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Studying the Influence of Reishi Mushroom (*Ganoderma lucidum*) Extract on Diabetic Rats

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ABSTRACT:

This study aims to evaluate the effects of various reishi mushroom (Ganoderma lucidum) extract dosages on the blood glucose levels of diabetic rats., and influence the blood glucose levels of rats with diabetes. Five groups of 30 albino rats weighing 150±10 g have been created. One group used to be maintained as a control (-ve), and the other four groups were given intraperitoneal injections of alloxan (150 mg/kg physique weight) to Induce diabetes. One group used to be maintained as a control (+ve). Three diabetic groups of Reishi mushroom extract at doses of 100, 200, and 300 mg/kg were administered for 28 days to treat three diabetic groups. Biochemical analysis includes blood glucose level, lipid fraction such as total cholesterol (TC), triglycerides (TG), high-density lipoprotein cholesterol (HDL-c), low-density lipoprotein cholesterol (LDL-c), very low-density lipoprotein cholesterol (VLDL-c), renal functions such as uric acid, urea, and creatinine, oxidative enzymes such as superoxide dismutase (SOD) and catalase (CAT), and malondialdehyde (MDA). Calculations have been made for body weight gain (BWG), feed intake (FI), and feed efficiency ratio (FER). The findings demonstrated that the reishi mushroom extract improved the lipid profile, kidney, and liver indicators whilst reducing the degree of blood glucose in diabetic rats. Reishi mushroom extract decreased MDA whilst elevating CAT, SOD, BWG, FI, and FER levels. In conclusion, reishi mushroom is an excellent nutraceutical therapy for diabetes in rats, as confirmed through all biochemical analyses.

Keywords: *Reishi Mushroom, Diabetes Mellitus, Oxidative Enzymes, Rats, Mushrooms*

1. INTRODUCTION

Diabetes is a disease associated with a disorder in the metabolism of the glucose in the body (1). Treatment for Type 2 diabetes includes everyday dietary adjustments, physical activity, and the use of nutraceuticals in addition to medicine remedies like metformin. Early in the 1970s, researchers recognized materials generated by using the human body referred to as "Incretions," additionally referred to as "Incretion hormones," that

caused beta cells to start producing insulin. These compounds are observed in the gut and have an impact on beta cell function (2). The addition of herbal therapeutic products and herbal supplements in pharmacovigilance classifications is significant because an organized method of collecting and examining adverse drug reactions related to these products will help doctors, patients, and controllers to gain more knowledge and prevent harm (3). In that case, G. lucidum is one of the best therapeutic plants Ganoderma lucidum (G. lucidum) is a type of mushroom suggested to improve health and prolong life. Its medical reputation has earned many epithets and titles, and it has been shown to be effective in the prevention and treatment of various metabolic disorders due to its unique source of bioactive metabolites, especially polysaccharides, triterpenoids, and polyphenols, they work as an anti-cancer, anti-diabetic and anti-inflammatory agent. These potentially unique pharmaceutical properties have led to its demand as an important supplier of nutritional supplements in the food industry (4). Therefore, this research was conducted to know the effect of reishi mushroom on diabetic rats.

The purpose of this study was to investigate the impact of reishi mushroom on rats with diabetes.

2. Material and Methods

2.1. Materials

2.1.1 Source of mushroom

Reshi mushroom was bought from the Giza governorate of Egypt's Agricultural Research Center at Al-Dokki, Giza.

Classification of mushroom

Ganoderma lucidum is known as "Reishi"(5). the Classification of mushroom is Kingdom: Fungi, Class: Agraicomycetes, and Family: Ganodermatacae.(6).

2.1.2 Animals used in experiments:

Thirty Sprague Dawley albino rats, weighing about 150±10 grams at ten weeks of age, have been bought from the Giza Memorial Institute for Ophthalmic Research, Animal House, Ministry of Health, Giza, Egypt.

2.1.3 Chemical kits

From the Al-Gomhorya Company for Trading Drugs and Medical Instruments in Cairo, Egypt, chemical kits for biochemical analysis, and alloxan had been purchased.

2.1.4 Ethical Approval

The Research Ethics Committee of the faculty of Home Economics accepted research protocol MUFHE / S / NFS / 5/ 24.

