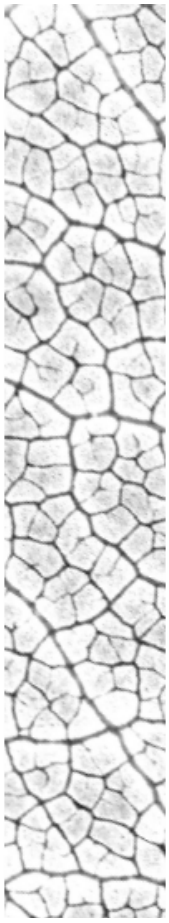

EurAsian Journal of BioSciences
Eurasia J Biosci 12, 393-397 (2018)

Effect of mushroom cooked in olive oil on some physiological and biochemical parameters of human

Wijdan I.A. Abd-alwahab [1], Fahad K.Y. Al-dulaimi [2], Abeer Talib Abdulqader [2]

[1] Samarra Univ., Education College, Dept. of Biology, IRAQ
[2] Northern Technical Univ., Institute of Medical Al-Dour, IRAQ

Abstract
The study included an experiment was aimed to know and investigate some of physiological and biochemical effects of mushroom (*Agaricus bisporus*) which cooked with olive oil on volunteer persons fed for 30 days. The results showed that feeding on mushroom (*Agaricus bisporus*) cooked with olive oil caused a significant decrease (P<0.05) in concentrations of glucose, cholesterol, TG, LDL-C, body weights, and significant increase (P<0.05) in HDL-C concentration, W.B.Cs and R.B.Cs count in compared with control group. While, the feeding of mushroom that cooked with olive oil resulted no significant variations in levels of urea, uric acid, Hb and PCV in comparison with the control group. The present results conclude that use mushroom (*Agaricus bisporus*) with olive oil are reducing the harmful lipids, glucose and enhancing the blood cells, accordingly, it's maybe have a beneficial effects on the liver and the health of human body.

Keywords: mushroom, *Agaricus bisporus*, olive oil, lipid profile, glucose, blood cells

Abd-alwahab WIA, Al-dulaimi FKY, Abdulqader AT (2018) Effect of mushroom cooked in olive oil on some physiological and biochemical parameters of human. Eurasia J Biosci 12: 393-397.

INTRODUCTION

Mushroom has been used as food sources important to humans since ancient times, as addressed by the human tasty, nutritional value and medical. It was found that the content of water in the Mushroom is very high as it can be up to 90% of the total weight of the body, and the remaining represents the proportion of other solid components (Selima et al. 2012). Mushroom is considered a protein source, has containing all essential amino acids (Mattila et al. 2002). The mushroom also contains of high carbohydrates, it is the main source of energy in the body, it's comprised of various fibers and sugars, such as gluconate, glycogen, and sugar alcohols (Bilal et al. 2010). Mushroom contains a low level of fat such as sterols and unsaturated fatty acids. The mushroom is rich source of B complex vitamins especially thiamine (vitamin B1), riboflavin (vitamin B2), niacin (vitamin B3), pantothenic acid (vitamin B5), folic acid (vitamin B9), biotin (vitamin B7) and cyanocobalamin (vitamin B12), and low amounts of vitamin C and E (Orsine et al. 2012).

Mushroom also consisting of mineral salts in different levels compared with other foods, for instance, low level of sodium and high level of potassium and iron, and there are amounts of phosphorus, copper and selenium, furthermore, it's containing soluble and insoluble fiber especially chitin (which is the main component), and appears to be important in fiber-supported diets (Vetter 2007). Due to the presence of nutrients in the mushroom as well as the presence of active substances in them, this may be increased their ability to stimulate the cells of the immune system and increased antibody production. It extracted from the active substances in mushroom such as β-glucan, which have activate the immune system and protect against heart diseases such as atherosclerosis (Akgul et al. 2017, Bobek and Galbavy 1999), and combination with cholesterol-lowering substances found in mushrooms such as eritadenine (Bhushan and Kulshreshtha 2018, Fukada et al. 2006). Olive oil is primarily used as dietary fat in the Mediterranean diet (Khayyat, 2016). All the above mentioned and in view of the absence of studies that show the role of mushrooms cooked with olive oil, to propose of this study and aim to: study the effect of mushroom cooked with olive oil on some physiological and biochemical parameters which correlated with the health of human.

