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EFFECT OF ADDING A MIXTURE OF LION'S MANE *HERICIUM ERINACEUS* AND REISHI MUSHROOM *GANODERMA LUCIDUM* TO BROILER DIETS ON THE PRODUCTIVE PERFORMANCE

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ABSTRACT

The study was conducted in the poultry field of the Department of Animal Production/ College of Agricultural Engineering Sciences/ University of Baghdad/ Abu Ghraib, for the period from 28/04/2022 to 08/06/2022 to demonstrate the effect of adding a mixture of Lion's mane *Hericium erinaceus* and Reishi Mushroom *Ganoderma lucidum* to broiler's diets on productive performance, 120 one day old Ross 308 breed broiler chicks were used in the experiment, with (10 birds / replicate) with an average starting weight of 49.95 g. The experiment treatments were as follows:(T1) basic diet control treatment free of any addition.

(T2) the basic diet with the addition of 0.5 g/kg fodder of Lion's Mane mushroom with 0.5 g/kg fodder of the Reishi Mushroom. (T3) the basic diet with the addition of 0.75 g/kg fodder of Lion's Mane Mushroom with 0.75 g/kg fodder of Reishi Mushroom.(T4) basic diet with the addition of 1 g/ kg fodder of Lion's Mane Mushroom with 1 g / kg fodder of Reishi Mushroom. The results showed in the sixth week a highly significant increase ($P<0.01$) in the average weekly body weight for the two treatments T2 and T4 over the control treatment T1, while in the fifth week a high significant increase ($P < 0.01$) was obtained in the weekly average body weight of the T4 treatment over the T1 control treatment free of addition, while in the sixth week T2 and T4 outperformed the T1 control treatment, but regarding weight gain ratio, it was observed that a high significant increase was observed ($P <0.01$) for treatment T3 over treatment T2, and the results showed a significant increase in the feed consumption ratio for both T1 and T3 over treatment T2 in the third week, and it was noted that a high significant improvement ($P<0.01$) was achieved in the feed conversion ratio and clearly for the birds of T2 treatment compared to the control treatment T1 at the age of 6 weeks, and the results showed a significant improvement in the carcass weight of treatment T4 compared to T3 treatment, and a significant increase ($P < 0.05$) in the carcass weight of birds of T2 treatment, to whose diet a mixture of lion's mane mushroom was added by 0.5 g/kg and reishi mushroom by 0.5 g/kg compared with control treatment T1 and T3. We conclude from this study that adding a mixture of lion's mane mushroom with reishi mushroom in different proportions has a role in improving the productive performance of broiler.

Key words: Mixture. Lion's Mane mushroom. Reishi mushroom. Body weight. Food conversion ratio. Broilers.

[*] **The article is taken from the doctoral thesis of the first researcher**.

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تأثير إضافة خليط من فطر غرة الأسد *Hericium erinaceus* والفطر الريشي *Ganoderma lucidum* لعلائق فروج اللحم في الأداء الأنتاجي

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الخلاصة

أجريت الدراسة في حقل الطيور الداجنة التابع لقسم الإنتاج الحيواني/ كلية علوم الهندسة الزراعية/ جامعة بغداد/ أبي غريب، للمدة من 28/4/2022 إلى 2022/6/8 لبيان تأثير إضافة خليط من فطر غرة الأسد *Hericium erinaceus* والفطر الريشي *Ganoderma lucidum* لعلائق فروج اللحم في الأداء الأنتاجي، أستعمل في التجربة 120 فرخاً من فروج لحم سلالة Ross 308 بعمر يوم واحد وبواقع (10 طائر/ مكرر) بمعدل وزن ابتدائي49.95 غم، وزعت الطيور على 4 معاملات بواقع 3 مكررات لكل معاملة وكل مكرر يحوي 10 طير وكانت معاملات التجربة على النحو التالي (T1):معاملة سيطرة عليقة أساسية خالية من أي اضافة(T2) العليقة الأساسية مع اضافة 0.5 غم/كغم علف من فطر غرة الأسد مع 0.5غم/كغم علف من الفطر الريشي، (T3) العليقة الأساسية مع اضافة 0.75 غم/كغم علف من فطر غرة الاسد مع 0.75 غم/كغم علف من الفطر الريش (T4) العليقة الأساسية مع إضافة 1 غم/كغم من فطر غرة الاسد مع1غم/كغم علف من الفطر الريشي، اظهرت النتائج في الاسبوع السادس ارتفاع عالي المعنوية(P<0.01) في معدل وزن الجسم الأسبوعي للمعاملتين T2 و T4 على معاملة السيطرةT1، اما فيما يخص معدل الزيادة الوزنية فقد لوحظ حصول ارتفاع عالي المعنوية (P<0.01) للمعاملة T3 على المعاملةT2،واظهرت النتائج حصول زيادة معنوية لمعدل استهلاك العلف لكل من T1 و T3 على المعاملة T2 في الأسبوع الثالث، ولوحظ حصول تحسن عالي المعنوية (P<0.01) في معامل التحويل الغذائي وبشكل واضح لطيور المعاملة T2 مقارنةً بمعاملة السيطرة T1عند عمر 6 اسابيع، وأظهرت النتائج حصول تحسن معنوي في وزن الذبيحة للمعاملةT4 مقارنةً بالمعاملةT3، وحصول زيادة معنوية (P<0.05)في وزن الذبيحة لطيور المعاملة T2 والتي اضيف لعلائقها خليط من فطر غرة الاسد وبنسبة 0.5غم/كغم مع 0.5 غم/كغم من الفطر الريشي مقارنة مع معاملة السيطرة T1 وT3 ، يستنتج من هذه الدراسة إلى إن إضافة خليط من فطر غرة الأسد *Hericium erinaceus* والفطر الريشي *Ganoderma lucidum* لعلائق فروج اللحم ساهمت في تحسين الصفات الانتاجية بالمقارنة مع معاملة السيطرة .

