledge of the affiliation amongst nourishment and diseases has directed to the expansion of all organised a new scientific discipline which is named as "functional food science.
" Functional foods may be whatever like nutritional supplements, therapeutic diets, vita foods, phytochemicals, myo-chemicals and pharma-food as well, which might be consumed exactly to improve health. Mushrooms fit very well into this category of functional foods as it has all the ability to mitigate illnesses. 'Mushroom Nutraceuticals' are the traditional measures which were employed in old times in the form of extracts, health tonics, concentrates, fermented beverages, tinctures, teas, soups, herbal formula, powders and arid healthful food dishes (Smith *et al.*, 2002). The term "Mushroom Nutraceuticals" has been invented by Chang and Buswell (Chang and Buswell, 1996). Various researches have revealed that consistent intake of mushrooms or their products is operative both in averting and treating particular ailments (Chang and Miles, 2004). Edible mushrooms and their active components have been defined to have beneficial effects on hyperglycaemia and hypercholesterolemia (Tiwari, 2004; Sharma, 1995). Numerous mushrooms have high contents of acidic polysaccharides, dietary fibre, and antioxidants, including vitamins C, B12, and D; folate ergothioneine; and polyphenol (Leelavathy and Ganesh, 2000) signifying that the mushroom may have the ability of anti-inflammatory, hypoglycaemic and hypocholesterolaemia effects (Table 6).

Table 6. Medicinal potential of important mushrooms

Mushrooms	**polysaccharides**	**Active Components**	**Therapeutic Actions**
Volvariella volvacea	Heteropolysaccharides	Glycoproteins	Enhance insulin secretion, anti-aging property.
Trametes versicolor	Heteropolysaccharides	Polysaccharide-K (Krestin),	Anti-tumour activities, lowers cholesterol, triglycerides, and lipid levels; decrease blood glucose, beneficial in coronary heart disease, immune tonic.
Pleurotus sajor-caju	Heteropolysaccharides	Lovastatin polysaccharide	Cure lung infections, hypoglycemic activity, cellular health properties, anti- depressant activity
Lentinula edodes	Heteropolysaccharides	Eritadenine, Lentinan	Antioxidant, anti-cancer activity, anti-ageing property; immuno-modulatory, anti-viral action
Grifola frondosa	Heteropolysaccharides	Grifloan, Lectins	Augments immune system, liver protection, antibiotic properties, inhibits cholesterol synthesis; immunomodulatory, anti-cancerous properties.

Ganoderma lucidum	Heteropolysaccharides	Polysaccharides, triterpenoids, germanium, nucleotides and nucleosides,	Increases insulin secretion, decrease blood glucose, improves ovulation
Flammulina velutipes	Heteropolysaccharides	Polysaccharide, FVP (Flammulina polysaccharide protein), peptide glycans, prolamin	Lower cholesterol, anti-cancer agent
Cordyceps sinensis	Heteropolysaccharides	Cordycepin	Lower cholesterol, prevents cardiovascular disorders.
Auricularia auricula	Heteropolysaccharides	Acidic Polysaccharides	Decrease immune system depression, prevents cancer, inhibits growth of Candida albicans
Agaricus bisporous	Heteropolysaccharides	Lectins	Cardio-protective, lowers blood pressure.

The important pharmacological properties and physiological effects of mushrooms are bio regulation (immune enhancement), upkeep of homeostasis and regulation of biorhythm, therapy of numerous sicknesses and inhibition and enhancement from life intimidating illnesses (cancer, cerebral stroke and heart). Mushrooms are also recognized to have active ingredients for anti-fungal, anti-tumour, anti-viral, anti-bacterial, hepato-protective, anti-diabetic, hypo-lipidemic, anti-thrombotic and hypo-tensive actions (Wasser and Weis, 1999). Mushrooms are identified to counterpart chemotherapy and radiation therapy by opposing the side-effects of cancer like nausea, bone marrow suppression, anemia, and lowered resistance. Freshly, several bioactive molecules, counting anti-tumour agents have been known from various mushroom species. Some of the recognised molecules are β-glucan, proteoglycan, lectin, phenolic compounds, flavonoids, volatile oils, tocopherols, phenolics, flavonoids, carotenoids, folates, ascorbic acid enzymes, and organic acids (Patel and Goyal, 2012), polysaccharides, triterpenoids, dietary fibre, lentinan, schizophyllan, lovastatin, pleuran, steroids, glycopeptides, terpenes, saponins, xanthones, coumarins, alkaloid, kinon, fenil propanoid, kalvasin, porisin, AHCC, maitake D-fraction, ribonucleases, eryngeolysin, and also have been capable against many types of sicknesses (Chihara, 1992; Wasser and Weis, 1999).

The active compounds in mushrooms are accountable for conversing anticancer ability are lentinan, krestin, hispolon, lectin, calcaelin, illudin S, psilocybin, Hericium polysaccharide A and B (HPA and HPB), ganoderic acid, schizophyllan, laccase (Chen and Seviour, 2007). The bioactive components found in mushrooms can be categorized into secondary metabolites, glycoproteins and polysaccharides. Mushroom poly-saccharides are the superlative known and most effective mushroom-derived materials with anti-tumour and immunomodulating functions. The mushroom poly-saccharide i.e beta glucans are the most multipurpose bioactive molecule owed to its outstanding beneficial allegations and wide range biological actions. (Valverde *et al.*, 2015).

Antitumor Activity

Mushrooms (Lentinus (Lentinula) edodes, Schizophyllum commune, Grifola frondosa, and Sclerotinia sclerotiorum) are their particular β-glucans, lentinan, schizophyllan and grifolan, are identified for anti-tumoral activities. Furthermost of the β-(1-6)- branched β-(1-3)-linked glucans, are potent to perform as anti-tumour action (Fekadu Alemu, 2014).

Pleurotus ramous produces ethyl acetate, methanol and aqueous that hinder the Dalton's Lymphoma Ascites (DLA) cell line persuaded solid tumour and EAC cell line encouraged ascites tumour in rats. While the anti-tumour result is maximum in ethyl acetate extracts than the other. Anti-tumour action of G. lucidum is again employed by (Sheena *et al.*, 2005) through the EAC cell line induced solid tumour model in rats, methanol and aqueous extracts provide momentous anti-tumour functions by hindering the tumour growth. Poly-saccharides extracted from mycelium and fruiting bodies of *L. tuberregium* efficiently withdrawn solid tumour creation in rats (Manjunathan *et al.*, 2010).

Antimicrobial Action

Mushroom known as *Osmoporus odoratus* produces petroleum ether, chloroform, acetone and water extracts that are valuable for its anti-bacterial action against *Staphylococcus aureus, Streptococcus pyogenes, Bacillus subtilis, Escherichia coli and Pseudomonas aeruginosa*. The water extract *Osmoporus odoratus* perform as anti-bacterial action against the organisms and it is akin to that of ampicillin slightly than chloramphenicol (Sivakumar *et al.*, 2010). The anti-fungal and anti-bacterial activities of methanol and aqueous extracts of fruit bodies from Phellinus is practicable by (Balakumar *et al.*, 2011) against five fungal strains *Penicillium spp, Aspergillus fumigatous, Aspergillus niger, Aspergillus flavus and Mucor indicus* and five bacterial pathogens such as *E. coli, P. aeruginosa, S. typhi, S. aureus* and *Streptococcus mutans* (Hrudayanath and Sameer, 2014).

