Comparative study to the effect of β-mannanase and Lysolecithin and Probiotic on some biochemical parameters in female quail

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Field experiments and laboratory analyzes were carried out in the animal house and laboratory of the College of Veterinary Medicine / University of Mosul. 600 one week old quail birds were used . The treatments were designed to study the effect of β-mannanase, Lysolecithin and probiotic in some biochemical parameters of quail. The birds were randomly divided into four groups (60 birds / groups) and each group divided in to three replicates (20 birds / replicate). The study included three stages (1-7) weeks and (7-13) weeks, (1-13) weeks, and the study treatments were as follows: - first group (control): given a standard ration, the second group :was given a standard ration supplemented with β - mannanase at a concentration of 0.5 g / kg feed ,third group: was given a standard ration supplemented with Lysolecithin at a concentration of 0.5 g / kg feed , four group :was given a standard ration supplemented with probiotic ta a concentration of 0.5 g / kg feed. The birds were slaughtered at the end of each experiment by cutting the jugular vein (6 birds / group) for the purpose of obtaining the blood samples for the laboratory tests. The results showed a significant increase in the level of glucose, total cholesterol, triglycerides , LDL , VLDL and HDL in group β-mannanase compared with the control as well as with Lysolecithin and probiotic, while the two groups Lysolecithin and probiotic showed a significant decrease in the glucose level , total cholesterol, triglycerides , LDL , VLDL and the atherogenic index with a significant increase at the level HDL compare with control.

Key words: β-mannanase . Lysolecithin . Probiotic . quail

Installation from Ph.D. thesis for first researcher

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Introduction

Poultry is an important animal protein source. as it is a cornerstone in filling an important part of humans food needs. the poultry industry has achieved significant progress in recent years. the poultry productivity has increased significantly due to the great progress and large and highly efficient made in applied research in various fields of this(Franco *et al*,2015) industry. Therefore. the recent studies are trying to focus in all scientific fields to yield animals that have high production specifications with lowest costs taking into account the shortest time period of production .Studies have focused on rearing quail. which is resistant to disease. small-scale. dual-purpose. low-cost in breeding. as well as characterized by rapid sexual maturity. shortening the period of other generation formation (Sertac,2017). Feed additives are of the most important strategy in order to improve the productivity of poultry industry as organic acids and macrominerals (Swiatkiewicz and Arczewska,2012),as well as enzyme which has become common during the previous ten years (DeBarros *et al*,2015) . In addition. they treats the negative impact of low-energy bonds (Graham *et al*,2002). One of these are β-mannanase (Wu *et al*,2005). Ibuki *et al*(2013) indicated that the addition of β-mannanase to poultry rations led to regular body weight and improved dietary conversion ratio. Other additives that have been used are emulsions. recent studies have indicated that the use of these emulsifiers as feed additives can support bile salts in fat emulsification process and micelles formation. thus showing a positive effect in the process of fats digestion (Joshi *et al*,2006). In recent times, scientific studies have directed to the use of instead of antibiotics in poultry diets because of these additives from a competitive or exclusionary effect of pathogenic bacteria, as studies conducted on humans and animals have demonstrated the ability of probiotic to change the type and number of intestinal microflora (Saulnier, 2007). Aim of study was to investigate the effect of β-mannanase and Lysolecithin and probiotic on some biochemical parameters on female quail.

Materials and Methods

Field experiments and laboratory analysis were carried out at the animal house and laboratories of Veterinary Medicine /University of Mosul. In this study. the quail birds were obtained by hatching fertilized eggs from the Agriculture and Forestry college / University of Mosul. The birds were raised from 1st day of its ages to the end of the study period was (13 weeks) in a closed-type hall. the ground floor of the hall divided into ten rooms with

