Effect of β-mannanase, Lysolecithin and probiotic on some reproductive performance and hormone profile in female quail

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Abstract

The aim of this study to evaluate the effect of β-mannanase. Lysolecithin and Probiotic on some reproductive performance and hormone profile in female quail. Six hundred one day - old quail birds were randomly divided to four treatments (60 birds/treatment) with 3 replicates for each group treatment (20 birds / replicate) and at three duration periods. The first period 1-7 weeks, second period 7 - 13 weeks, third period 1-13 weeks. The group of study were control was fed on a standard ration. the second, third and fourth treatments were given β-mannanase. Lysolecithin. probiotic 0.5 g /kg ration respectively. Blood samples wear taken for blood serum analysis. including estimation of follicle- stimulating hormone and luteinizing hormone. The results revealed that the treated groups showed a significant increase in relative weight of the ovary and oviduct compared with control group. β-mannanase and probiotic groups showed a significant increase in the oviduct length compared with the control and Lysolecithin groups. There was a significant increase in the numbers of growing and mature follicles and weight of large follicle in all treated groups compared with control group. The 3rd period showed a significant increase in the relative weight of ovary. oviduct and numbers of growing follicles. while the 2nd and 3rd period showed a significant increase in the oviduct length. About the interaction between treatments and periods. the best result appeared in the ovarian relative weight in the 3rd period for probiotic and β-mannanase. the 3rd period of probiotic showed a significant increase in the oviduct relative weight and for the oviduct length at 2ed and 3rd period for probiotic and β-mannanase. while 3rd period of probiotic show best interaction in the numbers of growing follicles, as 2nd and 3rd periods showed better increase in the mature follicle's numbers and for large follicle weight in 1st and 2nd period of probiotic. The result also showed a significant increase in the FSH and LH level in all treated groups compared with control group. The 2nd and 3rd period were better significantly in the level of FSH and LH. Probiotic at 2nd and 3rd period showed a significant interaction on the level of FSH. On the other hand, 2nd and 3rd period for the β-mannanase and probiotic showed a better significant in the LH level. In conclusion. β-mannanase. Lysolecithin and probiotic supplementation to quail ration improved the hormonal status and enhance reproduction.

Keywords: β-mannanase, Lysolecithin, Probiotic, Quail, Reproduction
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تأثير إضافة أنزيم بيتا ـ مانانيز، لايزوليسثين والمعزز الحيوي في بعض المعايير التناسلية والهرمونية وفي إناث طائر السلوى

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الخلاصة

هدفت الدراسة الحالية لمعرفة تأثير إضافة أنزيم بيتا ـ مانانيز. لايزوليسثين والمعزز الحيوي في بعض المعايير التناسلية والهرمونية وفي إناث طائر السلوى. قسم ٦٠٠ طائر من أفراخ طائر السمان بعمر يوم واحد الى ٤ معاملات وبواقع (٦٠طائر/معاملة) و ٣ مكررات