Anti-inflammatory

Ethanol extracted from cultured mycelium of *M. esculents* is sound identified for its anti-inflammatory action and is vital but based on the amount to hinder both acute and chronic inflammation in rats' model that is similar to the standard Diclofenac. The acute and chronic anti-inflammatory actions of ethyl acetate and methanolic extracts from *G. lucidum* are stated (Sheena *et al.*, 2005) through carrageen an encouraged acute and formalin-induced chronic inflammatory models in mice. Chloroform that can extract from *G. lucidum* is an important anti-inflammatory action (Joseph *et al.*, 2009).

CONCLUSION

Numerous species of mushrooms mentioned as a primary basis for bioactive components, along with its significant nutritive importance. The presence of mushroom in the daily diet might have efficiency as latent dietetic complements. Moreover, powder designs of few mushrooms' species exposed the existence of vital nutrients. Mushroom consists of low-fat contents and may be employed in low calories foods. They can also be utilized as anti-oxidants to avert oxidative stress and ageing as well. Upcoming research should need on the mechanism activity of mushrooms extracts will provide assistance for additional outline the motivating jobs and possessions of numerous mushrooms phytochemicals in the inhibition and to cure illnesses.

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Natural Antioxidants and Therapeutic Effects

İlknur UÇAK[1*], Maham ZAHID[1]

[1]Nigde Omer Halisdemir University, Faculty of Agricultural Sciences and Technologies, Nigde/Turkey

**Corresponding author: ilknurucak@ohu.edu.tr*
ORCID: 0000-0002-9701-0824

Abstract

Antioxidants are those compounds that slow down autoxidation by hindering free radicals formation. Flavonoids, carotenoids, phenolic acids, and tocopherols are natural antioxidants that can cause scavenging of free radical, hinder autoxidation, and may act as a reductant. Bamboo shoots are considered as a major source of phenolic compounds. Vitamin C as a natural antioxidant, allegedly, decreases the chance of cardiovascular issues, arteriosclerosis, and a few shapes of cancer. Utilization of vitamin E benefits to avoid Alzheimer's infection. Flavonoids as antioxidant used for treatment of cardiovascular illness. Antioxidant-based drugs are used for cure of illnesses like diabetes, atherosclerosis, Alzheimer's illness, Parkinson's infection, etc. Cancer preventing agents like polyphenols lower dangers of cancer, heart illness, hypertension, neurodegenerative illnesses, and stroke. The purpose of this review article is to give a summary of natural occurring antioxidants and their therapeutic effects.

Keywords: Antioxidants, Phenols, Flavonoids, Alzheimer Disease, Cancer

Review article

Natural Antioxidants

Antioxidants are substances that restrain oxidative harm to a specific particle. An antioxidant particle will respond to a single free radical at a time and free radicals will be neutralized by giving one of their electrons. Anti-oxidants are agents able to clean up free radicals and anticipate them from initiating cell harm. Free radicals may cause a wide number of wellbeing issues which incorporate cancer, maturing, heart infections and gastric issues etc. Numerous naturally critical compounds have been detailed to have non enzymatic antioxidant capacities as vitamin C (ascorbic corrosive), vitamin E (-tocopherol), (vitamin A (retinol), -carotene, polyamines, melatonin (5-methoxy-N-acetyltryptamine), NADPH, urate, coenzyme Q-10 (ubiquinol), polyphenols, flavonoids, phytoestrogens, terpenes, lipoic corrosive, glutathione (GSH), cysteine, homocysteine, taurine, methionine, adenosine, s-adenosyl-L-methionine, nitroxides and selenium (Mates et al., 2002, Mates et al., 2008).

Phenols

Phenolic compounds originated from plants are exceptionally vital cancer prevention agents. Intrigued in characteristic and nourishment determined phenolics have expanded since of their parts as foragers of free radicals and their suggestions within the anticipation of numerous infections. Bamboo shoots are considered the finest sources of phenolic compounds of plants origin (Nirmala, Bisht, & Laishram, 2014a; Nemenyi et al., 2015). Phenolic acids show within the delicate bamboo shoots has gentle anti-inflammatory properties and powerful antioxidative movement which will anticipate cancer and blood vessel harm. Such highlights make phenolic compounds a possibly curiously fabric for improvement of useful nourishments.

Vitamin C has numerous natural capacities that include collagen arrangement, retention of inorganic press, lessening cholesterol level of plasma, and improvement of safe framework. It is additionally essential for avoidance of scurvy and support of solid skin, blood vessels and gums. Vitamin C or ascorbic acid as an antioxidant, allegedly, decreases the chance of arteriosclerosis, cardiovascular issues, and a few shapes of cancer. It has the ability to neutralize reactive oxygen species within the fluid stage some time recently lipid peroxidation is started.

Vitamin E is considered a key lipid solvent antioxidant within the cell defence framework. Among isomers of vitamin E, a-tocopherol is the foremost organically vital antioxidant. Vitamin E appears defensive impacts against heart maladies due to hindrance of Moo Thickness Lipoprotein oxidation. Other advantages of vitamin E incorporate enzymatic exercises, expression of quality, and neurological capacities. New bamboo shoots are considered a major source of vitamin E (Shi & Yang, 1992; Nirmala et al., 2011). Vitamin E and vitamin C works synchronously in upgrading the safe capacities of the body. It is additionally necessary for the improvement of retina within eyes. Later inquire about confirmations show that normal utilization of vitamin E helps to avoid Alzheimer's infection. Bamboo shoot is not only a source of vitamin C and vitamin E, but it may be great multi-vitamin nourishment that can be considered as an establishment for great wellbeing.

Vitamin A antecedents and subordinates are retinoid that comprise of a beta-ionone ring connected to an isoprenoid carbon chain. Nourishments tall in vitamin A incorporate liver, carrot, sweet potato, broccoli leaf and pumpkin. Introductory intrigued in compounds related to vitamin A cantered basically on beta-carotene, given introductory epidemiological information with regard to cardio-protective impacts and a relationship of high levels of plasma to low blood weight in men (Stamler et al., 2002).

In any case, concerns around betacarotene's pro-oxidative potential came with a report recommending antagonistic mitochondrial impacts of betacarotene cleavage items (Siems et al., 2002). Moreover, unfavorable mortality information with regard to beta-carotene has constrained intrigued as a successful antihypertensive specialist (Hennekens et al., 1996). As of late, intrigued in vitamin A subordinates has changed to lycopene. Being a powerful antioxidant (Upritchard et al., 2000), lycopene in tomatoes are found concentrated. Research shows a decrease in blood pressure with a tomato extract-based intercession (containing a combination of potential antioxidant compounds counting lycopene) in patients having stage I hypertension (Engelhard et al., 2006), though other study showed no effect in pre-hypertensive patients (Ried et al., 2009).

Flavonoids

Flavonoids are known as polyphenolic compounds generally present in concentrated sums in natural products, vegetables, and refreshments, grapes, berries, counting apples, pomegranate, ruddy wine, onions, tea, cocoa, and dim chocolate. The precise composition and structure of the flavonoids change between nourishment sources and various flavonoids can be modified on the basis of nourishment planning (Peters et al., 2001). Intrigued in flavonoid substances as antioxidant treatment for cardiovascular illness starts from epidemiological information recommending progressed cardiovascular results in people with high levels of admissions of nourishment and refreshments with high flavonoid substance (Bazzano et al., 2002) including cellular work recommending a solid antioxidant outcome of these substances (Aviram and Fuhrman, 2002; Lotito and Frei, 2006).