2.2 Methods

2.2.1 Preparation of ethanolic extract of reshi mushroom

The reshi mushroom gradually began to crumble and get rough.. Traditionally, 10g of the powder was once soaked in 90 ml of 80% ethanol alcohol, shaken, and allowed to continue to be at room

temperature for 72 hours. The combination was once filtered with the use of filter paper, and the filtrate was then heated to 60°C on a water bath till it became blank. The ethanolic extract used to be as soon as the preferred crude extract and used to be saved in a fridge at 4°C in a sealed bottle till it was once needed (7).

2.2.2 Standard diet

The baseline diet prepared through use of the formulation given in (8) corresponds to this: Among the components are 10% protein, 5% cellulose, minerals, 10% corn oil and vitamin blend, 1%, choline chloride 0.2%, methionine 0.3%, and 69.5% corn starch.

2.2.3 The induction of diabetes mellitus

In healthy, regular rats, an intraperitoneal injection of 150 mg/kg body weight of alloxan resulted in to the pancreatic beta cells (9).

2.2.4 Experimental design:

For a week, all rats had been fed the basal diet prepared in accordance with (10). The rats were divided into 5 collections (each with six rats) following this edition step.

The rats were randomly assigned into two main groups. The first group (n = 6) known as the negative control group (-ve) was given the standard diet. The second group (n = 24) consisted of diabetic rats, that divided into four subgroups, one set of them was once retained as a positive control (+ve). Whilst the other three diabetes groups administered with various concentrations of reshi mushroom of 100, 200, and 300 mg/kg, respectively.

Throughout the experimental phase, the rats' standard overall performance used to be monitored each week, and measurements of their body weight gain (BWG), feed intake (FI), and food efficiency ratio (FER) have been made (11).

2.2.5 Blood collection

After twenty-eight days, the animals stopped consuming at night and have been sedated with diethyl ether. Samples of blood will accumulate in a dry, uncontaminated separator tube. Serum used to be loaded into a plastic ampoule and saved in a deep freezer till examination after being separated at 5000 rpm for 10 minutes the use of a separator (Centrifuge, HERMLE Z326K, and Germany) (12).

2.2.6 Biological evaluation

To perform biological assessments of a variety of diets, measurements of body weight gain (BWG), feed intake (FI), and food efficiency ratio (F.E.R.) have been made (13). Using the subsequent formulas:

$$\text{B.W.G.}(\%) = \frac{(Final\ weight - Initial\ weight)}{Initial\ weight} \times 100$$

$$F.E.R. = \frac{Gain\ in\ body\ weight\ (g)}{Feed\ intake\ (g)}$$

2.2.7 Biochemical analysis:

Procedure (14) was used to estimate the serum glucose levels. The methods described in (15) were applied to triglycerides. The (16) method was used

to determine total cholesterol. The techniques of (17) were applied to ascertain the amounts of high-density lipoprotein.

The following equation was used to determine both Low-Density Lipoprotein (LDL) and Very Low-Density Lipoprotein (VLDL).:

LDL-c = Total Cholesterol - HDL-c + VLDL.

VLDL-c = (TG/5) (18).

The methods of (19), (20), and (21) were applied to estimate the concentration of alkaline phosphatase (ALP), the levels of alanine aminotransferase (ALT), and the levels of aspartate aminotransferase (AST). While the methods of (22, 23 and, 24) were used to quantify serum creatinine, urea, and uric acid. The levels of the enzymes catalase (CAT), superoxide dismutase (SOD), and malondialdehyde (MDA) were determined in compliance with (25), (26), and (27).

2.2.8 Statistical analysis:

When a significant main effect was found, the data were analyzed using a completely randomized factorial design (28) and the Student-Newman-Keuls Test was used to separate the means. Using the Costat Program, differences between treatments of (P≤0.05) were deemed significant. One Way ANOVA was used to assess the biological results.

3. Results and Discussion

The data in Table (1) illustrates how the BWG, FI, and FER of diabetic rats have been affected by reishi mushroom concentrations of 100, 200, and 300 mg/kg. The facts indicated that there was once a significant increase in the average amount of BWG (P≤0.05) between the control (+ve) group and the control (-ve) group; the values had been 51.95 and 81.08 (g/d/r), respectively. Rats receiving reishi mushroom extract supplements at doses of 100, 200, and 300 mg/kg confirmed a statistically significant increase (P ≤ 0.05) in body weight gain. The average readings had been 62.35, 68.55, and 72.11 g/d/r in relation to the control (+ve) group, respectively.