الكلمات المفتاحية: خليط .فطر غرة الأسد. الفطر الريشي. وزن الجسم. معامل التحويل الغذائي. فروج لحم.

INTRODUCTION

Nowadays nutritional mushrooms have been used as a universal food product and alimental supplement and have also been used as a new class of medicine called mushroom medicines **(Wang *et al.*, 2019)**, and in natural biocontrol and used as antifungal and antiviral **(Mahfuz, 2020).**

Studies have also proved nutritional mushrooms' role in strengthening the immune system in general and thus showing anti-cancer activity, especially when used as a complementary treatment alongside conventional treatment (chemotherapy and radiotherapy) **(De Silva *et al.*, 2013)**. They were introduced as organic food supplements and used as alternatives to medicines and antibiotics, as it was found to have a stimulating and boosting effect on immunity, whether in human or animal nutrition **(Guo *et al.*, 2003).**

As for now, scientists have highlighted the potential of fungal therapy **(Bederska-Łojewska *et al.*, 2017)**, and they presented a list of food fungi used on animals and the effect of these fungi on growth parameters **(Mahfuz *et al.*, 2018).**

And that mushrooms may have a positive role as a natural food supplement that has a healthy effect on humans and animals, including poultry, which can improve growth performance, immunity, and general health status **(Guimarães *et al.*, 2014; Shang *et al.*,**

2016), so research and studies tended towards finding solutions to these problems through the use of some natural food additives **(Al-Masari & Al-Himdany, 2022; Mohamed& Bandr, 2023; Qasim & Bander, 2017; Shihab, 2017)** that improve the growth of poultry, increase the live weight, improve the feed conversion ratio, and increase the immune capability for birds, and among these additions is the use of food mushrooms and adding them to the diets of domestic birds, including broilers. Among these mushrooms is Hericium erinaceus, or what is known as the Lion's Mane, which is edible and for medical uses, because it contains many nutritional supplements **(Li *et al*., 2018)**, and it's very popular as a nutritional mushroom and nutritional supplement, and as a potential source of medicinal compounds. It contains many nutrients, including free amino acids, including glutamic acid, l-linin, proline and serine **(Friedman, 2015)**, in addition to containing polysaccharides, protein, vitamins and minerals **(Ulziijargal & Mau, 2011)**. It also contains some active substances, including pyranone, alkaloids, terpenoids, steroids, peptides, terpenoids, phenols and flavonoids therefore it is a potent antioxidant **(Rahman *et al*., 2014)**, anti-inflammatory **(Hetland *et al*., 2020)**, antiviral **(Vamanu & Voica, 2017)**, antiviral features **(liu *et al*, 2019)** and antifungal features**(Song *et al*., 2020)** and anti-harmful bacteria Staphylococcus aureus, Salmonella enteritidis, Vibrio parahaemolyticus and Escherichia coli **(Kim *et al*., 2019)** and adding it to diets may work to enhance the productive and immune performance of agricultural animals, including poultry. Another food fungus with high nutritional value is the reishi mushroom, known as the red mushroom (Ganoderma lucidum). It is an edible medical mushroom that has nutritional benefits as it was used for eating and has a chemical composition that adds health benefits to its use for medicines and is effective for immunity and for the treatment of many diseases, including cancer and chronic liver inflammation **(Zhao & He, 2018)** contains carbohydrates by 44.95%, protein by 15.75%, fiber by 14.81% and many vitamins including B1, B2, B6, C, D, E and beta-carotene and many minerals including phosphorus, potassium, calcium, sodium, carbon, iron and magnesium Chromium, zinc, arsenic, manganese, copper, silicon, aluminum, cobalt and lead **(Ahmed, 2018)** and about eighteen types of amino acids,as the Lysine was the most abundant, which has antioxidant activity and contains large amounts of effective compounds and important nutrients in human and animal nutrition. This mushroom contains polysaccharides and triterpenes, saponins, steroids, alkaloids and ganoderic acids, and this mushroom has an important role as an antioxidant **(Heleno *et al*., 2012; Karaman *et al*., 2010; Jeon *et al*., 2008).**

And due to the absence of a comprehensive study on the use of a mixture of Lion's Mane mushroom with Reishi mushroom in the form of a powder in the diet of animals, including domestic birds, and studies were limited to its addition to human nutrition and some laboratory animals, and for the purpose of benefiting from the nutritional value of each mushroom they contain effective compounds that may be complementary to each other, so the aim of this experiment is to demonstrate the nutritional value of the mixture by adding it to the diets of broilers and to know its effect on the productive performance characteristics of broilers bred for a period of 42 days.