لكل معاملة (٢٠طائر/مكرر) وعلى ٣ فترات. الفترة الأولى ١-٧ أسبوع. الفترة الثانية ٧-١٣ أسبوع والفترة الثالثة ١-١٣ أسبوع. هذه المعاملات كالآتي: معاملة السيطرة أعطيت عليقة قياسية. المعاملة الثانية والثالثة والرابعة أعطيت أنزيم بيتا - مانانيز. اللايزوليسثين والمعزز الحيوي بتركيز ٠,٥ غم /كغم علف على التوالي. وأخذت عينات من الدم لتقدير مستوى الهرمون المحفز لنمو الجريبات والهرمون اللوتيني. أظهرت النتائج زيادة معنوية في الوزن النسبي للمبيض وقناة البيض في مجاميع المعاملات مقارنة مع مجموعة السيطرة. سببت المعاملة بالأنزيم والمعزز الحيوي زيادة معنوية في طول قناة البيض مقارنة مع مجموعة اللايزوليسثين والسيطرة. هنالك زيادة معنوية في عدد الجريبات النامية والناضجة ووزن أكبر جريب في مجاميع المعاملات مقارنة مع السيطرة. أظهرت الفترة الثالثة زيادة معنوية في الوزن النسبي للمبيض وقناة البيض وعدد الجريبات النامية. بينما أظهرت الفترة الثانية والثالثة زيادة معنوية في طول قناة البيض. بالنسبة للتداخل بين المعاملات والفترات. أظهرت الفترة الثالثة للمعزز الحيوي والأنزيم أفضل تداخل معنوي في الوزن النسبي للمبيض. أظهرت الفترة الثالثة للمعزز الحيوي زيادة معنوية في الوزن النسبي لقناة البيض. بالنسبة لطول قناة البيض أظهرت الفترة الثانية والثالثة للمعزز الحيوي والأنزيم أفضل زيادة معنوية. في حين أظهرت الفترة الثالثة للمعزز الحيوي أفضل تداخل معنوي في عدد الجريبات النامية. في حين أظهرت الفترة الثانية والثالثة للمعزز الحيوي زيادة معنوية في عدد الجريبات الناضجة. بالنسبة لوزن أكبر جريب كانت في الفترة الأولى والثانية للمعزز الحيوي. أظهرت النتائج أيضاً زيادة معنوية في مستوى الهرمون المحفز لنمو الجريبات والهرمون اللوتيني في جميع المعاملات الثلاثة مقارنة مع مجموعة السيطرة. أظهرت الفترة الثانية والثالثة أفضل زيادة في مستوى الهرمون المحفز لنمو الجريبات والهرمون اللوتيني. أظهرت الفترة الثانية والثالثة للمعزز الحيوي أفضل تداخل معنوي في مستوى الهرمون المحفز لنمو الجريبات. من جهة أخرى أظهرت الفترة الثانية والثالثة للأنزيم والمعزز الحيوي أفضل زيادة معنوية في مستوى الهرمون اللوتيني. نستنتج من هذه الدراسة إن إضافة أنزيم بيتا-مانانيز اللايزوليسثين والمعزز الحيوي الى عليقة طائر السمان أدى الى تحسن في مستوى هرمونات الإنتاج والصفات التناسلية.

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 industry (1). 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. As a result of the increasing demand for animal protein, especially poultry, 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, it is characterized by a very rapid growth rate and high meat and eggs production. female puts between 250 - 300 eggs per year as well as breeding in accordance with an intensive breeding system with a number of 80-100 birds / m^2 (2). Feed additives are of the most important strategy in order to improve the productivity of poultry industry as organic acids and macrominerals (3), as well as β-mannanase to enhance benefit of ration, which has become common during the previous ten years (4). In addition, they treat the negative impact of low-energy bonds (5). One of these are β-mannanase (6). Ibuki *et al* (7) 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 (8). Where the studies conducted on humans and animals proved the ability of probiotics to change the type and number of intestinal microflora (9). The probiotic plays an important role in the natural gastrointestinal processes of the gastrointestinal tract of poultry, thus preserving the health of the animal, the disease also causes changes in the physico-chemical environment of the digestive tract also any slight change in the quality of food can significantly affect the microbial assembly thus affecting the health of the bird (10).

The aim of this study was to investigate the effect of β-mannanase, lysolecithin and probiotic on some reproductive parameters and hormonal status of female quail breeders.

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 separate rooms each room have a door and fully covered with soft metal wire, equipped with feed bowl, plastic water bowel, evacuator and thermometers, sawdust was used 5cm in thickness as a ground floor. 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 (11) (Table 1). 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.

Table 1: Composition of starter and finisher ration

Ingredients	Growth ration %	Production ration %
Maize	36	42
Wheat	22	22
Soy bean meal (24% protein)	35	30
Premix (40%protein)	5	4
Vegetable oil	1	1
Limestone	0.7	0.7
Salt	0.3	0.3
Total	100	100
Calculated Values*		
Metabolizable energy (Kal/kg)	2821.8	2985.1
Crude protein %	24.270	21.998
Crude fiber %	3.975	3.650

* According to N.R.C.1994

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 °C until assayed serum of follicle stimulating hormone (FSH) and luteinizing hormone (LH), were measured by using β-mannanase immunoassay test kit based on quantitative test of a solid phase B-mannanase - Linked immunosorbent Assay (ELISA).

Relative organs weight

After slaughtered the bird relative weight of ovary, oviduct, length of oviduct, numbers of growing, mature follicles, weight of large follicle was recorded, weighted, calculated as a percentage of life body weight.