The feed intake (FI) outcomes proven in Table (1) confirmed that the control (+ve) group's FI elevated significantly (P≤0.05) in comparison to the control (-ve) group; the values have been 18.72 and 21.53 g/d/r, correspondingly. There used to be additionally a noteworthy rise in the values between the G3, G4, and G5 diabetes groups (18.78, 18.99, and 20.89 g/d/r, correspondingly). When G5 obtained 300 mg/kg of reishi mushroom extract, their FI level used to be the highest (20.89 g/d/r) in comparison to the control (+ve) group's 18.72 g/d/r. Feed efficiency ratio (FER) values are proven in the same Table (1). Make it clear that the control (+ve) group's suggested FER value has a significant decrease (P≤0.05) in comparison to the control (-ve) group. There are no significant differences between the treated groups (3, 4, 5) and either the positive or negative control

group, with values of 0.113, 0.128, 0124, 0.095 and 0.134%, respectively.

When in contrast to the control (+ve) group, the G5 group (GL 300 mg/kg) achieved the great treatment for (BWG, FI, and FER). This is supported via some research through (29) which found that after six weeks, the fish fed MGL Mushroom Ganoderma Lucidum received 35 grams of weight, indicating greater feed quality.

Additionally, the information aligns with the find out about that established the value of mushrooms for the enhancement of digestive enzymes and the well-being of the digestive system.

Table (1): Influence of reishi mushroom extract on body weight gain, feed intake and feed efficiency ratio on diabetic rats

Parameters / Groups	BWG (g/d/r)	FI (g/d/r)	FER %
G (1): Negative control	81.08a±0.63	21.53a±0.87	0.134a±0.001
G (2) Positive control	51.95e±1.15	18.72b±0.83	0.095b±0.008
Group (3): Reishi mushroom 100mg/kg	62.35d±0.97	18.78b±1.01	0.113b±0.016
Group (4): Reishi mushroom 200 mg/kg	68.55c±0.57	18.99b±0.93	0.128a±0.004
Group (5): Reishi mushroom 300 mg/kg	72.11b±0.66	20.89a±1.57	0.124ab±0.041
LSD	1.513	1.964	0.036

body weight gain , feed intake and feed efficiency ratio.

Values are expressed as means±SD; means in similar column at different superscript letters are significantly different (p≤ 0.05).

The impact of reishi mushroom on the serum glucose degree of diabetic rats was confirmed by the data in Table 2 When comparing the control (+ve) group to the control (-ve) group, the glucose degree increased considerably (P ≤ 0.05), coming in at 257.36 and 86.33 mg/dl, respectively. As assessment to control (+ve), reishi mushroom extract at doses of 100 and 200 mg/kg confirmed a significant reduce (P ≤ 0.05) at 223.06, 183.63, and 257.36 mg/dl, respectively. the G5 that administered (300 mg/kg reishi mushroom extract) had the best serum level of glucose. The outcomes shared by way of (30) which indicated that reishi mushrooms decrease blood glucose levels, support these findings. Additionally, (31) observed that reishi mushroom helps mice with insulin resistance, lowers body weight, and lowers blood glucose. Furthermore, in accordance with (32), these findings have been corroborated, as it was once confirmed that mushrooms' defenses against antioxidants, glucose metabolic pathways, **α**-glucosidase and aldose reeducate inhibitory activities, **β**-cell augmentation, and insulin release activity all contribute to their potential to decrease diabetes.

Due to their natural flavoring and taste, plants and mushrooms have long been used to enhance food's nutritional value and taste. This is because they can help with a variety of health issues, including

decreased serum serum glucose levels (33).

Table (2): Impact of reishi mushroom extract on serum glucose level of diabetic rats

Parameters / Groups	Serum glucose level (mg/dl)
G (1): Negative control	86.33e±2.15
G (2) Positive control	257.36a±1.70
Group (3): Reishi mushroom 100mg/kg	223.06b±1.38
Group (4): Reishi mushroom 200 mg/kg	183.63c±2.01
Group (5): Reishi mushroom 300 mg/kg	129.26d±1.95
LSD	3.384

Values are expressed as means±SD; means in similar column at different superscript letters are significantly different (p≤ 0.05).