MATERIALS AND METHODS

The experiment was conducted in the poultry field of the Animal Production Department at the College of Agricultural Engineering Sciences - University of Baghdad (Abu Ghraib) for the period from 28/04/2022 to 08/06/2022 to demonstrate the effect of adding a mixture of lion's mane and reishi mushroom to broiler diets in the productive performance, as 120 broiler chicks were raised of Ross 308 breed, and the chicks were distributed randomly to four treatments by 30 chicks/ treatment, with 3 replicants/ treatment, 10 chicks / replicant, and the chicks were fed on the starter diet for a period of 1 - 10 days, and a growth diet for a period of 11-24, and a final diet for a period of 25-42 days Table (1), and the birds were distributed into 7 treatments, 3 replicants for each treatment, each replicant contain 10 birds, and these treatments of the experiment were as follows:(T1): The control treatment of the basic diet free from any addition(T2) the basic diet with the addition of 0.5 g/kg fodder from lion's mane mushroom with 0.5 g/kg fodder of the reishi mushroom(T3) the basic diet with the addition of 0.75 g/kg fodder from lion's mane mushroom with 0.75 g/kg fodder from reishi mushroom(T4) basic diet with the addition of 1 g/kg fodder of lion's mane mushroom with 1g/kg fodder of reishi mushroom

Table (1): Percentages and chemical composition of the components of the diets used in the study.

Ingredient %	**Type of diet**	
	Starter	**Grower**
	1-14 d.	14-28 d
Yellow Corn	37.5	36
Wheat	20	25
Soybean meal 1	32	28
Protein concentrate 2	5	5
Sunflower oil	3	4
Dicalcium phosphate (D.C.P)	0.7	0.5
Lime stone	1.2	1.14
Methionine	0.25	0.13
Lysine	0.25	0.13
Salt	0.1	0.1
Total	100	100
chemical composition3		
M.E(kcal/kg)	3050	3160
C.P %	23	21.4
C.F %	2.7	2.6

*** Soybeans used are of Argentine origin. The percentage of protein is 48%, and the metabolized energy is 2440 kilocalories / kg.**

**** The protein concentrate used is an animal protein of the Dutch origin of type Brocon, and each kg contains: 40% of crude protein, 2107 kilocalories / kg of protein as a metabolized energy, 5% of crude fat, 2.20% of crude fiber, 5% calcium, 4.68% phosphorus, 3.85% Lysine, 4.12% methionine, 4.12% methionine + cysteine, 0.42% tryptophan and 1.70% threonine.**

*****According to the chemical composition based on (National Research Council, 1994).**

The chicks were raised in a hall divided by wooden cages, the area of each cage was (2 x 1 m), and the replicants were distributed homogeneously and randomly on the cages from the first day of the chicks' life. The chicks were raised in a hall with the floor system, and water and fodder were given freely (adlibitum) during the experiment period, and a continuous lighting system was used (23 hours a day) with an hour of darkness being given daily for the purpose of accustoming the chicks to the dark and preventing their disturbance when the power is suddenly cut off, and the birds were fed with nutritional treatments. The lion's mane mushroom was brought, which is a white powder, and the reishi mushroom, which is a red powder from the DXN company, and an approximate chemical analysis was conducted for them in the College of Science and Technology Their values are shown in table (2) for the nutritional value of the lion's mane mushroom and the reishi mushroom.

Table (2): The nutritional value of each Lion's mane (Hericium erinaceus) and Reishi Mushroom (Ganoderma lucidum).

chemical composition	Lion's mane	Reishi Mushroom
Protein	33.5	26.4
Moi	5.4	6.9
ASh	9.8	19
Fat	3.9	4.5
CHO	17.2	11.4
Glysine	-	12.7%
Alanine	0.88	12.5%
Serine	1.62	11.5%
Therionie	0.47	11.1%
Linoleic	-	1083.23 ميكروغرام/غم
Olieic	-	1473 ميكروغرام/غم
Lysine	0.98	4
Histidine	0.54	-
Arginine	1.06	-

The statistical program was used to analyze the experiment data using a complete random design (CRD) to determine the effect of different treatments on the studied characteristics, and testing the significant differences between the averages using Duncan (1955) multinomial test and using the SPSS (2017) program in analyzing data.