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 (12) by using the ready statistical program SAS (13) under the level of significance $P \leq 0.05$.

Results

Data presented in table 2 and consequent table 2 showed the effect of β-mannanase, lysolecithin and probiotic on relative weight of ovary, oviduct, length of oviduct, numbers of growing and mature follicles and weight of large follicle. Statistical analysis showed a significant increase in the relative weight of ovary and oviduct in β-mannanase, lysolecithin and probiotic compared with the control group, the β-mannanase and probiotic were superior than lysolecithin group. The result showed a significant increase in the oviduct length in β-mannanase and probiotic groups compared with lysolecithin and control groups. The result also showed a significant increase in the numbers of growing and mature follicles and weight of large follicle in the treatment groups compared with the control group. Whereas the probiotic group superior than lysolecithin and β-mannanase in the numbers of growing and mature follicles and weight of the large follicle. The 3rd period of probiotic showed a significant increase in the relative weight of ovary. Oviduct and numbers of growing follicles, while the 2ndand 3rd period showed a significant increase in the length of oviduct. About the interaction between the treatments and periods, the best result in the relative weight of ovary in 3rd period for probiotic and β-mannanase and in the 3rd period for probiotic group in relative weight of oviduct and for the length of oviduct in the 2nd and 3rd period for probiotic and β-mannanase. While the 3rd period of probiotic show best interaction in the numbers of growing follicles, as in the 2nd and 3rd of probiotic in the numbers of mature follicles and for the weight of large follicle in the 1st and 2nd period of probiotic.

Figure 1 and 2 indicate the effect of β-mannanase, lysolecithin and probiotic on the level FSH and LH. The result shows a significant increase in FSH and LH level in all treated groups compared with control group. Also, the β-mannanase and probiotic superior the lysolecithin group. About the period (Figures 3 and 4) the 2nd and 3rd period was better significantly in the level of FSH and LH. For the interaction between the treatment and period (Figures 5 and 6) probiotic group at 2nd and 3rd period showed a significant

increase in FSH level. On the other hand, 2nd and 3rd period for β-mannanase and probiotic showed a significant increase on the LH level compared with other groups.

Table 2: Effect of β-mannanase. Lysolecithin and probiotic on some reproductive parameters in female quail

Effect	Groups	Parameters Means ± SE (n=6)					
		ovary % relative weight	oviduct % relative weight	oviduct length (cm)	no of growing follicles	no of mature follicles	large follicle weight (g)
Treatments	Control	3.44±0.04 ^{c}	3.36±0.01 ^{c}	40.53±0.14 ^{b}	23.22±0.26 ^{c}	3.27±0.15 ^{c}	2.83±0.07 ^{c}
	β-mannanase	4.42±0.03 ^{a}	4.41±0.03 ^{a}	41.19±0.10 ^{a}	30.27±0.46 ^{b}	4.72±0.13 ^{b}	3.58±0.05 ^{b}
	Lysolecithin	4.05±0.04 ^{b}	4.10±0.05 ^{b}	40.82±0.12 ^{b}	29.77±0.17 ^{b}	4.44±0.12 ^{b}	3.49±0.07 ^{b}
	Probiotic	4.39±0.03 ^{a}	4.39±0.03 ^{a}	41.17±0.11 ^{a}	32.11±0.27 ^{a}	5.27±0.13 ^{a}	3.90±0.02 ^{a}
Periods	1st period	4.05±0.06 ^{b}	4.02±0.08 ^{b}	40.64±0.10 ^{b}	28.37±0.66 ^{b}	4.41±0.23 ^{a}	3.46±0.11 ^{a}
	2nd period	4.01±0.08 ^{b}	4.01±0.08 ^{b}	41.10±0.12 ^{a}	28.54±0.70 ^{b}	4.41±0.16 ^{a}	3.470.08 ^{a}
	3rd period	4.17±0.1 ^{a}	4.16±0.10 ^{a}	41.04±0.10 ^{a}	29.62±0.83 ^{a}	4.45±0.17 ^{a}	3.41±0.08 ^{a}

Different letters within columns indicate significant differences at P≤0.05.