Natural products and vegetables are stacked with key cancer prevention agents such as vitamin A, C, E, beta-carotene and critical minerals, counting selenium and zinc. Natural products, vegetables and therapeutic herbs are the wealthiest sources of antioxidant compounds (Sies et al., 1992). Phytoconstituents are too imperative source oxidative push could be a destructive condition that happens when there's an abundance of ROS and/or a diminish in antioxidant levels, this may cause tissue harm by physical, chemical, mental variables that lead to tissue harm in human and causes distinctive infections (Tian et al., 2007). Living animals have advanced an exceedingly complicated guard framework and body act against free radical-induced oxidative stretch include by diverse protection instrument like preventative components, repair components, physical guards and antioxidant guards (Valko et al., 2007).f antioxidant and competent to end the free radical chain responses (Cody et al., 1986, Oluwaseun and Ganiyu, 2008).

Oxygen inferred free radical responses have been ensnared within the pathogenesis of numerous human infections counting (Pham-Hui et al., 2008; Valko et al., 2007; Agarwal and Prabakaran, 2005; Pourmorad et al., 2006, Dufor et al., 2007; Sen et al., 2009).:

- Neurodegenerative clutter like alzheimer's malady, parkinson's malady, numerous sclerosis, amyotrophic horizontal sclerosis, memory misfortune and depression.
- Cardiovascular infection like atherosclerosis, ischemic heart illness, cardiac hypertrophy, hypertension, stun and trauma.
- Pulmonary clutters like fiery lung maladies such as asthma and constant obstructive aspiratory disease.
- Diseases related with untimely new born children, counting bronchopulmonary, dysplasia, periventricular leukomalacia, intraventricular hemorrhage, retinopathy of rashness and necrotizing enterocolitis.
- Autoimmune infection like rheumatoid arthritis.

- Renal clutters like glomerulonephritis and tubulointerstitial nephritis, inveterate renal disappointment, proteinuria, uremia.
- Gastrointestinal infections like peptic ulcer, provocative bowel infection and colitis.
- Tumors and cancer like lung cancer, leukemia, breast, ovary, rectum cancers etc.
- Eye diseases like cataract and age related of ratina, maculopathy.
- Ageing process.
- Diabetes.
- Skin lesions
- Immunodepression.
- Liver disease, pancreatitis.
- AIDS.
- Infertility.

Therapeutic approaches using antioxidants

Drugs derived from antioxidants for avoidance and treatment of illnesses like stroke, atherosclerosis, Alzheimer's illness, diabetes, Parkinson's infection, cancer, etc. showed up over the past few years. Free radical hypothesis has incredibly fortified intrigued within the part of dietary cancer prevention agents in anticipating numerous human maladies, counting cancer, stroke, atherosclerosis, diabetes, rheumatoid joint pain and neuro-degeneration. Antioxidants might have encouraging therapeutic capability not just in deferring the beginning but also in avoiding the mature population with AD and complications related to it. Two neuroprotective clinical trials including deprenyl and tocopherol antioxidant therapy of Parkinson's study are available with antioxidants.

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ANTIOXIDANT THERAPY for VARIOUS DISEASES

Various syndromes are being reported that get advantage from antioxidant treatment and including all of them in an article is not conceivable. We will try to cover some diseases that may get advantage from antioxidant treatment.

Neurodegenerative Illnesses

The predominance of neuro-degenerative syndromes increments with progressed age and with growing population, neurodegenerative diseases gotten to be one of the foremost genuine wellbeing issues (Kalaria et al., 2008). As of now, there is no disease treatment exists for neurodegenerative illnesses. The central nervous system that includes brain, spinal cord and peripheral nerves are vulnerable to oxidative stress for a few reasons. Neurons have higher metabolic rates, so deliver wide quantities of ROS. On the contrary, CNS has higher amount of polyunsaturated fatty acids, which are exceptionally inclined to oxidative harm, additionally having higher amounts of iron, which is maybe included in development of unsafe ROS like hydroxyl radical (Aliev et al., 2008). Research exists on the association of oxidative stress within the pathogenesis of Alzheimer infection (Nunomura et al., 2001; Perry et al., 2002, Aliev et al., 2008; Migliore et al., 2005), Parkinson infection (Seet et al., 2010; Beal, 2003) and amyotrophic horizontal sclerosis (ALS) (Simpson et al., 2004). Oxidative stress occurs early within the pathogenesis of neurodegenerative maladies and is likely one of the main starting components of the pathology (Fydrych et al., 2008). The admissions of distinctive cancer prevention agents have been appeared to be imperative in decreasing the chance of neurodegenerative maladies (Engelhart et al., 2002; Commenges et al., 2000, Boothby and Doering, 2005).

For above-mentioned reasons cancer prevention agents show up to be great candidates for administration of neurodegenerative infections. Be that as it may, the nearness of blood brain barrier (BBB) is an additional impediment for the utilization of cancer prevention agents in neurodegenerative infections. Mostly known cancer prevention agents have trouble passing the BBB and a viable antioxidant ought to moreover be able to pass promptly this barrier.

Alzheimer Disease

Antioxidant therapy is recently studied for treatment of Alzheimer disease. An antioxidant drug known as Idebenone has been stated to be successful in administration of Alzheimer illness (Gutzmann and Hedler, 1998; Weyer et al., 1997; Gutzmann et al., 2002), but the evidence on its viability does not appear to be adequate (Thal et al., 2003). Selegiline, a monoamine oxidase inhibitor having antioxidant properties and vitamin E, neither alone nor combined together were able to recover Alzheimer's infection Assessment Scale Cognitive Score in Alzheimer patients, but may essentially detain the progression of disease (Sano et al., 1997). Other substances such as clioquinol (a lipid solvent metal chelator that can pass the BBB) (Fydrych et al., 2008, Ritchie et al., 2003) and LA has appeared guarantee in clinical trials of Alzheimer illness (hager et al., 2007, Hager et al., 2001) in any case these trials have been little and require encourage affirmation.

Other researches about the effectiveness of antioxidants for avoidance of Alzheimer infection and cognitive reduction are considered less empowering. An efficient review of 22 RCTs which utilized vitamin B for avoidance of cognitive decay appeared no noteworthy impact for the vitamin (Jia et al., 2008). In a Cochrane group investigation of certain clinical trials of people with dementia and low serum vitamin B12 levels, treatment with vitamin B12 had no critical impact on cognitive work (Malouf and Areosa, 2003). A new approach suggested by a few research scientists comprise of utilization of bi-functional atoms having both amyloid authoritative and antioxidant moieties that are capable of crossing BBB. This methodology might compensate for the entanglement of major antioxidants that endure from destitute specificity of targets.

Cancer Prevention:

Cancer prevention agents may anticipate and make strides diverse unhealthy states (Knight, 2000). Vitamin E and tocotrienols (for example palm oil) are proficient lipid solvent cancer prevention agents that work as a 'chain breaker' amid peroxidation of lipids in cell layers (Packer and Ong, 1998; Kagan et al. 2002). Vitamin E is known as the 'standard antioxidant' to which other antioxidants are compared, particularly with reference to its organic actions and clinical significance. Vitamin C is a free radical scavenger and it is water soluble.

A total understanding of the dietary and helpful part of dietary cancer prevention agents from nourishment plants is exceptionally critical for creating a sound eats less to counter beneath nourishment and to anticipate oxidation connected illnesses such as cardiovascular infections, diabetes, cancer, and cognitive maladies. Investigation has suggested a few wellbeing assistances related with bioactive compounds and cancer prevention agents display in bamboo shoots. Engineered chemical compounds, famously utilized as additives in therapeutic items have destructive impacts and presently buyers request for characteristic and secure added substances are expanding.