RESULTS AND DISCUSSIONS

Table (3) shows the effect of different levels of a mixture of lion's mane and reishi mushrooms added to the diet of broiler chickens on the average body weight for all weeks of the experiment, as the results showed that there were no significant differences for all the treatments of the experiment in the second and fourth week, while the results showed a high significant increase ($p>0.01$) in the average weight of birds for treatment T3 for the first week, compared with all treatments (T1, T2, T4), while the treatments did not differ significantly among them. While the results of the study showed that there were no significant differences for all the treatments of the experiment in the second week, but in the third week, the average body weight continued to increase for treatment T3 and T4 compared to the control treatment

T1 and T2, as they recorded 957.80, 958.13 g/ bird, and for the two treatments T1 and T2 did not differ significantly between them, and no significant differences were observed in the fourth week for all the treatments of the experiment, as for the effect of adding a mixture of lion's mane mushrooms and reishi mushrooms in broiler diets on the average body weight for the fifth week, it was found from Table (11) that there was a high significant increase (p>0.01) for the T4 treatment, as it recorded 2301.17 g/ bird compared to the T1 control treatment which reached 2131.73 g/ bird and in turn did not differ significantly with T2, while the control treatment T1 did not differ significantly with treatment T3 and this treatment did not differ significantly with T2, in addition to that it was observed in the sixth week that a high significant increase (p>0.01) occurred for each of T2 And T4, as they recorded the highest average body weight reached 3048.03, 3007.67 g/ bird compared to the control treatment T1, which recorded 2798 g/ bird, which in turn did not differ significantly with the treatment T3, which in turn also did not differ significantly with the control treatment T1.

Table (3): The effect of adding different levels of a mixture of lion's mane and reishi mushroom on the weekly average body weight of broiler, g/bird (average ± standard error).

Period week	Treatment [1]				Sg
	T1	T2	T3	T4	
1	155.80±2.10b	155.80±2.55b	166.60±0.42a	157.87±1.14b	**
2	415.73±2.57	429.13±21.87	422.80±4.45	430.47±5.09	Ns
3	903.47±1.81b	921.33±5.78b	957.80±9.62a	958.13±2.02a	**
4	1535.87±18.78	1572.13±10.88	1582.30±1.08	1589.57±9.55	Ns
5	2131.73±16.71c	2270.40±18.72ab	2199.30±21.60bc	2301.17±3.08a	**
6	2798.53±19.11b	3048.03±57.52a	2954.63±38.25ab	3007.67±10.13a	**

**** The different letters within the same row indicate that there are significant differences at a significant level (P<0.01), N.S means that there are no significant differences between transactions.**
Transactions T1, T2, T3, T4, in addition to a mixture of lion's forelock and reishi mushrooms mixed in the following proportions (0, 0.5 lion's mane + 0.5 reishi mushroom, 1 lion's mane + 1 reishi mushroom, 1.5 lion's mane + 1.5 reishi mushroom) g/ kg respectively.

As for the weight gain rate, as it is noted from table (4) the effect of adding different levels of a mixture of lion's mane and mixing them with the same levels of reishi mushroom to the diets of broilers on the weekly weight gain rate (g/ bird). The results showed a high significant increase (p>0.01) in the weekly average weight gain for treatment T3 in the first week compared to treatment T2, as it reached 115.87 g/bird, while it did not differ significantly on treatment T1 and treatment T4, which in turn did not differ significantly with treatment T2, and it was noted from Table (2) There were no significant differences for all the treatments of the experiment during the second, third and fourth week, but in the fifth week it was observed that there was a high significant increase (p>0.01) for the birds of T4 treatment, which were added to their diets a mixture of lion's mane with reishi mushrooms by 1 g/ kg of lion's mane and 1 g/ kg of reishi mushroom compared with the control treatment T1, as it reached 711.60 g/

bird, while it did not differ significantly with the treatment T2, as it reached 698.27 g/ bird. It was found that the second treatment, T2, was significantly superior to the control treatment, while it did not differ significantly from T3, as it recorded 617, and it was seen in the data of the table that there were no significant differences for all treatments of the experiment in the sixth week. As for the total average weight gain from the age of 1-6 weeks, it was significantly superior ($p>0.01$) each of T2 and T4, which was added to each of them 1g/kg Lion's mane + 1g/kg reishi mushroom mixed with them and 2g/kg Lion's mane + 2g/kg reishi mushroom mixed with them, respectively, compared with the control treatment, and did not differ significantly with T3.

Table (4): The effect of adding different levels of a mixture of the lion's mane and the reishi mushroom to the diet on the weekly average total weight gain (g) (average ± standard error) of broiler in the weeks of the experiment.

Period week	Treatment [1]				Sg
	T1	T2	T3	T4	
1	107.20±1.91ab	106.13±2.68b	115.87±1.18a	107.03±1.33ab	**
2	259.93±2.45	273.33±20.15	256.20±4.05	272.60±5.16	Ns
3	487.73±4.34	492.20±22.61	535.00±8.07	527.67±3.14	Ns
4	632.40±17.00	650.80±15.21	624.50±8.62	631.43±7.83	Ns
5	595.87±23.74c	698.27±11.59ab	617.00±20.86bc	711.60±6.53a	**
6	666.80±17.00	777.63±38.97	755.33±17.05	706.50±10.17	Ns
6-1	2749.93±19.36b	2998.37±57.84a	2903.90±38.98ab	2956.83±10.47a	**

**** The different letters within the same row indicate that there are significant differences at a significant level (P<0.01), N.S means that there are no significant differences between transactions.**

Transactions T1, T2, T3, T4, in addition to a mixture of lion's forelock and reishi mushrooms mixed in the following proportions (0, 0.5 lion's mane + 0.5 reishi mushroom, 1 lion's mane + 1 reishi mushroom, 1.5 lion's mane + 1.5 reishi mushroom) g/ kg respectively.