MATERIALS AND METHODS

Collection and Preparation of Samples

Mushrooms (*Agaricus bisporus*) samples were collected from the local market in Salah-adin province, Iraq, which was produced by the Iranian company (mallard mushroom). The fruit bodies were cleaned and

Received: May 2018
Accepted: September 2018
Printed: November 2018

then cut into small pieces and cooked with olive oil on little heat.

Design of Experiment

The study was included (50) volunteer of humans, they were divided into two groups, that mean twenty five (25) volunteer humans in each group, and they have approximate weights, as follows:

- Control group: this group was given regular drinking water and food daily for 30 days.
- Treatment group: (group of mushroom cooked in olive oil), this group was treated with (2 g/kg of body weight) mushroom cooked in olive oil by feeding daily for 30 days.

Blood Samples

At the end of experiment (30) day, body weight was measured for each group under study, and blood samples were collected intravenous, then take approximately (1) ml of whole blood from each human and put in EDTA tubes containing anticoagulant for measuring the most of blood cell parameters. Moreover, collected (5-8) ml of blood in test tubes free of anticoagulant and left for about 15 minutes at 37 °C in water bath. Then a serum was obtained by centrifuge at 3000 rpm and kept at -20°C in plain tubes for measuring some of physiological and biochemical parameters under study.

Physiological and Biochemical tests

The kits were depending on clinical chemistry methods according to the manufacturer's recommended procedure from Biolabo (France) to measure glucose, total cholesterol, triglycerides (TG), high density lipoprotein-cholesterol (HDL-C), urea and uric acid (Tietz, 2005). Whereas, low density lipoprotein-cholesterol (LDL-C) Calculated according to Friedewald equation (Friedewald *et al.,* 1972; Faas *et al.,* 2002). The analysis was by Spectrophotometer APLE (Japan) According to manufacturer company of kits. Also, the blood cell parameters such as white blood cells (W.B.Cs), red blood corpuscles (R.B.Cs), hemoglobin (Hb) and packed cell volume (PCV) measured by used automated haematology analyzer (Syamex model: K-1000, Japan) (Haen 1995).

Statistical Analysis

The data of results were analyzed by using the ANOVA analysis, and utilized the Statistically Analysis System (SAS 2001). Also, significant differences were evaluated by using Duncan's multiple-range test (Duncan, 1955), and significance level is based on level of probability (P<0.05).

RESULTS AND DISCUSSION

Effects of Mushroom Cooked in Olive Oil on Body Weights

The results in **Table 1** showed there was a significant decrease (P<0.05) in the volunteer weights after fed of mushroom cooked in olive oil in compared with control group. The decrease in body weights in the case of feeding on mushroom cooked in olive oil has been agreement with previous studies in this field on laboratory animals; the above mentioned results agreed with result of Gray and Flatt (1998) they reported a decrease in weights of the mice after treated with mushroom powdered for 20 days, also, there was agreed with result of Kang et al. (2001), who found a decrease in weights of the group which treated with mushroom by 18% when fed for 2 weeks. The decrease of weights may be due to the low level of fats and energy of up to 100 kJ and the absence of starch, as well as content of chitosan which reduces the absorption of fat in the intestines (Wu et al. 2007).