The impact of reishi mushroom extract on the total cholesterol (TC), HDL-c and triglycerides (TG) concentrations in diabetic rats have been displayed in Table 3. With TC values of 264.78 and 129.56 mg/dl, accordingly, the control (+ve) group clearly outperforms the control (-ve) group. Following dietary intervention with mushrooms at all concentrations, total cholesterol levels significantly decreased (P≤0.05). Group 5 exhibited the least amount of influence, measuring 151.39d±1.69, in comparison to the control group (ve+).

Regarding (TG), in Table (3) the result confirmed that, the value of (TG) has extensively increased (P≤0.05) in the control (+ve) group in contrast to the control (-ve) group. at 201.97 and 96.7 mg/dl, respectively. Rats given reishi mushroom extracts at 100 mg/kg (G3) and 200 mg/kg (G4) as dietary supplements showed significant reduction (P≤0.05) from control (+ve) at 178.47, and 150.48mg/dl, respectively, the G5 group (reishi mushroom 300 mg/kg extract) had the best serum TG level117.45±1.50 mg/dl. .

Additionally, in Table (3) the results confirmed that the control (-ve) group's HDL value extended significantly (P≤0.05) in contrast to the control (+ve) group, coming in at 50.56 and 40.26 mg/dl, respectively. When contrasted with the control group (+ve), rats given reishi mushroom supplements at doses of 100 mg/kg (G3) and 200 mg/kg (G4) had considerably greater ranges of HDL-c (P≤0.05), measuring 43.46 and 44.88 mg/dl, respectively. the G5 (Ganoderma lucidum 300 mg/kg) group had the highest serum (HDL-c) level. These findings had been corroborated by using (34), which stated that, in assessment to rats fed monosodium glutamate alone,(35) said that *G. lucidum* intake was related with increased levels of HDL-C of the rats treated with monosodium glutamate and G. lucidum (200 mg/kg extract) concurrently had been considerably lower.

Additionally, (36) discovered that oral administration of *Ganoderma lucidum* ethanol extract (GLE) 200, 400, 600, and 800 mg/kg body weight to mice for a continuous 28 days improved blood lipid profiles, ROS, anticoagulant impacts, and diabetes in rats suffering from diabetes.

GLE dosage will increase impact the rate of improvement.

Additionally, it is possible to draw the conclusion that giving obese female rats a 10% powdered mixture of evaluated herbs and plants will help them lose weight and improve other variables Including cholesterol (37).

Table (3): Effect of reishi mushroom extract on total cholesterol, HDL, and TG of diabetic rats

Parameters / Groups	Serum total cholesterol (mg/dl)	Serum HDL (mg/dl)	Serum TG (mg/dl)
G (1): Negative control	129.56e±1.99	50.56a±1.03	96.7e±2.02
G (2) Positive control	264.78a±1.43	40.26d±0.98	201.97a±1.91
Group (3): Reishi mushroom 100mg/kg	243.90b±2.07	43.46c±1.57	178.47b±1.87
Group (4): Reishi mushroom 200 mg/kg	198.29c±1.85	44.88bc±1.63	150.48c±2.14
Group (5): Reishi mushroom 300 mg/kg	151.39d±1.69	47.03b±1.20	117.45d±1.50
LSD	3.320	2.394	3.516

total cholesterol , high-density lipoprotein cholesterol, and triglycerides

Values are expressed as means±SD; means in similar column at different superscript letters are significantly different (p≤ 0.05).

The data provided in Table (4) demonstrates that low density lipoprotein (LDL-c), which is 184.13 and 59.68 mg/dl, respectively, has a particular rise in the control (+ve) group in contrast to the control (-ve) group. When contrasted with the control (+ve), administered groups G3 and G4 with 100 and 200 mg/kg extract reishi mushroom illustrated a great reduction (P≤0.05), with values of 164.74 and 123.31 mg/dl, respectively. The G5 (reishi mushroom 300 mg/kg extract) group had the great serum LDL-c level at 80.74 mg/dl.

The same Table (4) demonstrated that the receptive values of the VLDL-c have been 40.39±0.38 and 19.33±0.4 (mg/dl) respectively, with a great increase for the control (+ve) group compared to the control (-ve) group. When comparing G4 (reishi mushroom 200 mg/kg extract) at mean value 30.09 mg/dl to control (+ve), the difference is considerable (P≤0.05). Whereas G5's (reishi mushroom 300 mg/kg extract) confirmed its best concentration at 23.61 mg/dl. These findings are regular with (38) which discovered that in rats given alloxan to induce diabetes, groups treated with reishi mushroom had the lowest ranges of LDL-c and VLDL-c.