Consequent table 2: Effect of β-mannanase. Lysolecithin and Probiotic on some reproductive parameters in female quail

Groups	Parameters, Means ± SE (n=6) Effect of interaction between treatments and periods					
	ovary % relative weight	oviduct % relative weight	oviduct length (cm)	no of growing follicles	no of mature follicles	large follicle weight (g)
Control P1	3.65±0.09 d	3.39±0.04 f	40.14±0.21c	23.33±0.61 e	2.83±0.30 d	2.62±0.05 f
Control P2	3.34±0.02 e	3.34±0.02 f	40.73±0.24 abc	23.16±0.40 e	3.50±0.22 d	2.93±0.15 e
Control P3	3.340.02 e	3.34±0.02 f	40.73±0.24 abc	23.16±0.40 e	3.50±0.22 d	2.93±0.15 e
β-mannanase P1	4.37±0.10 b	4.35±0.07 c	40.97±0.13 ab	29.50±0.76 d	5.00±0.25 abc	3.75±0.08 abc
β-mannanase P2	4.38±0.03 b	4.37±0.03 bc	41.33±0.19 a	29.66±0.71 d	4.50±0.22 bc	3.53±0.04 cd
β-mannanase P3	4.53±0.02 a	4.52±0.01 ab	41.27±0.18 a	31.66±0.71 bc	4.66±0.21 abc	3.45±0.10 cd
Lysolecithin P1	3.94±0.07 c	4.09±0.14 de	40.51±0.16 bc	29.50±0.22 d	4.66±0.21 abc	3.58±0.15 bcd
Lysolecithin P2	3.97±0.03 c	3.97±0.03 e	41.07±0.23 ab	29.50±0.22 d	4.33±0.21 c	3.53±0.11 cd
Lysolecithin P3	4.24±0.01 b	4.24±0.00 cd	40.88±0.20 ab	30.33±0.33 cd	4.33±0.21 c	3.36±0.11 d
Probiotic P1	4.25±0.02 b	4.25±0.02 cd	40.95±0.17 b	31.16±0.30 bc	5.16±0.30 ab	3.91±0.02 a
Probiotic P2	4.36±0.03 b	4.37±0.03 bc	41.27±0.25 a	31.83±0.30 b	5.33±0.21 a	3.90±0.05 a
Probiotic P3	4.56±0.01 a	4.56±0.01 a	41.28±0.18 a	33.33±0.33 a	5.33±0.21 a	3.88±0.04 ab

Different letters within columns indicate significant differences at P ≤0.05, P1=first period p2= second period p3= third period.

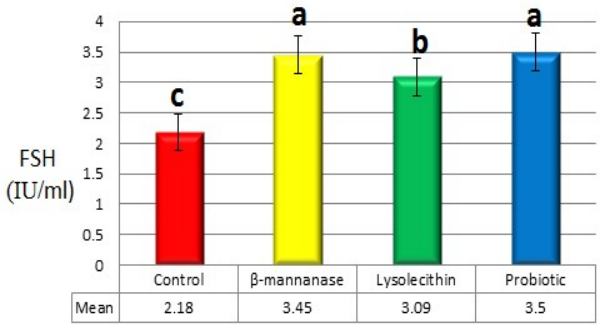

Figure 1: Effect of β-mannanase, lysolecithin and probiotic on FSH level in serum of quail breeders (effect of treatment).

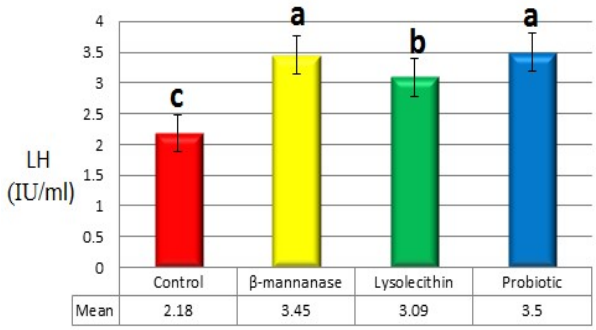

Figure 2: Effect of β-mannanase, lysolecithin and probiotic on LH level in serum of quail breeders (effect of treatment).