Table 1. Effects of mushroom cooked in olive oil on body weights of human

Parameter / Treatment	Initial Body Weight (kg)	Final Body Weight (kg)
Control-group	74±1.50 a	75±1.00 a
Treatment-group	75±1.10 a	72±2.00 b

- The values represent mean±S.E.
- Different of letters vertically mean significant difference at the level of significance (P<0.05)

Table 2. Effects of mushroom cooked in olive oil on serum glucose and lipids profile of human

Parameter / Treatment	Glucose (mg/dl)	Cholesterol (mg/dl)	Triglyceride (mg/dl)	HDL-C (mg/dl)	LDL-C (mg/dl)
Control- group	100±2.20 a	175±2.30 a	122±2.60 a	46.00±2.30 b	104.6±2.80 a
Treatment-group	92±1.60 b	167±2.10 b	116±1.80 b	49.00±2.00 a	94.80±2.50 b

- The values represent mean±S.E.
- Different of letters vertically mean significant difference at the level of significance (P<0.05)

Effects of Mushroom Cooked in Olive Oil on Glucose and Lipids Profile

The results in **Table 2** showed there was a significant decrease (P<0.05) in the level of serum glucose in volunteer person which fed on mushroom cooked in olive oil in comparison with control group, this result was agreed with Bailey et al. (1984) they were proved that feeding of mice on a diet containing powdered of mushroom led to reduced blood glucose, also the above result agreed with Jeong et al. (2010), they used the extract of mushroom A. bisporus to prove has the ability to decrease glucose and lipid levels in rats' blood.

The effect of mushroom cooked in olive oil to reduce sugar (glucose) can be attributed as follows: The high content in mushroom of fibers and other carbohydrate compounds such as β-glucan which improve of pancreatic tissues (β-cells) (Xiao et al. 2011), therefore, may led to reduce of blood glucose. The mushroom (Agaricus bisporus) contains lectin, which have shown a stimulus to excretion of insulin and glucagon from pancreatic cells (De Silva et al. 2012), thus, decreased level of glucose in bloodstream. Also the mushroom

contain polysaccharides and water soluble fibers such as pectin and vegetable glue which showed high viscosity (Hwang et al. 2005), that may be led to increased gastric emptying time and delay the digestion of carbohydrates and absorption within the intestines, subsequently, to prevent the rapid increase in blood glucose. While observed a significant decrease of cholesterol and TG in serum of group which fed on mushroom cooked in olive oil it was 167 mg /dl, 116 mg /dl respectively, in compared with control group that was 175 mg/dl, 122 mg/dl, and significant increase of HDL-C that was 49.0 mg/dl in compared with control group 46.0 mg/dl, whereas, observed a significant decrease in level of LDL-C that was 94.80 mg/dl in comparison with control group 104.6 mg/dl.

The above mentioned results were agreed with result of Bajaj et al. (1997), they founded that the addition of mushroom (*P. florida*) to rabbit diet caused a reduction in the concentrations of cholesterol and TG. In the same situation, the present results agreed with researchers results Cheung, (1998); Fukushima et al. (2000), they perceived that the addition of 5% of mushroom powder of types of *volvacea* and *A. bisporus* to the diet of rats led to a reduction in total cholesterol and LDL-C in compared with control group. The aforementioned results also agreed with the result of Jeong *et al*. (2010), who used the extract of *A. bisporus* to prove his ability to decrease of glucose and lipid levels in rats' blood.

The decrease of cholesterol and triglycerides in present study may be due to containment of mushrooms on polysaccharides (β-glucan) which may led to reduce cholesterol level (Cheung, 1996), the β-glucan make an increase in intestinal viscosity that led to increase secretion of bile salt and lowering absorption of lipids, thereby, decrease of cholesterol levels in bloodstream. On the other hand, the contain of mushroom (*A. bisporus*) on high amount of fiber, which serve to reduce serum lipid through prevent absorption it in the intestines and thus release with wastes (Fukushima et al. 2000, Jeong et al. 2010). Moreover, the decrease of harmful lipids maybe due to the fermentation processes in colon for *A. bisporus* fibers, as a result, short-chain fatty acids such as propionate are formed by the fermented bacteria, the propionate have shown an inhibitory role in building of cholesterol into hepatocytes (Maja *et al*., 2015). Furthermore, the mushroom (*A. bisporus*) is contained unsaturated fatty acids such as linoleic acid which have an effect on the metabolism of lipids (Mircea et al. 2013), hence, decreased concentrations of cholesterol, LDL-C and TG. In addition, the mushroom considers as a source of natural antioxidants such as vitamin A, C and E, selenium and phenol (Sevindik 2018), these antioxidants have the ability to reduce oxidative damage by free radicals in liver tissue, therefore, that maybe led to the low in levels of LDL-C, TG and cholesterol in body of volunteer human.