Table (5) shows the effect of adding different levels of a mixture of the lion's mane and the reishi mushroom to the broilers' diet on the weekly feed consumption ratio, as the results did not show any significant differences between all the treatments of the experiment during the first and second week, while the results showed a high significant increase ($p>0.01$) in the third week of control treatment T1 and T3 compared to treatment T2, while it did not differ significantly with treatment T4, which in turn did not differ significantly with treatment T2, and the results did not show any significant differences between the treatments of the experiment in the fourth, fifth and sixth week and the period of total feed consumption 1-6 weeks.

Table (5): The effect of adding different levels of a mixture of the lion's mane and reishi mushroom to the diet on the weekly and total feed consumption ratio (g) (average ± standard error) for broilers in the weeks of the experiment.

Period week	Treatment [1]				Sg
	T1	T2	T3	T4	
1	97.47±1.19	97.13±1.17	96.87±1.55	95.53±0.35	Ns
2	255.27±14.35	238.47±5.31	256.80±2.31	257.00±3.36	Ns
3	627.60±2.11a	575.87±17.49b	630.80±11.02a	605.73±1.44ab	**
4	925.93±6.22	871.77±22.88	885.87±1.99	886.73±3.17	Ns
5	1020.13±26.90	1010.77±5.66	1003.00±3.00	1038.00±7.94	Ns
6	1271.00±16.46	1285.47±45.37	1260.00±12.16	1215.80±10.56	Ns
6-1	4197.40±29.50	4079.47±39.91	4133.33±4.12	4098.80±13.12	Ns

**** The different letters within the same row indicate that there are significant differences at a significant level (P<0.01), N.S means that there are no significant differences between transactions.**

Transactions T1, T2, T3, T4, in addition to a mixture of lion's forelock and reishi mushrooms mixed in the following proportions (0, 0.5 lion's mane + 0.5 reishi mushroom, 1 lion's mane + 1 reishi mushroom, 1.5 lion's mane + 1.5 reishi mushroom) g/ kg respectively.

As for Table (6), the results of the statistical analysis of the characteristic of the feed conversion ratio in Table (14), no significant differences were observed for all the treatments of the experiment in the first and second week, but in the third week, a significant improvement was found for the T4 treatment birds compared with the T1 control treatment birds, but It did not differ significantly from T2 and T3, which recorded (1.15) (g fodder / g weight gain), while it did not differ significantly with treatment T2 and T3, and these two treatments did not differ between them, and there were no significant differences between the treatments during the fourth week, but in the fifth week It was observed that there was a significant (p>0.01) improvement in the feed conversion ratio for the T2 treatment compared to the control treatment T1, but it did not differ significantly from the T4 treatment, and this treatment did not differ significantly from the T3 treatment, while in the sixth week, there was a clear significant improvement (p>0.01) for the birds of T2 treatment, which added to their diets a mixture of lion's mane by 0.5 g/kg and reishi mushroom by 0.5 g/kg compared to the control treatment T1, but it did not differ significantly with T3, and it was noted that the rate of feed conversion ratio for birds during the duration of the experiment was a significant improvement (p>0.01) for birds of T2 treatment, which reached 1.36 gm of fodder/ g of weight gain compared to the control treatment, which reached 1.53 gm of fodder/ g of weight gain.

Table (6): The effect of adding different levels of a mixture of the lion's mane and the reishi mushroom to the diet on the weekly and total feed conversion ratio (g fodder / g weight gain) (mean ± standard error) for broilers in the weeks of the experiment.

Period week	Treatment [1]				Sg
	T1	T2	T3	T4	
1	0.91±0.03	0.92±0.03	0.84±0.02	0.89±0.01	Ns
2	0.98±0.05	0.88±0.07	1.00±0.02	0.94±0.03	Ns
3	1.29±0.01a	1.17±0.03ab	1.18±0.04ab	1.15±0.01b	**
4	1.47±0.03	1.34±0.03	1.42±0.02	1.40±0.01	Ns
5	1.71±0.04a	1.45±0.03c	1.63±0.05ab	1.46±0.02bc	**
6	1.91±0.04a	1.66±0.03b	1.67±0.04b	1.72±0.02b	**
6-1	1.53±0.01a	1.36±0.02b	1.42±0.02b	1.39±0.01b	**

**** The different letters within the same row indicate that there are significant differences at a significant level (P<0.01), N.S means that there are no significant differences between transactions.**

Transactions T1, T2, T3, T4, in addition to a mixture of lion's forelock and reishi mushrooms mixed in the following proportions (0, 0.5 lion's mane + 0.5 reishi mushroom, 1 lion's mane + 1 reishi mushroom, 1.5 lion's mane + 1.5 reishi mushroom) g/ kg respectively.

It is obvious from Table (7) the effect of using different levels of a mixture of lion's mane and reishi mushrooms added to the diet of broilers on some carcass characteristics: carcass weight, dressing percentage, breast percentage and percentage ratio, as the T4 treatment for carcass weight showed a high significant increase (p>0.05) compared to the third treatment, T3, and it did not differ significantly from the control treatment, T1, and this treatment did not differ significantly with the treatment of T2, and this treatment was significantly outperformed T3, as for dressing percentage, the results of the table showed a significant improvement (p>0.05) for birds of treatment T2 compared with both T1 and T3, and these two treatments did not differ between them, while T4 significantly outperformed T1 and T3, and there were no significant differences for the main pieces (breast percentage - thigh) between the treatments of the experiment when using different levels of a mixture of lion's mane and reishi mushrooms in diets' broiler.