As of now, engineered cancer prevention agents are utilized both within the nourishment and pharmaceutical industry in arrange to draw out item rack life basically by avoiding the oxidation of unsaturated double bonds of fatty acids. It includes numerous dangers since of the carcinogenic and harmful impact of the manufactured cancer prevention agents in this way fuelling and seriously rummage around for normal and effective cancer prevention agents. Bamboo shoots and leaves are a great source of cancer prevention agents, and could play a crucial part within the nourishment and pharmaceutical industry. In addition, they can be utilized for invigorating different nourishment items.

Antioxidant technique has moreover been proposed for anticipating and easing metabolic disorder, counting weight, diabetes, hypertension and atherosclerotic cardiovascular illness, all of which include oxidative push as a critical factor. Cancer prevention agents have appeared neuroprotective action in neurodegenerative illnesses such as Alzheimer's and Parkinson infection (Foley and White, 2002; Ishihara and Brayne, 2005). Cancer prevention agents can dispose of the ROS that are known to influence the generation of different neurotrophins, neurotransmitters and steroids within the brain, subsequently ensuring neurons from oxidative harm. The immunomodulatory impacts of cancer prevention agents have moreover been recorded. Cancer prevention agents, particularly polyphenols, have been found to strikingly delay or avoid the onset of constant incendiary infections (Shahidi and Zhong, 2009).

Common cancer prevention agents like polyphenols give neuro-protective impacts through a assortment of natural activities, such as interaction with move metals, inactivation of free radicals, tweak within the action of diverse chemicals, and impacts on intracellular flagging pathways and quality expression (Obrenovich et al., 2010; Soobrattee et al., 2006). A few epidemiological ponders recommend that diets wealthy in cancer prevention agents play an imperative part within the security against different pathologies. The most sources of these atoms are found in natural products and vegetables and are related with lower dangers of cancer, heart illness, hypertension, neurodegenerative illnesses, and stroke (Wolfe et al., 2003; vinson et al., 2001; Albani et al., 2010)

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Short communication: Proximate chemical and nutritional composition of *Moringa oleifera,* and *Adansonia digitata* leaves

Abdalbasit Mariod

Indigenous Knowledge and Heritage Center, Ghibaish College of Science & Technology, Ghibaish, Sudan

Corresponding Author: basitmariod58@gmail.com

Abstract

This study was conducted in the powder leaves of *Moringa oleifera*, and *Adansonia digitata*. Samples were collected from different areas in Sudan. The leaves were washed, crushed and analyzed for approximate chemical composition. *M. oleifera* contained the highest percentage of protein 28.3%, fat 8.0% and fiber 18.5%, while *A. digitata* has the highest percentage of moisture 7.2%, and ash 16.0%. *M. oleifera* showed the highest percentage in minerals.

Keywords: *Moringa oleifera, Adansonia digitata*, leaves, composition

Review article

INTRODUCTION

Starting late there is a development in the undertakings to examine the activity of green leaves in the eating schedule. Both the incredible references and more forward-thinking conveyances on nutrition are of worth. From trees the physical necessities of life are taken e.g. wood for safe house and for cooking, bark and fiber to be beat or to be woven into texture, both sweet and insipid natural items, nuts, and rich wellsprings of edible oils, fluids to be used as refreshments with or without fermentation, or to be scattered to yield sugar. Notwithstanding their abundance and their assortment of jobs, trees are infrequently thought of as source of edible green leaves. Believe it or not, relatively few trees of the quiet zone are utilized in that plan. Some sort of pruning of trees bearing tasteful leaves is continually appealing to keep the leaves inside straightforward reach (Martin et al. 1998).

Adansonia digitata

family Malvaceae, is the most widespread of the Adansonia species on the African mainland, arrive at heights of 5 to 30 meters and have trunk distances across of 7 to 11 meters, fruit is 15 to 20 cm long. Leaves are commonly having 5 leaflets when experienced. The leaflets have entire edges and are elliptic to obovate-elliptic, with hone zenith and a repetitive base. Old leaf size may touch base at a broadness of 20 cm (Sidibe and Williams, 2002). It's found in the hot, dry savannahs of sub-Saharan Africa. Tabaldi is the name of the Baobab tree in Sudan and its regular fruit is Gongolaze. Baobab's trunk is used as a tank to store water. People in west Sudan use the void in the capacity compartment to extra water in the downpour season. Gongolaze is used to make juice or to fix stomach and various ailments. It understands that baobab particular life outperforms a period of 5,000 years. A.digitata fruit contains half more calcium than spinach, is high in cancer prevention agents, and has a high more vitamin C than orange In Kordofan and Darfour states, Sudan, the leaves blended with onion slides, lemon juice, peanut paste and eaten as salad of mixed greens, in other African nations the fruits broke down in milk or water and utilized as a beverage. The seeds additionally produce palatable oil. In 2008, the European Union affirmed the utilization and consumption of baobab fruit as a component in smoothies and grain bars (http://en.wikipedia.org). The baobab fruit mash is likely the most significant staple. It tends to be dissolved in water or milk as in some Sudanese areas where young children shepherds used to mix baobab fresh fruit with goat milk to have thick delicious paste known as *ummartabo*. In other African countries the produced liquid is then utilized as a beverage, a sauce for food, an aging operator in neighborhood fermenting, or as a substitute for cream of tartar in baking (Sidibe and Williams, 2002). No studies to our knowledge have been carried out on leaf protein and its concentrate (http://www.bigbaobab.co.za).

Moringa olifera (Rawag)

Moringa (*Moringa oleifera*) tree belong to family Moringaceae, known in Sudan a s rawag tree which means tree that used to clean and purify drinking water, It grows fast and reaches up to 12 m moringa tree is developed for the most part in semi-dry, tropical, and subtropical territories.

While it develops best in dry sandy soil, it endures poor soil, including waterfront regions. It is viewed as one of the world's most valuable trees, as pretty much all aspects of the Moringa tree can be utilized for food or has some other helpful property. In the tropics, it is utilized as animal feed (Ray et al., 2003).

The leaves have 7 times more vitamin C than oranges and 15 times more potassium than bananas. It also has calcium, protein, iron, and amino acids, which help your body heal and build muscle. leaves contain high levels of nutrients and could reduce cancer symptoms associated with mesothelioma. Moringa leaf powder has been appeared to contain: 46 sorts of cancer prevention agents, 18 amino acids,10 times the vitamin A of carrots, multiple times the potassium of bananas, multiple times the calcium of cow's milk and multiple times the iron of spinach. Chemical composition of leaves powder vary depending on type of leaf powder where, for example in the *Moringa Olefira* leaves has different proportions, of moisture (7.6%), ash (7.1%), fat (2.23%), and protein(27.51%), and Carbohydrate (43.8) (Oduro *et al.*, 2008). While Freiberger et al. (1998) reported 17% protein for Moringa leaves contained which is found to be favorable when compared with the WHO standard.

Leaf protein concentrate (LPC)

It is a concentrated type of the proteins found in the leaves of plants. It has been inspected as a human or animal food source, since it is conceivably the least expensive, most inexhaustible source of accessible protein. In spite of the fact that people can get some protein from the immediate utilization leaves as leaf vegetables, the human stomach system would not have the option to manage the colossal greater part of leaves expected to meet dietary protein prerequisites with leaf vegetables alone. LPC was first recommended as a human food during the 1960s, however it has not made much progress, in spite of early guarantee of Pirie 1971 and Pirie 1975, evaluated and underlined significance of its advantages which presented the subject. The expanding dependence on feedlot based animal raising to fulfill human cravings for meat has expanded interest for less expensive vegetable protein sources. This has as of late prompted recharged enthusiasm for LPC to lessen the utilization of human-edible vegetable protein sources in animal feed. Leaf protein is a decent wellspring of amino acids, with methionine being a restricting variable (Hussein, et al. 1999) (Ayodeji, et al, 2005). Leaf proteins can likewise be rich in polyphenols (Rambourg and Monties 1983).