Additionally, (39) showed that while reishi mushroom has varying degrees of efficacy on lipid profiles, it is beneficial for TG, TC, LDL-C, HDL-C, and VLDL-c.

The information in Table (5) proves how the renal functions of diabetic rats have been affected by way of the reishi mushroom extract. The urea values, which are 60.9 and 39.68 mg/dl, respectively, exhibit a discernible rise in the control (+ve) group in contrast to the control (-ve) group. The results for the G4 and G5 groups, which were 41.37 and 39.89 mg/dl, respectively, did not significantly change. G5 (reishi mushroom 300 mg/kg

extract) had the lowest serum urea level, at 39.89 mg/dl had the lowest serum urea level, that did not differ significantly than negative control group.

Table (4): Effect of reishi mushroom extract on LDL and VLDL of diabetic rats

Parameters Groups	Serum LDL-c (mg/dl)	Serum VLDL-c (mg/dl)	Serum TC/LDL (ratio)
G (1): Negative control	59.68e±1.31	19.33e±0.4	2.17e±0.017
G (2) Positive control	184.13a±2.06	40.39a±0.38	1.43e±0.008
Group (3): Reishi mushroom 100mg/kg	164.74b±3.24	35.69b±0.33	1.48d±0.017
Group (4): Reishi mushroom 200 mg/kg	123.31c±0.10	30.09c±0.42	1.60c±0.016
Group (5): Reishi mushroom 300 mg/kg	80.74d±0.4	23.61e±0.3	1.87b±0.017
LSD	3.326	0.679	0.028

low density lipoprotein cholesterol and very low density lipoprotein cholesterol

Values are expressed as means±SD; means in similar column at different superscript letters are significantly different (p≤ 0.05).

Additionally, Table 5 showed that uric acid values in the control (+ve) group and the control (-ve) group have been highly greater (P≤0.05), at 2.90 and 5.69 mg/dl, correspondingly. The results for the G3, G4, and G5 had been 4.66, 3.91, and 3.20 mg/dl, accordingly, with no discernible drop between them. The G5 (reishi mushroom 300 mg/kg extract) group had the lowest uric acid value, 3.20 mg/dl,

The same Table (5) information made it clear that the control (+ve) group's suggest creatinine value used to be considerably greater (P≤0.05) than the control (-ve) group's, at 1.06 and 0.58 mg/dl, respectively. G4 (reishi mushroom 200 mg/kg extract) has a great drop at 0.76 mg/dl. G5, which received a 300 mg/kg extract of reishi mushrooms, exhibited a serum creatinine level of 0.64 mg/dl, which was not significantly different from the control negative group (0.76 mg/dl).

respectively, these findings corroborated by (40) who reported that reishi mushroom treatments improved glomerular filtration rate, which in turn improved renal function values.

Table (5): Effect of reishi mushroom extract on kidney functions of diabetic rats

Parameters Groups	Urea (mg/dl)	Uric acid (mg/dl)	Creatinine (mg/dl)
G (1): Negative control	39.68c±1.14	2.9d±0.12	0.58d±0.04
G (2) Positive control	60.98 a±2.48	5.69a±0.95	1.06a±0.09
Group (3): Reishi mushroom 100mg/kg	52.18b±2.80	4.66b±0.22	0.92b±0.04
Group (4): Reishi mushroom 200 mg/kg	41.37c±1.68	3.91bc±0.17	0.76c±0.04
Group (5): Reishi mushroom 300 g/kg	39.89c±1.67	3.20cd±0.06	0.64d±0.03
LSD	3.726	0.878	0.100

Values are expressed as means±SD; means in similar column at different superscript letters are significantly different (p≤ 0.05).

The data displayed in Table (6) confirmed that, at 199.59 and 139.72 U/L receptively, the amount of AST clearly elevated for the control (+ve) group in comparison to the control (-ve) group. The levels of G3 and G4 confirmed a great decline; they had been 189.36 and 169.28 U/L, respectively. According to the control (+ve) group, G5 (reishi mushroom 300 mg/kg) had the lowest AST level, which was 151.24 U/L.