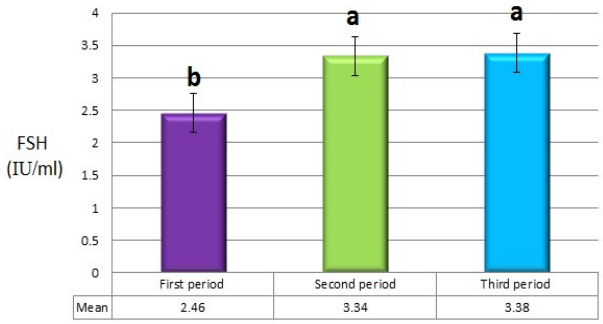

Figure 3: Effect of β-mannanase, lysolecithin and probiotic on FSH level in serum of quail breeders (effect of periods).

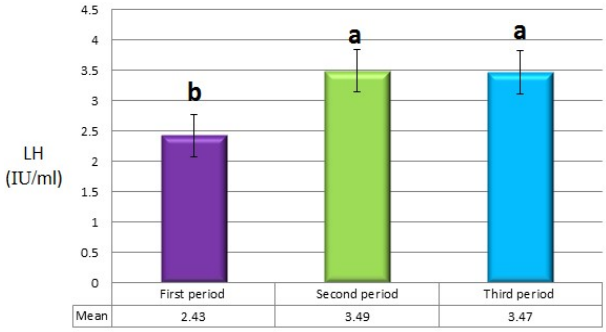

Figure 4: Effect of β-mannanase, lysolecithin and probiotic on LH level in serum of quail breeders (effect of periods).

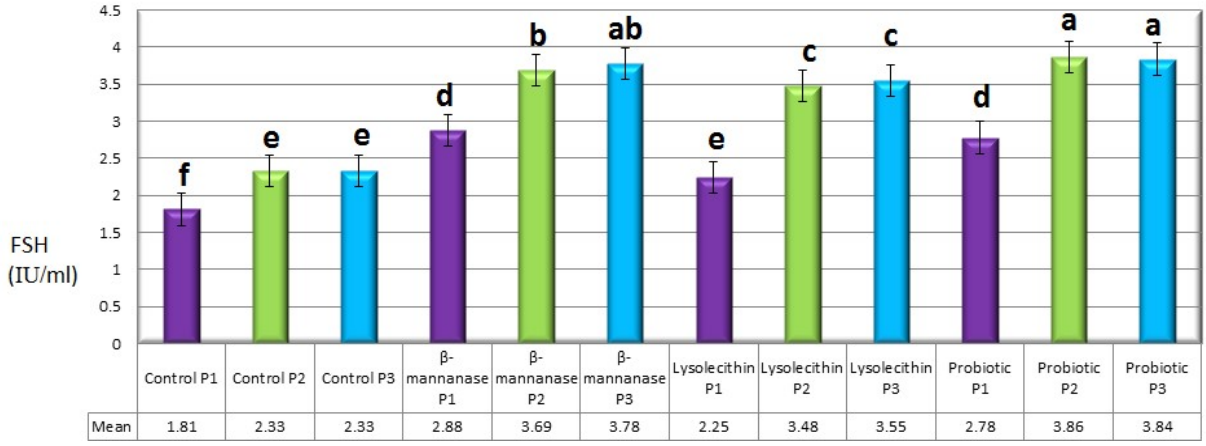

Figure 5: Effect of β-mannanase, lysolecithin and probiotic on FSH level in serum of quail breeders (effect of interaction between treatment and periods) P1= first period P2= second period P3= third period.