The challenges that must be overcome before LPC transforms into an appropriate protein source for individuals consolidate the high fiber content and anti-nutritional of factors, for instance, phytate, cyanide and tannins (Ayodeji and Fasuyi, 2005; Pirie, 1971). For the most part, LPC is created by pulping leaves and squeezing the juice out, warming the juice to coagulate the protein, and sifting the protein through and drying it. This study aims to study the proximate chemical composition, percentage of protein and minerals of the Moringa and baobab leaves

MATERIAL and METHOD

Material

Samples were collected from different areas. *A. digitata* and *M. oleifera* leaves were collected from Khartoum north, Sudan. Leaves of Roselle were collected from University of Khartoum, farm of Medicinal and Aromatic Plants at Shambat, Khartoum north, Sudan. The collected leaves were washed with tap water and sun dried at room temperature (30°C) for 2-3 days, then grinded and stored at 4°C.

Method

A .digitata, and *M.oleifera* leaves proximate analysis

Moisture content

For the determination of moisture content and volatile matter of the leaves in the three samples, A.O.C.S official method Ab 2-49 reapproved (2006) was followed.

Ash content

For the determination of ash content of the leaves A.O.C.S official method Ba 5a-49 reapproved (2006) was followed.

Fiber

A.O.C.S method Ba 6-84 (2006) was followed for the determination of the crude fiber.

Oil content

The obtained clean, dried and fine powdered collected leaves of baobab, rossele and moringa were weighed using a sensitive balance, the official A.O.C .S method Aa 4-38 reapproved (2006) was followed for oil content determination.

Protein

A.O.C.S official method Ba4d –90 reapproved (2006) modified Kjeldahl method was followed, for the determination of protein content in the dried leaves.

Carbohydrate

Carbohydrates were calculated by difference using this equation
(Moistuer+Ash+Fiber+Protein+Fat)-100)

Preparation of leaf protein concentrates (LPC)

The dried powdered leaves were weighed using a sensitive balance (KERN GMBH, d-72336 Balingen, Germany) and suspended in distilled water at a 1:3 ratio, utilizing a magnetic stirrer, the blend was mixed for 3 minutes while altering the pH at 8.5 with NaOH (4 M). At that point, the blend was centrifuged at 3500 rpm for 15 min at room temperature. The supernatant was moved into a measuring utensil, blended for another 30 min, and the pH changed in accordance with 4.5. The supernatant was left undisturbed for cold precipitation medium-term at 4°C in a cooler. From that point onward, the supernatant was painstakingly redirected and the protein slurry was washed multiple times with refined water by centrifuging at 3500 rpm for 10 min, at 4°C. The pellet was then resuspended in refined water, and the pH was balanced at 7.0. The slurry was kept medium-term at 80°C (Chandi and Sogi, 2007). The example was totally dried. The protein concentrates got were gauged utilizing logical adjusts.

Statistical Analysis

Determinations were carried out in triplicate. Their mean values with standard error were calculated. Analysis of variance with critical difference was applied to to identify significant differences among treatment means ($p<0.05$).

RESULT and DISCUSSION

Proximate chemical composition

Table 1. Proximate chemical analysis (%) of *M.oleifera* and *A.digitata*, leaves powder

Leaf sample	Moisture	Ash	Fat	Fiber	Carbohydrate	Protein%
M .oleifera	6.7	13.8	8.0	18.5	24.7	28.3
A. digitata	7.2	16.0	6.9	14.4	33.4	22.1

Table 1. *A. digitata* showed the highest percentage of moisture 7.2%, followed *M. oleifera* 6.0%. The highest percentage of ash was found in *A. digitata* 16% followed by *M. oleifera* which was found to be 13.8%. The highest percentage of fat was found in *M. oleifera* 8.0%, followed by *A. digitata* 6.9%.

From the same table it was clear that the highest percentage of fiber was found in *M. oleifera* 18.5%, followed by *A. digitata* 14.4% and the highest percentage of protein was found in *M. oleifera* which was 28.3%, and followed by *A.digitata* which was 22.1%. The lowest carbohydrates were found in *M. oleifera* which was 24%.

Table 2. The proportion of protein in the leaves of the protein concentrates (*A.digitata* and *Moringa oleifera*), washed with distilled water, ethanol and acetone.

Sample	***A.digitata***	***M. oleifera***
washed with distilled water	23.4%	29.8%
washed with the acetone	20.6%	21.7%
washed with ethanol	22.8%	26.0%

Table 2 shows the percentage of protein concentrate washed by distilled water in *A. digitata* was 23.4% which was lower than *Moringa oleifera* which was 29.8%. The percentage of protein concentrate washed by acetone was found in *Moringa oleifera* as 21.7% which was higher than that of *A.digitata* 20.65%, and the concentrate washed by ethanol was found as 26.0% in *Moringa oleifera* leaf which was higher than that of *A.digitata* 22.8%. This study confirmed that protein concentrates washed by distilled water gave the highest percentage than ethanol and acetone.

Table 3. Percentage (%) of minerals in the leaves powder

Sample	**Na**	**K**	**Ca**	**Mg**	**Fe**
M .oleifera	0.47125	0.92375	3.000	6.97625	0.01320
A .digitata	0.3720	0.92386	2.375	5.88875	0.01534

From the table 3, it was clear that the *M.oleifera* contain the highest percentage of Na (0.47125) which was higher than *A.digitata* (0.372), also we found that K percentage of both samples was similar 0.923. In case of calcium the percentage was 3.00 and 2.375 in *M. oleifera* and *A. digitata* samples, respectively. The percentage of the magnesium was found as 6.97625 and 5.88875 in *M.oleifera* and *A.digitata* samples, respectively. While iron was found as 0.01320 and 0.01534 in *M.oleifera* and *A.digitata* samples, respectively.

CONCLUSION

The leaves of the *A. digitata*, and *M. olefira,* trees are a staple for many populations in Africa. Young leaves are widely used, as salad or cooked like spinach, and frequently dried, often powdered and used for sauces over porridges, thick gruels of grains, or boiled rice. They appear to be a good source of protein and as a significant source of Fe, Ca, K, Mg, Mn, and Na.

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Nutritive potentials of Soybean and its significance for humans health and animal production: A Review

Wajid Ali[1*], Muhammed Moiez Ahmad[2], Fozia Iftikhar[3], Moin Qureshi[4], Ayhan Ceyhan[1]

[1]Niğde Ömer Halisdemir University, Faculty of Agricultural Sciences and Technologies, Department of Animal Production and Technologies, 51240 Niğde, Turkey

[2]Selçuk University, Faculty of Veterinary Sciences, Department of Animal Nutrition and Nutritional Diseases, 42250 Konya, Turkey

[3]Bahauddin Zakariya University, Faculty of Veterinary Sciences, Department of Livestock Production, 66000 Multan, Pakistan

[4]Niğde Ömer Halisdemir University, Faculty of Agricultural Sciences and Technologies, Department of Plants Production, 51240 Niğde, Turkey

Corresponding author; wajid.ali@mail.ohu.edu.tr

Abstract

Nutrition matters for every living thing and a complete diet with balanced nutrients is a canonic right for humans and animals. Agricultural products possess a substantial position to fulfill the requirements of both animals and humans. The soybean being a part of the Leguminosae family is a very renowned paltry source of protein in consecrated nature. Due to unique nutritional potentials, the usage of soybean in humans and livestock is very frequent. Soybean averts humans from different diseases and boosts up the milk, meat and wool production in animals. Besides many benefits, the soybean also begets some health upsbot and disasters. So this article particularizes the absolute composition, nutrition value, emoluments and drawbacks of soybean and permits the different researchers to explore more about soybean.