Additionally, Table (6) records confirmed that the control (+ve) group's suggest ALT value elevated highly (P≤0.05) when in contrast to the control (-ve) group; the values have been 50.3 and 20.35 U/L, respectively. Comparing the G3 and G4 groups, there was once a great decline in U/L values, which have been 45.36±0.98 and 36.12±0.89, respectively. According to the control (+ve) group, the reishi mushroom 300 mg/kg G5 had the smallest ALT value, measuring 27.62±0.71 U/L.

The same Table (6) data confirmed that the control (+ve) group's suggest ALP value was once significantly greater (P≤0.05) than the control (-ve) group's, at 320.32 and 220.26 U/L, respectively. When comparing G4 (200 mg/kg) to control (+ve), U/L values are significantly decreased at 260.26 and 320.32. G5 (300 mg/kg) confirmed the great result, with corresponding value of 232.26 U/L. These findings are in line with these posted with the aid of (41). They confirmed that the liver health, triglyceride levels, and whole cholesterol in mice had been significantly elevated by way of reishi mushroom polysaccharides.

Furthermore, (42) found that all through testing (AST, ALT, and ALP), reishi mushroom significantly protected the liver from the buildup of hepatic fats. Following remedy with 100 mg/kg of reishi mushroom, there used to be a huge reduction in enzyme concentrations.

Plants and their powdered mixtures improved liver function by reducing the activity of liver enzymes such as ALP and AST. The plant's 4% powder blend is thought to be the most effective therapy (43).

Table (6): Impact of reishi mushroom extract on liver enzymes of diabetic rats

Parameters Groups	AST U/L	ALT U/L	ALP U/L
G (1): Negative control	139.72e±0.79	20.35e±0.96	220.26e±1.09
G (2) Positive control	199.59a±0.82	50.3a±0.86	320.32a±0.66
Group (3): Reishi mushroom 100mg/kg	189.36b±0.68	45.3b±0.98	280.35b±1.20
Group (4): Reishi mushroom 200 mg/kg	169.28c±0.95	36.12c±0.89	260.26c±1.08
Group (5): Reishi mushroom 300 g/kg	151.24d±0.10	27.62e±0.71	232.26d±1.04
LSD	1.610	1.616	1.882

alkaline phosphatase, alanine aminotransferase, and aspartate aminotransferase.
Values are expressed as means ± SD; means in similar column at different superscript letters are significantly different (p≤ 0.05).

Table (7) displays data indicating a great increase (P≤0.05) in the suggest value of MDA for the control (+ve) group when in contrast to the control (-ve) group; the values have been 29.74 and 16.64 nmol/g, respectively. When in contrast to the control (+ve) group, rats given supplemental foods containing 100, 200, or 300 mg/kg of reishi mushroom extract had considerably decrease (P≤0.05) of MDA, with values of 27, 06, 18.71, and 13.28 nmol/g, respectively.

The same Table (7) result confirmed that, when comparing the control (-ve) group to the control (+ve) group, the value of (CAT) elevated significantly (P≤0.05), 269.55 and 140.35 U/g, respectively. Rats given a supplemented diet containing 100 and 200 mg/kg reishi mushroom confirmed a great increase (P≤0.05) in (CAT) in contrast to the control (+ve) group, with values of 179.61, 240.50, and 140.35 U/g, respectively. The group receiving 300 mg/kg reishi mushroom extract confirmed the highest serum (CAT) level, at 252.69 U/g, respectively, in contrast to the control (+ve) group.

Additionally, Table (7) effects confirmed that the control (-ve) group's mean value of SOD elevated (P≤0.05) when in contrast to the control (+ve) group; the values have been 224.52 and 48.53 U/mg, respectively. When in contrast to the control (+ve) group, rats given supplemental foods containing 100, 200, or 300 mg of reishi mushroom extract confirmed big will increase (P≤0.05) in their SOD levels, which have been 62.74, 99.46, and 171.32 U/mg, respectively. Based on these findings, G5 (300 mg/kg) obtained the excellent treatment for MAD, CAT, and SOD when in contrast to the control (+ve) group. These findings are supported by way of research by (44) who located that reishi mushroom can increase plasma ranges of antioxidant enzymes, enhance overall antioxidant capacity, and expand glutathione content.