dimensions (1. 5 × 2. 5 m) , each room was divided into three separated rooms each room have a door and fully covered with soft metal wire. The birds were fed on two types rations the starter and finisher. the starter ration gave from 1st day to 3 weeks age and the finisher gaved until the end of the experiment at 13 weeks age by using special plastics bowels for water and ration (*ad libitum*) according to the decisions of the US National Research Council. The study was conducted on 600 quail birds (one week old) were randomly distributed in to ten groups (60 birds / group). The animals were divided in to three replicates (20 birds / replicate). the experimental groups treated as follows :The first group as control was given standard ration without addition. The second group was given a standard ration containing β-mannanase with a concentration of 0.5 g / kg ration. The third group was given a standard ration containing Lysolecithin with a concentration of 0.5 g / kg ration . The fourth group was given a ration with a probiotic with a concentration of 0.5 g / kg ration. The study was divided into three periods. first period at age (1-7) weeks. the second period at age (7-13) weeks and the third period at age (1-13) weeks. The birds were separated depending on gender by relying on what called a cloacal gland this gland only founded in males as a swelling reach 1-1.5 cm in the upper side of the cloaca which is getting bigger at the sexual growing age with pressing this gland a soap like foam material comes out so it's also called a Foam gland.

Collection of blood samples

Blood samples were collected at the end of each period of the treatments by cervical dislocation of each bird (6 bird/ treatment) from each group .Serum samples were taken and stored under(-20^{o}c)until assayed. The net ratio of all slaughtered birds was calculated at the end of each experiment by finding live body weight and carcass weight after removing the internal viscera and by applying the following formula: -

Dressing out %= carcass weight(g)+ weight of edible organ(g)/ body weight ×100.

Statistical analysis

In this study a complete randomized design CRD and two way analysis of variance and the difference between groups determined by Duncan's multiple range test (Duncan,1983) by using the ready statistical program SAS (SAS,2010) under the level of significance ($p \leq 0.05$).

Biochemical parameters:-

Estimating the level of glucose in the blood serum by using a kit prepared by the British company, Randox, (Tietz, 1990) , the total cholesterol level by using a ready-made analysis kit (kit) manufactured in the French company (Biolabo), (Allain, 1974) , the level of triglycerides (Fossati and L-Principe, 1982), level of high-density lipoproteins - cholesterol(HDL) (Fossati and L-Principe, 1982).The absorbance intensity was measured using a Spectrophotometer at a wavelength of 500 nm. Determination low density lipoprotein (LDL) level (Friedwald *et al*., 1972) using the following equation :Total cholesterol – (Triglycerides /5 + HDL).

Estimating the level of very low-density lipoproteins(VLDL) according to the method mentioned in (Friedwald *et al*., 1972) using the following equation: - Triglycerides/5

Estimation of atherogenic index according to the method mentioned in (Friedwald *et al*., 1972) using the following equation:- Total cholesterol /HDL

Results

Data presented in table(1)the effect of β-mannanase, Lysolecithin and probiotic on the carcass indications for female quails cause a significant increase in body weight before slaughter, carcass weight, and dressing out%($p\leq0.05$) in the β-mananese, Lysolecithin and probiotic group compared with the control group.Also, the group of probiotic showed significant increase ($p\leq0.05$) in the carcass weight characteristic compared with β-mananese and lysolecithin. Regarding the effect of the periods, the second and third period showed a significant increase ($p\leq0.05$) in body weight before slaughter and the weight of the carcass compared to the first period, while the first period showed a significant increase ($p\leq0.05$) in the dressing out% . As for the interaction between the treatments and periods(table 2) , the third period of probiotic showed a significant increase ($p\leq0.05$) in the body weight before slaughter and the weight of the carcass, while the first period of β-mannanase and Lysolecithin showed a significant increase ($p\leq0.05$) in the dressing out%. About the effect of β-mananese, lysolecithin , and probiotic on some biochemical parameters of the blood serum of female quail(table 3), there was a significant increase ($p\leq0.05$) in the glucose level of the β-mannanase group compared with the control as well as with the two groups of Lysolecithin and probiotic, and the probiotic group showed a significant decrease ($p\leq0.05$) in the level of glucose compared with the control. The β-