Keywords: Soybean, Golden Bean, Nutrition, Livestock, Human health.

Review article

INTRODUCTION

Agriculture is a very vast field for funding the economy of the world and provides beneficial foodstuff to humans. The animal production industry is an ultimate part of agriculture which yields many products for human nutrition and welfare. Globally, livestock contributes 40% value of agricultural productivity and secure food for more than 1.3 billion people like it is the fastest emergent part of the agricultural economy (FAO, 2017). With the provision of a row of food items, the animals also need a balanced and accurate diet for survival and management as humans required. In the animal industry, the feeding of animals is very obligatory for the production of meat, milk, egg, fiber and other fecund products. de Visser et al. (2014) reported that the European population acquires their major portion of protein from animals as 59% of the diet and other portions from cereals, vegetables, and pulses. So that is the reason the animals' protein and other animal products have symbolical importance in nutrition. In the living population (humans and animals) the nutrition affects health, welfare, physical fitness, and emotions and averts different diseases by providing natural immunity. Pond et al. (2004) stated that optimum animal production needs an equilibrium between all energy transfiguration and nutritional balance. The balanced nutrition of animals can be obtained by different vegetable meals, crops, fodder, crops residues and concentrate feeding either in plain or treated form.

Among the vegetables, the soybean and its products are cheap and the richest source of protein for the whole animal industry especially to accomplish the protein requirement. The soybean is a yellow vegetable protein grain that originates from China and spread all over the world as a cheap source of vegetable protein (nearly 48 to 50 %) with low-fat contents (Garcia et al., 1997). Belloque et al. (2002) reported that soybean use in animals is very communal due to its nutritional and functional possessions especially as meat extenders in animals. The use of soybean and its products is very common in the present generation due to its economical values and high nutritive values. The uncontrolled increase of the human population demands a high quantity and quality of nutrition from agricultural fields.

Ali et al. (2020) reported that the human population is expected to increase up to 9 billion in 2050, which will fashion a very austere pressure on the animal production industry in respect of food requirements. So to overcome the pressure of food scarcity, scientists are working to generate new varieties of animal feed and new breeds of animals with high production. Good human health is trusting on the consumption of milk, meat, egg, fruits and vegetables because they are the vital source of some indispensable and basic nutrients along with phytochemicals that decrease the risk of chronic disease. Soybean is also very eminent in use for compensating the nutrition value directly for humans and indirectly for humans through animal feeds. Yin et al. (2011) stated that the United States is on top number according to global soybean production with 206.4 tons in 2007 and Brazil, Argentina, China, and India are in descending order respectively. Asian countries are using soybean as tofu while other countries are highly using it as feeding for animals and it is also the most researched ingredient and most important part of animal nutrition. By keeping the excellent role of soybean and its products in animals and human nutrition fields, this review paper will give a trivial depiction about the significance of soybean nutritive values and its commercial uses for humans, animal production and health. We will try to describe every aspect of soybean and its products on the animal nutrition and production industry, which will be very helpful for the improvement of the human diet and uplift the economy.

Nutritional potentials and composition of Soybean

The *Leguminosae* family (beans, peas, lentils, peanuts, soybean, and fava beans) possesses high nutritional value and the soybean is a fundamental part of the household. *Leguminosae* family also called a *Fabaceae* family produces pod with seeds and 12,000-18,000 species are present in the *Leguminosae* family. These species contain climbers, shrubs, herbs, and trees but only a limited amount of plants is used as human feed and as forage for livestock. Legumes are thought to be the first plant cultivated by humankind as humans are consuming legumes as staple food back to as far as 5500 BC and it remained staple food in the world for over 10,000 years (Kouris-Blazos and Belski, 2016). Maximum legumes consumed by humans are grain legumes or food legumes known as peas, broad beans, lentils, soybean, lupins, sprouts, mung bean, green beans, and peanuts. Whereas only about 40 legumes are noteworthy in forage production includes alfalfa, clovers, trefoils, soybean, etc.

The legumes are valued cheap and a better alternative for meat, after cereals legumes are considered as the second most important food worldwide because they can be a good source of oil and traditional food (Maphosa et al., 2017). Soybean scientific name Glycine max and is the most important warm-season crop in the leguminous family. It is not only important as a protein source but also important as an oil crop (Yamaguchi, 2012). Wild soybean (Glycine soja) can be found in East Asia regions of the world but Glycine max is a cultigen from the same region (Dovring, 1974). It is cultivated in the different regions of the world especially for grain in Asia, South and North America. The production purpose of soybean is not only restricted for human consumptions or oil production nevertheless it is also grown to produce forage for grazing, haying and ensiling. Due to its high protein content, it can use alone or in a mixture to feed the livestock (Chang et al., 2012; Touno et al., 2014; Spanghero et al., 2015). With this point, soybean production was increased because soybean meal was used as a replacement protein source for the animal protein feeds (Dei, 2011).

Soybean is also called as the 'Golden Bean', it is an important food source in human food and animal feed. A single soybean seed on a dry weight base contains about 40% protein and 21% oil. Soybean with protein and oil content contains other major and minor components like phospholipids, vitamins and minerals. On the other side, soybean has biological active or minor substances such as trypsin inhibitors, phytates, oligosaccharides. The soybean has 5 most abundant fatty acids in the triacylglycerol of soybean. These are unsaturated fatty acids of linoleic acid (C18:2) and linolenic (C18:3), palmitic (C16:0), saturated fatty acids of oleic (C18:1) and stearic (C18:0) acids. These fatty acids could vary in type, composition and distribution which affect their nutritional quantity, flavor, oxidative stability, melting point, crystallization form and processing characteristics (Yadav, 1996). The soybean has minor components that include phospholipids, un-saponifiable material (tocopherols, phytosterols, hydrocarbons), trace metals and free fatty acids. The phospholipids are the main component in the soybean seed membrane lipid account in a total of 1-3% or 05-1.5% of soybean seed (Wang et al., 1997). Among this 1-3% phospholipids, there are also major and minor phospholipids such as phosphatidylcholine (35%), phosphatidylethanolamine (25%), and phosphatidylinositol (15%) are the major phospholipids whereas 5-10 % phosphatidic acid and the rest is a composite of all the minor phospholipid compounds (Liu, K., 1997).

In moisture-free soybean, the carbohydrates content is 35%, therefore, it is the third abundant component in the soybean seed and soybean carbohydrate has less importance than the soybean protein and oil content. Soybean seed contains about 11-25% soluble carbohydrates and these soluble carbohydrates are made from 15-20 different sugars (Obendorf et al., 2008) in which sucrose 1.1–7.4%, raffinose 0.1–1.4% and stachyose 1.2–6.9% is the most abundant (Obendorf et al., 2008; Kumar et al., 2010). With proteins, lipids and carbohydrates as major components soybean also contain minor nutrients which include phytate, phenolics and other minerals. It has 5% ash content, ash contains the major minerals as sulfates, phosphates, and carbonates. Among all the mineral potassium concentration is high following magnesium, sulfur, calcium, chloride, and sodium along with other minor minerals silicon, iron, zinc, manganese, copper, molybdenum, fluorine, chromium, selenium, cobalt, cadmium, lead, arsenic, mercury, and iodine.