Table (7): Impact of reishi mushroom extract on oxidative enzymes in liver tissue of diabetic rats

groups	MDA (nmol/g)	CAT (U/g)	SOD (U/mg)
G (1): Negative control	16.64d±0.66	269.55a±0.59	224.52a±0.52
G (2) Positive control	29.74a±0.76	140.35e±0.82	48.53e±0.61
Group (3): Reishi mushroom 100mg/kg	27.06b±0.52	179.61d±0.55	62.74d±0.74
Group (4): Reishi mushroom 200 mg/kg	18.71c±0.79	240.50c±0.84	99.46c±0.86
Group (5): Reishi mushroom 300 g/kg	13.28e±0.59	252.69b±0.68	171.32b±0.94
LSD	1.228	1.291	1.374

Superoxide dismutase, Catalase and Malondialdehyde.

Values are expressed as means ± SD; means in similar column at different superscript letters are significantly different (p≤ 0.05).

4- Conclusion

One type of mushroom that is said to boost health, especially glucose levels and lengthen lifestyles is Ganoderma lucidum. Due to its special supply of bioactive metabolites, when used in

doses 100, 200, and 300 mg/kg it has been shown to be effective in improving the lipid profile, kidney and liver indices, while reducing the blood sugar level in diabetic rats. Reishi mushroom extract decreased MDA while raising CAT and SOD levels and BWG, FI and FER values. In conclusion, Reishi mushroom is an excellent dietary treatment for diabetes in mice. It is therefore recommended as a major supplier of nutritional supplements in the food industry.

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التغذية وعلوم الاطعمة

دراسة تأثير مستخلص الفطر الريشى على الفئران المصابة بالبول السكرى

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الملخص العربى:

الهدف من هذا البحث هو تقييم تأثير ثلاث جرعات مختلفة من مستخلص فطر الريشى (جانوديرما ليوسيديم) على مستويات السكر في الدم لدى الفئران المصابة بداء السكري. تم عمل خمس مجموعات مكونة من ثلاثين فأرًا أبيضًا عمرهم 10 اسابيع، تزن جميعها ١٥٠±١٠ جم. تم الحفاظ على مجموعة واحدة كمجموعة ضابطة سالبه (-ve)، وتم إعطاء المجموعات الأربع الأخرى حقن الألوكسان (١٥٠ ملجم / كجم من وزن الجسم) لإحداث مرض السكري. حصلت ثلاث مجموعات مصابة بالسكري على علاج بجرعات (١٠٠، ٢٠٠، ٣٠٠ ملجم/كجم من فطر الريشى)، في حين تم الاحتفاظ بالمجموعة الأولى كمجموعة ضابطه موجبه (+ve). تم استخدام التقييمات البيوكيميائية بعد ٢٨ يومًا للتحقق من اية المعلمات التالية: مستوى الجلوكوز في الدم، وصورة دهون الدم مثل الكوليسترول الكلي (TC)، والدهون الثلاثية (TG)، والبروتين الدهني عالي الكثافة (HDL-c)، و البروتين الدهني منخفض الكثافة (LDL-c)، البروتين الدهنى منخفض الكثافة جدًا (VLDL-c)، وظائف الكلى مثل حمض اليوريك، اليوريا، والكرياتينين، الإنزيمات المؤكسدة مثل سوبر أكسيد ديسموتاز (SOD) والكتاليز (CAT)، والمالونديالدهيد (MDA). تم إجراء حسابات لزيادة وزن الجسم (BWG)، ومعدل تناول الغذاء (FI)، ونسبة كفاءة الغذاء (FER). وأظهرت النتائج أن مستخلص فطر الريشي أدى إلى تحسين خريطة الدهون ومؤشرات الكلى والكبد، مع خفض مستوى السكر في الدم لدى الفئران المصابة بالسكري. خفض مستخلص فطر الريشى من مستوى انزيم المالونديالدهيد مع رفع مستويات الكتاليز وسوبر أكسيد ديسموتاز والزيادة فى وزن الجسم، وتناول الغذاء، ونسبة كفاءة الغذاء. فى الختام، يعتبر فطر الريشى علاجًا غذائيًا ممتازًا لمرض السكري لدى الفئران، وهذا ما تؤكده جميع التحاليل البيوكيميائية.

الكلمات المفتاحية: الفطر الريشى، داء السكري، الانزيمات المؤكسدة، الفئران، الفطريات.