mannanase group showed a significant increase ($p\leq0.05$) in the total cholesterol level compared with the control as well as with the lysolecithin and probiotic, while the groups of Lysolecithin and the probiotic showed a significant decrease ($p\leq0.05$) in the total cholesterol level compared with the control and the group of the probiotic($p\leq0.05$) in total cholesterol level on lysolecithin. The β-mannanase group showed a significant increase ($p\leq0.05$) in the level of triglycerides compared with control as well as with the group of Lysolecithin and the probiotic, whereas the groups of Lysolecithin and the probiotic showed a significant decrease ($p\leq0.05$) in the level of triglycerides compared with the control. In addition, the group of β-mannanase, Lysolecithin and probiotic showed a significant increase ($p\leq0.05$) in HDL level compared with control. While the group of probiotic showed a significant increase ($p\leq0.05$) in the level of HDL compared with β-mannanase and lysolecithin , and the group of enzyme-β-mannanase was superior to lysolecithin in the level of HDL. The β-mannanase group showed a significant increase ($p\leq0.05$) in the level of LDL compared to control as well as with lysolecithin and probiotic ($p\leq0.05$) in the level of LDL compared to control and showed probiotic significantly decreased ($p\leq0.05$) in the level of LDL on lysolecithin . The β-mannanase group showed a significant increase ($p\leq0.05$) in the VLDL level compared with control as well as with lysolecithin and probiotic, and the groups of lysolecithin and probiotic showed a significant decrease ($p\leq0.05$) in the VLDL level compared to control .The group of lysolecithin and the probiotic showed a significant decrease (improvement) ($p\leq0.05$) in the atherogenic index compared to control as well as with β-mannanase enzyme, and the group of probiotic showed a significant decrease (improvement) in the atherogenic index compared with lysolecithin. Regarding the effect of periods, the first period showed a significant decrease (improvement) ($p\leq0.05$) in the level of glucose, total cholesterol, triglycerides, LDL, and VLDL compared to the second and third period. The first period also showed a significant increase ($p\leq0.05$) in the HDL level compared to the second and third period, as the first period showed a significant decrease (improvement) ($p\leq0.05$) in the atherogenic index compared to the second and third period .About interaction between treatments and periods(table 4) showed a significant decrease ($p\leq0.05$) in the level of glucose during the first period of the two groups of lysolecithin and the probiotic, as well as the third period of the group of the probiotic showed a significant decrease ($p\leq0.05$) in the level of total cholesterol total triglycerides. The first period of the probiotic showed a

significant increase ($p\leq0.05$) in the HDL level, while the first period of the lysolecithin group showed a significant decrease ($p\leq0.05$) in the LDL level as well as the first period of the control group showed a significant decrease in the level of VLDL, The first period of the probiotic group also showed a significant decrease (improvement) ($p\leq0.05$) in the atherogenic index.

Table (1) Effect of β-mannanase , Lysolecithin and Probiotic on live weight ,carcass weight and dressing out% in female quail

Parameters / Groups	Live weight (g)	Carcass weight (g)	Dressing out %
	Effect of treatments		
Control	208.20 ±6.13 b	116.13 ±3.04 c	63.38 ±0.94 b
β-mannanase	253 ±9.70 a	150.18 ±3.31 b	66.80 ±1.34 a
Lysolecithin	247.85 ±9.65 a	146.17 ±3.56 b	66.87 ±1.22 a
Probiotic	260.60 ±10.09 a	157.38 ±4.04 a	67.47 ±1.22 a
	Effect of periods		
First period 1-7 week	196.27 ±2.76 b	125.78 ±2.88 b	71.47 ±0.60 a
Second period 7-13week	266.29 ±6.82 a	149.24 ±3.74 a	63.03 ±0.82 b
Third period 1-13 week	264.73 ±6.44 a	152.38 ±4.38 a	63.89 ±0.64 b

-The value represent as: means±SE n=6

- Different letters within columns indicate significant differences at ($p\leq0.05$)

Table (2) Effect the interaction between β-mannanase , Lysolecithin and Probiotic on live weight ,carcass weight and dressing out% in female quail