Table 3. Effects of mushroom cooked in olive oil on serum urea and uric acid of human

Parameter / Treatment	Urea (mg/dl)	Uric acid (mg/dl)
Control-group	32.0±1.23 a	5.70±1.23 a
Treatment-group	30.0±1.23 a	5.50±1.84 a

- The values represent mean±S.E.
- Different of letters vertically mean significant difference at the level of significance (P<0.05)

Table 4. Effects of mushroom cooked in olive oil on W.B.Cs, R.B.Cs, Hb and PCV of human

Parameter / Treatment	W.B.Cs (× 10^3/µL)	R.B.Cs (×10^6 /mm^3)	Hb g/dl	PCV %
Control-group	7.0±1.00 b	6.2±1.10 b	13.9±2.12 a	46±1.13 a
Treatment-group	8.8±1.20 a	8.8±1.30 a	14.2±1.22 a	47±1.00 a

- The values represent mean±S.E.
- Different of letters vertically mean significant difference at the level of significance (P<0.05)

Effects of Mushroom Cooked in Olive Oil on Urea and Uric Acid

The results in **Table 3** showed no significant difference (p>0.05) of serum urea and uric acid in group of humans which treated with mushroom cooked in olive oil in comparison with normal control group.

The above mentioned results may due to that the used dose or amount of mushroom cooked in olive oil may be not enough to induce an effect on concentrations of urea and uric acid in blood stream or it have not any effect on above mentioned parameters under study.

Effects of Mushroom Cooked in Olive Oil on Blood Cell Parameters

The results in **Table 4** indicated there was a significant increase (P<0.05) in W.B.Cs and R.B.Cs of volunteer that fed on mushroom cooked in olive oil compared with control group, whereas, observed no significant variance (p>0.05) in Hb concentration and PCV in group of volunteer which treated with mushroom cooked in olive oil in comparison with control group.

Increasing of numbers of W.B.Cs may due to the following causes; Mushroom may containing many compounds which improved and modulated of immune system such as antioxidants and free radical scavenging (superoxide dismutase, peroxidase) (Bal et al. 2017, De Silva et al. 2012), thus, when remove the source of oxidative stress in the human body that may lead to return the count of W.B.Cs even if little to normal numbers, subsequently, this little increase in W.B.Cs count after treated with mushroom. Moreover, the mushroom is contain some compounds as polysaccharides such as β-glucans (Friedman 2016), it's have able to stimulation the immune system and promoted the immune response (Chen and Shao 2006), subsequently, this effect can to be the immune system desiring of systems in human body, as well as, that may

lead to increase even if little the numbers and viability of leucocytes.

While, increase of R.B.Cs count in bloodstream may refer to this mushroom is rich source of folic acid and vitamins B12 (Sheikh et al. 2010), this compounds are stimulating and enhancing formation of erythrocytes through the process of erythropoiesis. In the same situation, uses of mushroom and olive oil are contend against oxidative stress and enhancing of antioxidant enzymes (De Silva et al. 2012, Paiva-Martins et al. 2009), therefore, this effect maybe promote a role of glutathione (GSH) (inside of erythrocytes) as a reductant which extremely important particularly in the highly oxidizing environment of the erythrocytes and prevent of fragility, furthermore, increasing the viability and count of erythrocytes in bloodstream.