Whole cultivated soybeans constitute major parts hulls, cotyledons, hypocotyl and plumule. Cotyledon of soybean comprises 90% with the highest percentage of both protein and oil. Hull comprises 8% of cultivated soybean, whereas hypocotyl is the only 2 percent. This composition of soybean and structure depends upon the variety, growing season, Drought, temperature, land, soil fertility, and agricultural practices (Kouris-Blazos and Belski, 2016). Proximate composition of a dry soybean seed contains approximately 40% protein and 20% oil which makes 60% of whole dry matter. Other remaining 40% dry matter is composed of main carbohydrates about 35% mainly poly-saccharides, stachyose (3.8%), raffinose (1.1%), sucrose (5.0%) and ash that is about 5% (Singh, 2010). Phosphatides, sterols, and other minor constituents are also present and this composition is not the same for the wet soybean.

Wet soybean contains protein and oil by about 35% and 17% respectively. Other carbohydrates and ash are 31% and 4.4% respectively. It has 13% water content to keep storage stability (Liu, 1997). Soybean seed proteins based upon the role can be classified into four classes like metabolic enzymes, structural (including ribosomal and chromosomal), membrane, and storage proteins (Krishnan, 2001). Metabolic enzymes and structural are considered as metabolic proteins and storage proteins are produced during soybean seed development. Soybean major protein part is considered as storage protein and it comprises the 65-80% of the total seed protein (Murphy, 2008). The storage protein of soybean is an exceptional source of dietary proteins for humans and animals excluding that this in sulfur-containing amino acids 13-conglycinin is very deficient (Fukushima, 1991).

Soybean and its products' worth in human nutrition and health

The practice of soybean in the human diet is healthy in response to prevent from different diseases like heart disease, obesity, blood cholesterol (Henley and McNiven, 1996) diabetes, kidney disease, and osteoporosis (Garcia et al., 1997). It contains the inhibitory activity of an angiotensin 1-converting enzyme (ACE) which very supportive to regulate water ratio and blood pressure and soybean is also a suitable diet for milk allergic infants.

Soybean can prevent some major diseases that happen in humans such as cancer because of isoflavones contains by soybean. Its high nutritional value is due to unsaturated fatty acids and these unsaturated fatty acids also have good effects on the human health like prevention of atherosclerosis, reduction of total and low-density lipoprotein (LDL) cholesterol and triacylglycerol levels in plasma, and suppression of inflammatory processes (Bahrami, 2009).

In soybean seed beside phospholipids, there are other minor components such as sphingolipids, glycosylceramide are the most abundant (Johnson et al., 2015). Both phospholipids and sphingolipids have convenient health effect as they both are bioactive components of soybean and the intake of sphingolipids can inhibit the development of colorectal and skin cancer, decrease plasma and liver cholesterol levels, and regulate immune cell function, whereas the consumption of phospholipids shows the reduction of serum cholesterol levels and fat accumulation in the liver of human body (Schmelz, 2000; Olivera and Rivera, 2005; Wang, 2008).

The soybean phytate is not available to humans and nonruminants animals as they have lacked the enzymes that synthesize the phytase enzyme (Oltmans et al., 2005). Some studies show that phytate also has some positive effects on the animals and humans and act as an anticarcinogen and an antioxidant by complexing iron and decreasing free radical generation and peroxidation of membranes (Ferry et al., 2002; Vucenik and Shamsuddin, 2003). Soybean isoflavones have a positive effect such as cholesterol-lowering effect making cardioprotective if they fed along with the soya proteins (Johnson et al., 2015). It has also suggested that isoflavones show a protective role against several cancers and osteoporosis (Weaver and Cheong 2005) but the link between soybean isoflavones and these diseases is still not clear.

Use of Soybean and its products in animal production Sector

Nutrition is a very mandatory part of animal production sector as it plays a dynamic role in milk production, animal health, disease resistance, good body score and proper growth of animals for intensification the economy of this sector (Kambara et al., 1993; Wallace et al., 1995). For example, lambs can enhance their resistance against Oesophagostomum columbianum and Trichostrongylus colubriformis by a decent supplementation of protein in nutrition. Soybean can also add up to the honey and pollen mixture, provided to bee larvae as feed to increase production and boosting of the immune system (Raghuvanshi and Bisht, 2010).

Soybean is a very rich source of protein as it's quite necessary for milk and meat production in the animal production industry. To compensate for the food need of the growing population, the use of new techniques and appropriate feed formulation for optimum growth of animals is very compulsory. During the feed formulation, the proper mix and balancing of diet nutrients according to the requirement of animals is the first goal. Soybean being a rich source of a cheap legume protein source is a basic component for a balanced animal diet.

Globally, in the animal feeds soybean meal (SBM) can be used as a major supplemental protein source. Fan et al. (1995) nominated the soybean meal as a superior source of protein and it gives almost 480 g/kg dry matter protein with excellent quality (Yamka et al., 2003). Soybean is the best legume for animal feeding and as a bypass protein source for dairy animals as it has the highest crude protein content (44.1%) shown from crude protein analysis and elevating milk production (Osti et al., 2013). The digestibility and composition of amino acid determine protein quality. It can be changed with the presence of different structural and non-structural components (carbohydrates) and processing conditions (Yamka et al., 2003). Due to its outstanding amino acid profile and elevated level of digestibility, soybean meal is a major protein source for animals. Along with the highest lysine digestibility (91%), soybean meal is a concentrated source of energy and protein with lower crude fiber than most of the other oilseed meals (Willis, 2003).

SBM (soybean meal) digestibility shows variability because of some unsuitable factors like the presence of oligosaccharides, tannins, phytate, lectins and trypsin inhibitors (Zuo et al., 1996). Due to its distinguished properties and a high source of nutrients, its use is very trendy nowadays in all fields of the animal production sector. Castro et al. (2007) specified that among all oilseed meals, the soybean meal is most useable for dairy animals of America and contains the highest quality of amino acids as compared to other oilseed meals. Several scientists (Mielke and Schingoethe,1981; Rafalowski and Park, 1982; Anderson and Wolf, 1984; DePeters et al., 1985; Drackley and Schingoethe, 1986) had elaborated about oilseed meals like soybean, cottonseed meal and sunflower meal are a big source of AA (amino acids) and fat for animals production (Ipharraguerre and Clark, 2005). Drackley and Schingoethe, (1986) also reported that feeding of extruded, heat-treated and roasted soybean with a mixture of sunflower meal give more balancing in a diet for rumen digestibility and increase milk production in dairy animals because this combination overcomes the shortage of lysine in sun-flower meal and methionine in soybean meal. This combination of diet increase milk production in early lactation of animals and enhance the amount of escape ruminal amino acid during feed digestibility.

The soybean meal is considered a high-value ingredient as compared to recent low glucosinolate rapeseed foodstuffs because it gives more balanced in essential amino acid contents. Koné et al. (2020) proposed a study on Guinea fowl by feeding soybean meal supplement partially substituted by 15% cashew nut (*Anacardium occidentale*) and 15 % hevea seed (*Hevea brasiliensis*) meal) separately and resulted with no adversative consequence on growth performance and carcass yield while cashew nut meal imposes a harmful consequence on performance like daily weight gain and feed conversion ratio. Digestible amino acids and protein absorption reduce by excessive feeding of soybean as it contains plant fibers and indigestible oligosaccharides that obstruct digestion enzymes and increase bacterial activity by resulting in the lower degradability of nutrients (Erdaw et al., 2018).