Parameters / Groups	Live weight (g)	Carcass weight (g)	Dressing out %
Effect of interaction between treatments and periods			
Control P1	175.56 ±2.26 e	103.87 ±2.11 f	67.40 ±0.81 b
Control P2	224.51 ±5.41 c	122.26 ±4.74 e	61.38 ±1.32 d
Control P3	224.51 ±5.41 c	122.26 ±4.74 e	61.38 ±1.32 d
β-mannanase P1	205.58 ±2.71 cd	135.30 ±2.70 d	73.30 ±0.59 a
β-mannanase P2	277.51 ±11.42 ab	156.61 ±4.04 bc	63.35 ±1.90 bcd
Beta-mannanase P3	276.16 ±12.03 ab	158.63 ±4.63 bc	63.74 ±1.36 bcd
Lysolecithin P1	198.18 ±1.80 cd	128.35 ±1.80 de	71.99 ±1.04 a
Lysolecithin P2	279.10 ±11.26 ab	153.16 ±2.13 c	63.02 ±2.18 cd
Lysolecithin P3	266.26 ±7.98 b	157.01 ±5.00 bc	65.60 ±0.94 bc

Probiotic P1	205.77 ±1.82 cd	135.59 ±1.84 d	73.21 ±0.25 a
Probiotic P2	284.05 ±9.99 ab	164.93 ±2.36 ab	64.39 ±1.17 bcd
Probiotic P3	292.00 ±5.32 a	171.63 ±3.34 a	64.82 ±1.06 bcd

-The value represent as: means±SE n=6

- Different letters within columns indicate significant differences at ($p \leq 0.05$)

P1=first period p2= second period p3= third period

Table (3) Effect of β-mannanase , Lysolecithin and Probiotic on some biochemical parameters in female quail

-The value represent as: means±SE n=6

- Different letters within columns indicate significant differences at ($p \leq 0.05$)

Parameters / Groups	Glucose mg/100 ml of blood	Cholesterol mg/100 ml of blood	Triglyceride mg/100ml of blood	HDL mg/100 ml of blood	LDL mg/100 of blood	VLDL mg/100 of blood	Atherogenic index
Effect of treatments							
Control	282.22 ±11.64	274.13 ±1.87 b	291.92 ±8.69 b	47.91 ±3.44 d	167.87 ±6.16 b	58.38 ±1.73 b	5.91 ±0.38 a
β-mannanase	318.82 ±4.70 a	301.89 ±3.97 a	319 ±4.60 a	55.77 ±3.54 b	182.98 ±5.19 a	63.91 ±0.92 a	5.73 ±0.33 a
Lysolecithin	264.97 ±18.31 bc	265.95 ±4.37 c	274.31 ±5.44 c	53.15 ±4.08 c	157.96 ±7.32 c	54.87 ±1.08 c	5.52 ±0.41 b
Probiotic	255.56 ±9.43 c	253.21 ±2.83 d	265.17 ±6.14 c	62.34 ±4.41 a	137.79 ±5.96 d	53.23 ±1.23 d	4.41 ±0.30 c

Effect of periods							
First period 1-7 week	229.44 ±8.02 b	258.56 ±4.92 c	251.90 ±5.34 c	77.93 ±1.41 a	130.29 ±5.95 c	50.37 ±1.06 c	3.33 ±0.10 b
Second period 7-13 week	297.76 ±12.19 a	279.69 ±1.78 b	307.35 ±3.50 a	42.64 ±0.68 c	175.59 ±9.98 b	61.49 ±0.70 a	6.51 ±0.12 a
Third period 1-13 week	313.20 ±3.89 a	285.49 ±5.07 a	302.35 ±4.96 b	45.05 ±1.07 b	179.99 ±11.53 a	60.46 ±0.99 b	6.41 ±0.18 a

Table (4) Effect the interaction between β-mannanase , Lysolecithin and Probiotic on some biochemical parameters in female quail

Parameters / Groups	Glucose mg/100 ml of blood	Cholesterol mg/100 ml of blood	Triglyceride mg/100 ml of blood	HDL mg/100 ml of blood	LDL mg/100 of blood	VLDL mg/100 of blood	Atherogenic index
Effect of interaction between treatments and periods							
Control P1	212.08 ±0.78 d	262.84 ±1.23 f	238.06 ±0.39 i	62.26 ±0.29 c	146.99 ±0.57 j	47.60 ±0.07 h	3.79 ±0.02 f
Control P2	314.27 ±0.67 ab	278.83 ±0.98 de	314.36 ±0.63 c	39.01 ±0.30 h	176.98 ±0.93 b	62.86 ±0.12 b	7.14 ±0.04 a
Control P3	314.27 ±0.67 ab	278.83 ±0.98 de	314.36 ±0.63 c	39.01 ±0.30 h	176.98 ±0.93 b	62.86 ±0.12 b	7.14 ±0.04 a
β-mannanase P1	291.82 ±2.35 abc	293.85 ±1.10 b	292.99 ±0.81 d	76.23 ±0.47 b	159.37 ±0.83 e	58.59 ±0.16 d	3.79 ±0.06 f
β-mannanase P2	330.81 ±0.56 a	287.29 ±0.39 c	330.61 ±0.59 b	43.66 ±0.30 f	177.35 ±0.24 d	66.11 ±0.14 a	6.57 ±0.04 c