REFERENCES

Akgul H, Sevindik M, Coban C, Alli H, Selamoglu Z (2017) New approaches in traditional and complementary alternative medicine practices: Auricularia auricula and Trametes versicolor. J Tradit Med Clin Natur., 6(3):239-242. https://doi.org/10.4172/2573-4555.1000239

Bailey CJ, Trner SL, Jakeman KJ, Hayes WA (1984) Effect of Coprinus comatus on plasma glucose concentrations in mice. J Planta Med, 50(6):525-526. https://doi.org/10.1055/s-2007-969791

Bajaj M, Vadhera S, Brar AP, Soni GL (1997) Role of oyster mushroom Pleurtus florida as hypocholesterolemic/antiatherogenic agent. Indian J Exp Biol., 35:1070-1075.

Bal C, Akgul H, Sevindik M, Akata I, Yumrutas O (2017) Determination of the Antioxidative Activities of Six Mushrooms. Fresenius Envir Bull, 26:6246-6252.

Bhushan A, Kulshreshtha M (2018) The medicinal Mushroom Agaricus bisporus: Review of phytopharmacology and potential role in the treatment of various diseases. J Nat Sci Med., 1(1):4-9.

Bilal AW, Bodha RH, Wani AH (2010) Nutritional and medicinal importance of mushrooms. Journal of Medicinal Plants Research, 4(24):2598-2604. https://doi.org/10.5897/JMPR09.565

Bobek P, Galbavy S (1999) The oyster mushroom (Pleurotus ostreatus) effectively prevents development of Atherosclerosis in rabbits. Cesk Slov Farm, 48(5):226-230.

Chen L, Shao H (2006) Extract from Agaricus blazei Murill can enhance immune responses elicited by DNA vaccine against foot and mouth disease. Vet Immunol Immunopathol, 109:177-182. https://doi.org/10.1016/j.vetimm.2005.08.028

Cheung PCK (1996) The hypocholesterolemic effect of two edible mushroom: Auricularia auricular (Tree-ear) and Tremella fuciformis (White-jelly leaf) in hypercholesterolemic rats. J Nutr Res, 16:1721-1725. https://doi.org/10.1016/0271-5317(96)00191-1

Cheung PCK (1998) Plasma and hepatic cholesterol levels and feacal neutral sterol excretion are altered in hamsters fed straw mushroom diets. J Nutr, 128:1512-1516. https://doi.org/10.1093/jn/128.9.1512

De Silva D, Rapior S, Hyde KD, Bahkali AH (2012) Medicinal mushrooms in prevention and control of diabetes mellitus. Fung Diversity, 56:1-29. https://doi.org/10.1007/s13225-012-0187-4

Duncan DB (1955) Multiple range and F-test. Biomertic, 11:42.

Faas FH, Earlewine A, Smith G, Simmons DL (2002) How should low-density lipoprotein cholesterol concentration be determined? J Fam Pract, 51:973-975.

Friedewald WT, Levy R, Fredrickson DS (1972) Estimation of low density lipoprotein in plasma without use of the preoperative ultra-centrifuge. Clin Chem, 18(6):499-502.

Friedman M (2016) Mushroom polysaccharides: Chemistry and antiobesity, antidiabetes, anticancer and antibiotic properties in cells, rodents and humans. Foods, 5(4):80. https://doi.org/10.3390/foods5040080

Fukada S, Setoue M, Morita T, Sugiyama K (2006) Dietary eritadenine suppresses guanidinoacetic acid induced hyperhomocysteinemia in rats. J. Nutr, 136(11):2797-2802. https://doi.org/10.1093/jn/136.11.2797

Fukushima M, Nakano M, Morii Y, Ohashi T, Fujiwara Y, Sonoyyama M (2000) Hepatic LDL receptor mRNA in rats is increase by dietary mushroom Agaricus bisporus fiber and suger beet fiber. J Nutr, 130(9):2151-2156. https://doi.org/10.1093/jn/130.9.2151

Gray AM, Flatt PR (1998) Insulin-releasing and insulin-like activity of Agaricus campestris (mushroom). J Endocrinology, 157:259-266. https://doi.org/10.1677/joe.0.1570259

Haen PJ (1995) Principles of hematology. Wm. C. Brown publishers, USA.