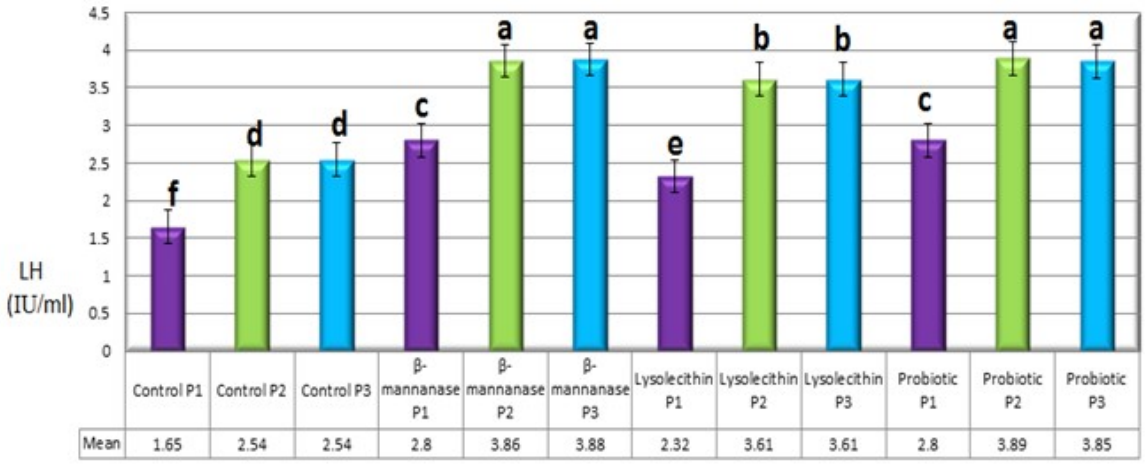

Figure 6: Effect of β-mannanase, lysolecithin and probiotic on LH level in serum of quail breeders (effect of interaction between treatment and periods) P1= first period P2= second period P3= third period.

Discussion

The result showed a significant increase in some reproductive parameters such as relative weight of ovary, oviduct, numbers of growing and mature follicles, weight of large follicle. From the result it could be postulate that this improvement in these parameters may be due to the hormonal status improvement specially the FSH level which enhance the follicles growing and the balance with LH level which enhance the ovulation rate, this suggestion was sustained by a significant increase in FSH and LH levels in the current study. This was agreed with Sultan and Abdul-Rhaman (14) who reported that probiotic at 10, 20 g/kg ration to broiler lead to increase level of FSH and LH. Improvement in FSH and LH levels were reflected an increase in the egg yolk weight by FSH and improvement of egg production% by LH (14), also this increase in FSH and LH level reflected by via improvement in animal performance, β-mannanase increase protein and minerals assimilation by reduce digestive viscosity and enhance the activity of digestive in the intestine Lv *et al* (15). β-mannanase decrease the viscosity of digesta, increase the rate of diffusion involved in the digestion and absorption of nutrient in the small intestine Jackson *et al* (16). The important role of β-mannanase is hydrolyzing β-1,4 glycosidic linkages in mannan (anti-nutrient compound) to produce mannan-oligosaccharide (MOS) Khanongnuch *et al* (17). MOS supplementation at 1kg/ton lead to improvement in egg production in quail, it has been supposed that the benefits of MOS based on its specific properties such as modification of the intestinal flora, reduction in turnover rate of the intestinal mucosa and modulation of immune system (18). The improvement in the weight of the female reproductive system may be due to improved nutritional status of the bird, where Gao *et al* (19) noted that changes in regulating the metabolism and function of organs that are dependent on the growth of the endocrine system have an important relationship to changes in the nutritional state of the bird so the use of external enzymes is an effective way to break down the walls of the cells of anti-nutrient compounds and improve the efficiency of production for non-ruminants including poultry. The importance of external emulsions is to improve digestion by increasing the formation of emulsified droplets that reduce surface tension and stimulate the formation of lipid particles and increase the concentration of monounsaturated fats in the intestines and thus facilitate the transfer of digested food through the walls of the intestines and facilitate the absorption process and power processing (20,21) and this will improved fat and protein digestion (22). Probiotic in poultry have several actions include maintaining normal intestinal microflora by competitive exclusion antagonism, competing for mucosal attachment, lowering the pH through acid fermentation, stimulating the immune system associated with the gut, producing bacteriocins and increasing production of short- chain fatty acids Chiara *et al* (23). The most characteristics of the probiotic are to compete with pathogenic bacteria on the adhesion site of the target organ, these site are usually in the gastrointestinal tract and the female reproductive canal and its adhesion ability is due to adhesion factors on the surface of the probiotic and existing receptors in host cells and especially epithelial cells in the intestine (24).

Conclusion

We concluded from this study that β-mannanase, lysolecithin and probiotic supplementation to quail ration showed a significant improvement on some reproduction parameters and hormonal status. Therefore. these products might be promising alternative for antibiotic growth promoters in animal feed.

Acknowledgments

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