Table (7): The effect of adding different levels of a mixture of lion's mane and reishi mushrooms to the diet on carcass weight, dressing percentage and main pieces (average ± standard error) of broiler carcasses at 42 days of age.

Traits	Treatment [1]				Sg
	T1	T2	T3	T4	
C.W	2317.33±78.83ab	2259.33±78.60b	2192.67±53.00c	2540.67±11.51a	*
D.P	74.73±0.62c	78.14±2.24a	74.52±0.37c	75.32±0.32b	*
B	39.71±0.28	41.99±1.35	39.71±0.77	39.31±0.82	Ns
TH.	31.63±0.58	29.51±1.08	30.39±0.84	30.75±1.69	Ns

**** The different letters within the same row indicate that there are significant differences at a significant level (P<0.01), N.S means that there are no significant differences between transactions.**

Transactions T1, T2, T3, T4, in addition to a mixture of lion's forelock and reishi mushrooms mixed in the following proportions (0, 0.5 lion's mane + 0.5 reishi mushroom, 1 lion's mane + 1 reishi mushroom, 1.5 lion's mane + 1.5 reishi mushroom) g/ kg respectively.

The results of table (8) showed the effect of using different levels of a mixture of lion's mane and reishi mushrooms added to the diet of broilers on the relative weight of the internal viscera, as the results showed that there were no significant differences to the relative weights of each of the liver, heart, gizzard, Fabricia gland and spleen for all treatments of the experiment.

Table (8): Effect of adding different levels of a mixture of lion mane and reishi mushrooms to the diet on the percentage of internal viscera (mean ± standard error) of broiler carcasses at the age of 42 days.

Traits	Treatment [1]				Sg
	T1	T2	T3	T4	
Liver	2.26±0.12	2.34±0.32	2.23±0.22	2.04±0.10	Ns
heart	0.50±0.07	0.48±0.02	0.46±0.02	0.41±0.06	Ns
gizzard	1.22±0.07	1.22±0.12	1.20±0.06	1.17±0.06	Ns
Bursa	0.08±0.02	0.06±0.01	0.08±0.02	0.07±0.02	Ns
Spleen	0.10±0.02	0.11±0.01	0.11±0.01	0.07±0.01	Ns

**** The different letters within the same row indicate that there are significant differences at a significant level (P<0.01), N.S means that there are no significant differences between transactions.**

Transactions T1, T2, T3, T4, in addition to a mixture of lion's forelock and reishi mushrooms mixed in the following proportions (0, 0.5 lion's mane + 0.5 reishi mushroom, 1 lion's mane + 1 reishi mushroom, 1.5 lion's mane + 1.5 reishi mushroom) g/ kg respectively.

The productive performance of broilers is affected by the level and quality of nutrients and their type included in the composition of the diet, in addition to other factors related to the breeding and management of birds. The reasons for the increase in the average weight of birds may be due to the role of both the lion's mane and reishi mushrooms for what they contain of active substances, as the lion's mane contains organic acids, amino acids of high biological value, carbohydrates, alkaloids, terpenoids, phytosteroids, peptides, flavonoids, unsaturated fatty acids, phenolic acids, phenylpropanoids, and phenols **(Zhang *et al,* 2017; Li *et al*., 2014; Friedman, 2015).** As for the reishi mushroom, it contains some essential amino acids, polyunsaturated fatty acids, and active substances such as ergosterol, riboflavin glycosides, ascorbic acid, volatile oils, squalene, a type of triterpenes, and vitamins (β-carotene, C, D, E, B1, B2, B6) and polysaccharides **(Wadt *et al*. 2015; Reza, 2022).** The clear improvement in the productive performance of the treatments in which a mixture of lion's mane and reishi mushroom were used and with an increase in the proportion of each of the two mushrooms in the mixture may be due to the fact that each of them contains a group of essential amino acids and fatty acids unsaturated, which makes this mixture a synergistic mixture of these acids and has a high nutritional value, as it is an integrated source of essential amino and fatty acids, which work to improve and stimulate the digestion and metabolism processes and by stimulating the pancreas to produce some digestive enzymes such as lipase, protease, trypsin and amylase and stimulate the production of bile acids, which work to increase the benefit of food and increasing its metabolization, and thus improving productive performance through the increase of average body weight and the food conversion ratio.

The reason for the improvement in productive performance may be due to the fact that both the lion mane and the reishi mushroom contain sterols, especially Ercosterol, which act as natural antioxidants that prevent E.coli from the reproduction by stopping the formation of enzymes and the synthesis of proteins necessary for reproduction, which leads to the death of these bacteria and an increase in the number of Lactobacilli bacteria in gut microbiota, which creates a good environment for digestion and benefit from the nutritional compounds and effective compounds in the diet, which is reflected in the improvement of the health of the birds and thus the improvement of productive performance, as well as the presence of polysaccharides of glucose (B-glucaus) in both mushrooms, which acts as a prebiotic that increases the number of beneficial bacteria and increases their activity and their reproduction, and thus increase the length of the villi and increase the surface area to absorb the digested nutrients and thus improve the health of the intestine and its positive reflection on the productive performance of broilers.