β-mannanase P3	333.83 ±0.58 a	324.55 ±0.39 a	335.27 ±0.55 a	47.43 ±0.88 e	217.69 ±1.69 a	59.46 ±0.26 c	6.84 ±0.13 b
Lysolecithin P1	210.38 ±0.32 d	240.88 ±1.22 h	244.16 ±1.91 h	76.92 ±0.43 b	115.98 ±2.05 i	48.82 ±0.38 f	3.31 ±0.02 h
Lysolecithin P2	263.13 ±0.66 c	276.50 ±1.38 e	295.55 ±0.25 d	40.51 ±0.28 gh	176.88 ±1.79 b	59.10 ±0.65 c	6.75 ±0.11 bc
Lysolecithin P3	321.39 ±0.56 ab	280.47 ±1.23 d	283.22 ±0.66 f	42.00 ±0.66 g	171.84 ±1.17 c	66.67 ±0.14 a	6.68 ±0.11 bc
Probiotic P1	200.58 ±0.64 d	298.89 ±0.72 i	230.09 ±0.41 j	87.89 ±0.68 a	164.98 ±1.64 d	46.01 ±0.08 j	3.41 ±0.03 g
Probiotic P2	282.82 ±0.77 bc	237.40 ±1.36 f	288.88 ±0.58 e	47.37 ±0.49 e	133.27 ±0.44 h	57.77 ±0.11 d	5.57 ±0.04 d
Probiotic P3	283.29 ±0.75 bc	264.12 ±0.83 g	276.55 ±0.91 g	51.76 ±0.75 d	157.11 ±0.79 f	55.30 ±0.18 e	5.10 ±0.06 e

-The values represent as : means ± SE n=6
- Different letters within columns indicate significant differences at ($p \leq 0.05$)
P1=first period p2= second period p3= third period

Discussion

The three treatments resulted in increased body weight before slaughter, carcass weight, and dressing out % compared to the control group. This came in line with Ocak et al (2009) that the addition of MOS which is one of the most important β-mannanase products to broiler diets, led to increased carcass weight, as indicated by Guclu (2003) and Parlat *et al* (2003). And Oguz and Parlat (2004), that adding MOS to the broiler diet at the age of 14 and 42 days resulted in a significant increase in body weight. Gheisar *et al* (2015) also indicated that the addition of lysolecithin to the poultry diet with a concentration of 0.08% led to an increase in body weight and this came in line with what Melegy *et al* (2010) stated that the addition of external emulsions dependent on lysolecithin at a concentration of 0.25 and 0.5 kg / ton of feed resulted to a significant increase in the daily growth rate of broiler