Hwang HJ, Kim SW, Lim JM, Joo JH, Kim HO, Kim HM, Yan JW (2005) Hypoglycemic effect of crude exopolysaccharides produced by a medicinal mushroom Phellinusbaumii in streptozotocin-induced diabetic rats. Life Sci, 76:3069-3080. https://doi.org/10.1016/j.lfs.2004.12.019

Jeong SC, Jeong YT, Yang BK, Islam R, Koyyalamudi SR, Pang G, Cho YK, Song CH (2010) White button mushroom Agaricus bisporus lowers blood glucose and cholesterol levels in diabetic and hypercholesterolemic rats. Nutr Res, 30:49-56. https://doi.org/10.1016/j.nutres.2009.12.003

Kang JS, Park WP, Lee DS (2001) Quality of enoki mushrooms as affected by packaging conditions. J Sci Food Agric, 81(1):109-114. https://doi.org/10.1002/1097-0010(20010101)81:1<109::AID-JSFA789>3.0.CO;2-Y

Khayyat LI (2016) Protective effects of extra virgin olive oil against paracetamol-induced liver toxicity In Wistar albino rats. Eurasia J Biosci, 10: 30-40.

Maja K, Anita K, Dragica J, Nina T, Jovana V, Predrag P, Miomir N, Miroslav MV, Leo G (2015) Antioxidants of edible mushrooms. Molecules, 20:19489-19525. https://doi.org/10.3390/molecules201019489

Mattila P, Konko K, Eurola M, Pihiava J, Astola J, Vahteristo L, Hietaniemi V, Kumpulainen J, Valtonen M, Piironen V (2001) Contents of vitamins, mineral elements, and some phenolic compounds in cultivated Mushrooms. Agric. Food Chem, 49(5):2343-2348. https://doi.org/10.1021/jf001525d

Mircea C, Blid V, Zavastin D, Cionanca O (2013) The protective effect of mushroom in experimentally induced Diabetes in mice. Farmacia, 61(2):268-275.

Orsine JV, Novaes CG, Asquieri ER (2012) Nutritional value of Agaricus sylvaticus; mushroom grown in Brazil. Nutr Hosp, 27(2):449-455.

Paiva-Martins F, Fernandes J, Rocha S, Nascimento H, Vitorino R, Amado F, Borges F, Belo L, Santos-Silva A (2009) Effects of olive oil polyphenols on erythrocyte oxidative damage. Mol Nutr Food Res, 53:609-616. https://doi.org/10.1002/mnfr.200800276

Selima K, Aminul I, Ugur C, Narayan C (2012) Research on Mushroom as a potential source of nutraceuticals: A review on indian perspective. American Journal of Experimental Agriculture, 2(1):47-73. https://doi.org/10.9734/AJEA/2012/492

Sevindik M (2018) Mushrooms as natural antioxidant agents. J Tradit Med Clin Natur, 7(1):140. https://doi.org/10.4172/2573-4555.1000e140

Sheikh MA, Kumar A, Islam MM, Mahomud MS (2010) The effects of mushroom powder on the quality of cake. Progress Agric, 21(1&2):205-214.

Tietz NW (2005) Fundamentals of clinical chemistry. W.B. Saunders, Philadelphia:723-750.

Vetter J (2007) Chitin content of cultivated mushrooms Agaricus bisporus, Pleurotus osteatus and Lentinula edodes. Food Chem, 102:6-9. https://doi.org/10.1016/j.foodchem.2006.01.037

Wu D, Pae M, Ren Z, Guo Z, Smith D, Meydani S (2007) Dietary supplementation with white button mushroom enhances natural killer cell activity in C57BL/ 6 mice. J Nutr, 137:1472-1477. https://doi.org/10.1093/jn/137.6.1472

Xiao C, Wu QP, Tan JB, Cai W, Yang XB, Zhang JM (2011) Inhibitory effects on alpha-glucosidase and hypoglycemic effects of the crude polysaccharides isolated from 11 edible fungi. J Med Plants Res, 5:6963-6967.