Or the improvement in productive performance may be due to the action of the active compounds present in each of the two mushrooms, as the lion’s mane mushroom contains pyranones, alkaloids, terpenoids, steroids, peptides, terpenoids, phenols and flavonoids. As for reishi mushroom, it contains triterpenes, phenols, steroids, alkaloids, and saponins. These compounds prevent the formation of free radicals and prevent oxidative stress in birds by increasing antioxidant enzymes such as Peroxidase, Glutathion, and Catalase (CAT).

CONCLUSIONS

We conclude from this study that adding a mixture of lion's mane mushroom with reishi mushroom in different proportions has a role in improving the productive performance of broiler.

REFERENCE

1- Ahmad, M. F. (2018). Ganoderma lucidum: Persuasive biologically active constituents and their health endorsement. *Biomedicine & Pharmacotherapy*, *107*, 507-519.

2- Al-Masari, A. I., & Al- Himdany, H. Q. (2022). Effect of adding artichoke leaves extract powder (Cynara scolymus L.) to the diet on the productive performance of broilers. *Iraqi Journal of Agricultural Sciences*, *53*(1), 9-15.

3- Bederska- Łojewska, D., Świątkiewicz, S., & Muszyńska, B. (2017). The use of Basidiomycota mushrooms in poultry nutrition—a review. *Animal Feed Science and Technology*, 230, 59-69.

4- De Silva, D. D., Rapior, S., Sudarman, E., Stadler, M., Xu, J., Aisyah Alias, S., & Hyde, K. D. (2013). Bioactive metabolites from macrofungi: ethnopharmacology, biological activities and chemistry. *Fungal Diversity*, *62*, 1-40.

5- Friedman, M. (2015). Chemistry, nutrition, and health-promoting properties of Hericium erinaceus (Lion's Mane) mushroom fruiting bodies and mycelia and their bioactive compounds. *Journal of Agricultural and Food Chemistry*, *63*(32), 7108-7123.

6- Guimarães, J. B., Dos Santos, É. C., Dias, E. S., Bertechini, A. G., da Silva Ávila, C. L., & Dias, F. S. (2014). Performance and meat quality of broiler chickens that are fed diets supplemented with Agaricus brasiliensis mushrooms. *Tropical animal health and production*, *46*, 1509-1514.

7- Guo, F. C., Savelkoul, H. F. J., Kwakkel, R. P., Williams, B. A., & Verstegen, M. W. A. (2003). Immunoactive, medicinal properties of mushroom and herb polysaccharides and their potential use in chicken diets. *World's Poultry Science Journal*, *59*(4), 427-440.

8- Heleno, S. A., Barros, L., Martins, A., Queiroz, M. J. R., Santos-Buelga, C., & Ferreira, I. C. (2012). Phenolic, polysaccharidic, and lipidic fractions of mushrooms from Northeastern Portugal: chemical compounds with antioxidant properties. *Journal of Agricultural and Food Chemistry*, *60*(18), 4634-4640.

9- Hetland, G., Tangen, J. M., Mahmood, F., Mirlashari, M. R., Nissen-Meyer, L. S. H., Nentwich, I., ... & Johnson, E. (2020). Antitumor, anti-inflammatory and antiallergic effects of Agaricus blazei mushroom extract and the related medicinal basidiomycetes mushrooms, Hericium erinaceus and Grifola frondosa: A review of preclinical and clinical studies. *Nutrients*, *12*(5), 1339, 9-10.

10- Jeon, J. R., Murugesan, K., Kim, Y. M., Kim, E. J., & Chang, Y. S. (2008). Synergistic effect of laccase mediators on pentachlorophenol removal by Ganoderma lucidum laccase. *Applied Microbiology and Biotechnology*, *81*, 783-790.

11- Karaman, M., Jovin, E., Malbaša, R., Matavuly, M., & Popović, M. (2010). Medicinal and edible lignicolous fungi as natural sources of antioxidative and antibacterial agents. *Phytotherapy research*, *24*(10), 1473-1481.

12- Kim, M. U., Lee, E. H., Jung, H. Y., Lee, S. Y., & Cho, Y. J. (2019). Inhibitory activity against biological activities and antimicrobial activities against pathogenic bacteria of extracts from Hericium erinaceus. *Journal of Applied Biological Chemistry*, *62*(2), 173-179.

13- Li, I., Lee, L. Y., Tzeng, T. T., Chen, W. P., Chen, Y. P., Shiao, Y. J., & Chen, C. C. (2018). Neurohealth properties of Hericium erinaceus mycelia enriched with erinacines. *Behavioural Neurology*, Special issue, 1-11.

14- Li, W., Sun, Y. N., Zhou, W., Shim, S. H., & Kim, Y. H. (2014). Erinacene D, a new aromatic compound from Hericium erinaceum. *The Journal of antibiotics*, 67(10), 727-729.