meat, in addition, Polycarpo *et al* (2016) indicated that the addition of lysolecithin to the broiler diet at the age of 1-42 days led to an increase in body weight. Sinol *et al* (2012) explained that giving the probiotic with a concentration of 0.3 and 0.4% for broiler meat diets resulted in increased body weight and feed consumption and improved nutritional conversion factor during the growth stage from the age of 1-21 days.The increase in body weight before slaughter and carcass weight as a result of the addition of β-mannanase and lysolecithin , and the probiotic can be attributed to the improvement in the process of digestion and absorption of food and feed consumption and improvement the internal environment of the bird as well as the reduction of pathogenic bacteria inside the intestines. Studies have also shown that the MOS substance added to poultry diets improves poultry health either by interfering with the pathogenic bacteria 'association with the walls of epithelial cells (Spring *et al*., 2000) or improving the work of the immune system (Newman and New man, 2001) which in turn contribute in a way partial improvement in body weight and food consumption by adding MOS, which are the main products of the enzyme β-mannanase (Sundu *et al*., 2006).Attia *et al* (2008) indicated that lysolecithin is one of the best energy sources, and the addition of lysolecithin to poultry diets reduces the size of the lipid fraction and thus increases the surface area of enzymatic digestion by lipase enzyme(Gu and Li, 2003, Gheisar *et al*., 2015). In addition, the probiotic increases the level of digestive enzymes such as lipase, amylase and trypsin, which play an important role in the digestion of nutrients and thus improves the performance of birds (Imran et al., 2012) and increases the body's resistance to diseases by balancing the intestinal microflora and stimulating the immune system (Francis *et al*., 2002). About the effect of β-mannanase, lysolecithin and probiotic on some biochemical parameters of female blood serum..The effect of β-mannanase on the level of glucose came in line with what Justina *et al* (2018) mentioned, adding that the β-mannanase enzyme at a concentration of 400 IU to broiler at the age of 21 days led to an increase in the level of glucose, as the results of this study matched what he indicated Kim *et al* (2017) mechanism that the addition of β-mannanase at 400, 800 and 1,600 IU increased the level of glucose, total cholesterol and triglycerides. The increased level of glucose, total cholesterol, triglycerides and HDL can be attributed to the role of the β-mannanase enzyme in reducing the viscosity of digested materials and increasing the digestion of non-starch polysaccharide , the addition of β-mannanase to poultry diets convert the negative effect of non-starch polysaccharide , including β-manan and the

production of MOS, which is one of the major products of β-manan degradation by β-mannanase, causing an increase in the level of glucose and cholesterol triglycerides (Ishihara *et al*. 2000; Khanongnuch *et al*., 2006). With regard to the effect of lysolecithin on some biochemical parameters, significant decrease in the level of total cholesterol, triglycerides, LDL and VLDL and significant increase in HDL level These results are consistent with Cho *et al* (2013) who indicated the lower level of triglycerides in serum broiler fed diets containing 0.05% external emulsions, including lysolecithin. The improvement in the biochemical parameters of the quail animal as a result of the addition of lysolecithin can be attributed to the role of lysolecithin in regulating fats metabolism in poultry (Jinhuang *et al*., 2008). If the process of digestion and absorption of fats in birds is incompetent due to the lack of production of the enzyme lipase and excreta of bile salts until the intestinal duct became mature (Zhang *et al*., 2011).Also, the process of digesting fats is complex and requires sufficient quantities of bile salts and the lipase enzyme, which are essential in the process of emulsification of fats (Ravindran *et al*., 2016). Probiotic caused a significant decrease in the level of glucose, total cholesterol, triglycerides and VLDL in the blood with a significant decrease in the athergenic index, with significant increase in the level of HDL compared to the control group. The results of this study were identical to what Qingqing *et al* (2016) mentioned, that the probiotic works to reduce the level of glucose in rats as indicated by both Lay-Gaik and Min-Tze (2010) that the probiotic works to reduce the level of cholesterol, triglycerides and the level of LDL in serum with increased level of HDL. Perhaps the ability of the probiotic to reduce the level of glucose in the blood serum is due to its antioxidant role (Willcox *et al*., 2004), where Yadav *et al* (2007, 2008) indicated that the probiotic reduces oxidative stress by inhibiting fat rancidity and increasing the level of antioxidants such as glutathione, glutathione peroxidase, Catalase, and SOD. This came in line with Imran *et al* (2012) stated that giving the probiotic with a concentration of 1 × 10 8 for ducks at a 160-day age increased the concentration of IL-2, SOD, IgA, IgG and the total antioxidant capacity in the blood and liver. The importance of the probiotic comes in reducing the level of triglyceride, cholesterol to its important role in fat metabolism, as the probiotic has an important role in increasing the separation of bile acids (Lambert *et al*., 2008). Since these acids are low in solubility and absorption in the intestine, this leads to increased Subtract them with excreta, as cholesterol is the main material in the manufacture of these acids, so many cholesterol molecules

will be consumed for the purpose of making bile acids and reducing the deficiency resulting from increasing their excretion, which leads to a decrease in the level of cholesterol (Begley *et al*., 2006).

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