The use of fish meal affords a sympathetic pillar for balancing the ratio of amino acids when it mixes with soybean meal while its result is not very clear for sorghum, maize, oat and other cereals source of protein even it intensify the performance by mixing with soybean meal as compared to simple feeding of soybean meal. Fish growth and survival are enhanced by the use of soybean and maize in fish feed preparation (Solomon and Alasa, 2017). Krogdahl et al. (2000) stated that soybean meal (SBM)-encouraged enteritis in the distal intestine of the teleost Atlantic salmon (*Salmo salar L.*) and other salmonids may be considered a model for diet-related mucosal disorders in other animals and man.

For all types of the poultry industry, soybean meal is an ideal protein source and 50% of all soybean meal used in animal industries is consuming by the chicken meat industry as a major user (Willis, 2003). Soybean mixed with grain sorghum or corn provides a balanced source of essential amino acids except methionine needed by poultry. To increase energy density and to enhance the efficiency of feed utilization, oil extracted from soybeans is excessively used as feed grade fat to supplement soybean-based diets of broiler chickens and turkeys (Erdaw et al., 2016). Irish et al. (1993) reported that animal protein concentrates generate more abdominal fat content with a high rate of oily bird syndrome in broilers as compared to the soybean-maize protein source because it may help to enhance dietary amino acid balance.

The role of soybean against the production of pet feed is very significant as Linolenic acid and soybean proteins in full-fat soybean meal further improve the quality of mink's fur (Raghuvanshi and Bisht, 2010). Addition of fermented soybean reduced the serum insulin and leptin levels, indicating the effectiveness of fermented soybean addition as an anti-diabetic feed ingredient that alleviates hyperleptinemia in Rabbits (Sada et al., 2017).

In recent times, many nutritionists are focusing on soybean as a protein source for the Canine family. The use of soybean meal in canine food is very technical as it should not increase more than 150g/kg because it can decrease digestibility due to the presence of Oligosaccharide, soluble fiber and anti-nutritional contents (Yamka et al., 2003). Due to the high content of dietary fiber comprise of cellulose and pectin, soybean hulls have a huge potential to be used as a functional feed ingredient. Metabolizable energy intake in the diet and stereotypical and scratching behaviors of beagle dogs decreased by the addition of soybean hulls as a fiber source (Scheraiber et al., 2018).

The feeding of soybean meals and its other products is very up-to-the-minute nowadays for the feed of lactating animals. In dairy cow diets supplementation of soybean oil is effective in reducing saturated fatty acid and elevating the level of monounsaturated fatty acid content in milk (Park et al., 2020). The feeding heat-treated soybeans instead of soybean meal or raw soybeans, favored more milk (4.5 L/d), 3.5% FCM (4.0 L/d), and milk protein (0.09 kg/d) (Tiwari et al., 2018). Soybean lecithin oil in diets of lactating sow enhance the PC content along with phospholipid in milk and decrease the milk fat globule size. Soybean lecithin oil further improves the weaning weight of piglets, immunoglobulin plasma level, milk and colostrum (Shi et al., 2019). Replacement of soybean meal in lactating sow's diets by 10-15% fermented soybean remarkably elevates the nutrients digestibility and biological values and further enhance serum biochemical parameters along with the antioxidant activity of lactating sows and elevate the production performance of suckling piglets (Wang et al., 2016). By adding soybean oil, fat and energy content of diet increased which leads to the production of enriched fat CLA and TVA in milk compared with non-fat supplemented diet in goats. Miraj and Kiani, (2016) revealed that even though dry matter intake and growth rate decreased by the addition of 4% soybean oil in the diet, progesterone concentration and the number of goats with functional corpus luteum increased, indicating that soybean oil inclusion in diet stimulated puberty in prepubertal goats.

Worldwide, soybean supply two-third of the protein concentrates for animal feeds, over one-fourth of the fats and oils and three fourth of the total world trade in high protein meals. Untreated soybean meal feeding leads to intestinal morphological and physiological changes along with marked immune response in young piglets and calves (Peisker, 2001). In young animals preferably calves, milk proteins are replaced by soy proteins usually, 30% or less of the milk is replaced by soy proteins. In the United States round, about 70% of dairy herd replacement calves are being fed milk replacers (Endres, 2001).

Concerning disease resistance, soybean meal has a converse effect on parasites growth in young lambs as lower fecal egg counts were observed four weeks in Finn Dorset lambs with infection and no fecal egg counts in Scottish blackface lambs (Abbott et al 1991). Pond et al. (2004) denoted that supplementary soybean meals can intensify the immunity in animals, withstand power against infections (anemia, hypoproteinemia, and hypoalbuminemia), increase milk production and overall growth of animals.

The cultivation history and uses of soybean in the world are very old but in turkey (Black sea area), its cultivation had started after first World War as a first crop and production reached up to 10000-12000 tons, Later on, it was cultivated as a second crop in the Aegean and Mediterranean areas (Kibar and Öztürk, 2008). At present, the cultivation and uses of soybean for animal feed and human nutrition are very famous all over the globe due to its beneficial potentials. Now young farmers also need new techniques to formulated it with some others feeds for animal health improvement and better production. That is the reason for this subject, soybean is a very important legume protein and needs more research for its production, cultivation and uses as food and feed.

Some drawbacks of soybean

The feeding of protein source and balancing of nutrients in dairy feed is an art because nowadays is very common to feed protein for desire milk production and without pay any attention to its disasters like emissions of nitrogen in environment and impairment in animal reproductive performances (Nousiainen et al., 2004). Soybean seed contains storage proteins with some low-abundance proteins and these low-abundance proteins are accountable for the mobilization of stored nutrients also act as a defense against many micro-organisms and macro-organisms. These proteins also cause allergic symptoms like gastric reactions and atopic eczema in humans and animals due to some antimetabolic compounds present in these proteins (Herman, 2005).

In soybean, the isolated protease inhibitors are present as Bowman-Birk trypsin-chymotrypsin inhibitor and the Kunitz trypsin inhibitor along this other main protease inhibitor is a lectin and Protease inhibitor amount in the soybean seed at a considerable level can cause reduced digestibility or proteins and pancreatic hypertrophy in some animals whereas lectin disturbs the animal nutrient absorption system which inhibits the growth of the anima (Krishnan, 2001).

In soybean carbohydrates, raffinose and stachyose have gained the most attention because their presence is considered as antinutritional factors. They produce flatulence and abdominal discomforts in humans and animals (Liying et al. 2003). These factors especially flatulence is the major reason that is limiting the use of soybean as food. Raffinose and stachyose are galactooligosaccharides and mammals do not have the α-galactosidase enzyme required to hydrolyze galactooligosaccharides to D -galactose. When it is consumed by mammals it is not digested and these intact sugars go directly to the lower intestine where they get mobilized by the microorganisms that contain the enzyme results in flatulence producing gases such as methane, carbon dioxide and nitrogen, etc. (Kumar et al., 2010).

Besides its beneficial effects on human health still, soybean use as raw food is limited due to its antinutritional factors include isoflavones, trypsin inhibitor, phenolics and phytate (Sharma et al., 2014).

CONCLUSION

The maximum credit for a healthy life goes to appropriate and well-managed nutritional ingredients in diet and soybean has the unsurpassed name as a gigantic source of protein which encompasses more than 45% protein. The core determination of this review is to elaborate on the potential paybacks and some drawbacks of soybean and open the door for new researchers to find some new practices for optimal usage of soybean in the welfare of living things. The plant production sector can engender new varieties suitable for every region while animal production and health sectors can justify their work with appropriate use of soybean for meat, milk, fiber and wool production as well as for production of a healthy diet for human beings. This article delivers some universal subjects related to the practice of soybean that wishes unusual care to be solved. Overall soybean is the superlative source of protein for every living thing but its use needs some precise attention for high production and human health issues.

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