15- Liu, Z., Li, M., Yan, P., Zhu, Z., Liao, L., Chen, Q., ... & Wu, Y. (2019). Transcriptome analysis of the effects of Hericium erinaceus polysaccharide on the lymphocyte homing in Muscovy duck reovirus-infected ducklings. *International journal of biological macromolecules*, 140, 697-708.

16- Mahfouz, A. Y. (2020). Assessment of antibacterial, antifungal, antioxidant, and antiviral activities of black pepper aqueous seed extract. *Al-Azhar University Journal of Virus Research and Studies*, 2(1), 1-12.

17- Mahfuz, S., Song, H., Liu, Z., Liu, X., Diao, Z., Ren, G., ... & Cui, Y. (2018). Effect of golden needle mushroom (Flammulina velutipes) stem waste on laying performance, calcium utilization, immune response and serum immunity at early phase of production. *Asian-Australasian Journal of Animal Sciences*, 31(5), 705-711.

18- Mohamed. A.I. & L.K. Bandr. (2023). Effect of Using Different Levels of Chia Seeds in Broiler Diets on Productive Performance. *Indian Journal of Ecology*, 50 Special Issue (21): 83-89.

19- National Research Council, (1994). *Nutrient Require- ments of Poultry*. 9th rev. ed. National Academy Press, Washington, DC.

20- Qasim A.A. & Bandr L.K. (2017) . Effect of supplementing different levels of conjugated linoleic acid (CLA) to the diet on productive performance of broiler chicken, *Iraqi Journal Of Agricultural Sciences*.48(4):1081-1088.

21- Rahman, M. A., Abdullah, N., & Aminudin, N. (2014). Inhibitory effect on in vitro LDL oxidation and HMG Co-A reductase activity of the liquid-liquid partitioned fractions of Hericium Erinaceus (Bull.) Persoon (lion's mane mushroom*). BioMed research international*, 1-9.

22- Reza, M.J. (2022). *Effect of sdding different levels of Reishi mushroom powder (Ganoderma lucidum) to broiler diets and its effect on productive performance and some physiological traits and meat oxidation indicators*. MSc. Thesis, College of Agricultural Engineering Sciences, University of Baghdad, Iraq.

23- Shang, H. M., Song, H., Xing, Y. L., Niu, S. L., Ding, G. D., Jiang, Y. Y., & Liang, F. (2016). Effects of dietary fermentation concentrate of Hericium caput-medusae (Bull.: Fr.) Pers. on growth performance, digestibility, and intestinal microbiology and morphology in broiler chickens. *Journal of the Science of Food and Agriculture*, 96(1), 215-222.

24- Shihab, I. M. (2017). Effect Of Different Levels Of Turmeric Supplementation With Diet On Humoral Immune Response To Newcastle And Infectious Bursal Disease Virus And Histopathological Changes Of Some Internal Organ Of Broiler Chickens. *Iraqi Journal of*

Agricultural Sciences, 48(Special), 150-155.

25- Song, X., Gaascht, F., Schmidt-Dannert, C., & Salomon, C. E. (2020). Discovery of antifungal and biofilm preventative compounds from mycelial cultures of a unique North American Hericium sp. fungus. *Molecules*, 25(4), 963, 1-14.

26- SPSS® 22.0. Computer Software, (2017). SPSS Inc. Headquarters, 233 p., Wacker Drive, Chicago, Illinois. 60606, USA.

27- Ulziijargal, E., & Mau, J. L. (2011). Nutrient compositions of culinary-medicinal mushroom fruiting bodies and mycelia. *International journal of medicinal mushrooms*, 13(4),343-349.

28- Vamanu, E., & Voica, A. (2017). Total phenolic analysis, antimicrobial and antioxidant activity of some mushroom tinctures from medicinal and edible species, by in vitro and in vivo tests. *Scientific Bulletin Series F. Biotechnologies*, 21, 318-324.

29- Wadt, N. S. Y., Okamoto, M. K., Hi, E. M. B., & Bach, E. E. (2015). Chemical, toxicological, anti-inflammatory, and antimicrobial evaluation of Ganoderma lucidum extracts. *Emirates Journal of Food and Agriculture*, 577-584.

30- Wang, X. Y., Zhang, D. D., Yin, J. Y., Nie, S. P., & Xie, M. Y. (2019). Recent developments in Hericium Erinaceus polysaccharides: extraction, purification, structural characteristics and biological activities. *Critical reviews in food science and nutrition*, 59(sup1), pages 96-115.

31- Zhang, C. C., Cao, C. Y., Kubo, M., Harada, K., Yan, X. T., Fukuyama, Y., & Gao, J. M. (2017). Chemical constituents from Hericium Erinaceus promote neuronal survival and potentiate neurite outgrowth via the TrkA/Erk1/2 pathway. *International journal of molecular sciences*, *18*(8), 1-13.

32- Zhao, R. L., & He, Y. M. (2018). Network pharmacology analysis of the anti-cancer pharmacological mechanisms of Ganoderma lucidum extract with experimental support using Hepa1-6-bearing C57 BL/6 mice. *Journal of ethnopharmacology*, *210*, 287-295.