Egypt. Poult. Sci. Vol (37)(II):(363-377)(2017) **(1719)**

Egyptian Poultry Science Journal

http://www.epsaegypt.com

ISSN: 1110-5623 (Print) – 2090-0570 (Online)

EFFECTS OF USING DDGS AND AVIZYME ENZYME IN THE BROILER DIETS ON SOME PHYSIOLOGICAL RESPONSES

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Received:10/04/2017 Accepted:25/042017

ABSTRACT: This experiment aimed to study the effect of using distillers dried grains with soluble (DDGS) at different levels (0, 5, 10, 15%) treated with or without enzyme (avizyme1500) at level 0 and 1g/ kg diet on some immunological and physiological responses of broiler chicks. Two hundred and sixty five, Arbor acres unsexed broiler day-old chicks, were randomly divided into eight groups with 32 birds per each. The sequence of the eight dietary treatments were as follow: T1- Basal diet (without DDGS or enzyme); T2, T3 and T4- Basal diet contains 5, 10 and 15% DDGS without enzyme; T5, T6, T7 and T8- Basal diet contain 0, 5, 10, 15% DDGS with enzyme. The results showed that blood proteins for birds fed dietary DDGS at different levels significantly ($p<0.01$) increased than those fed control diet. The means of total lipids, triglyceride, cholesterol, AST and ALT in the broilers fed dietary DDGS ($p<0.01$) differed, while creatinine value was insignificantly affected. The means of AST values for broilers fed the diet containing enzyme significantly ($p<0.01$) decreased, while ALT level was not affected. Similarly, the means of T_4 hormone concentration for broiler fed diet with adding enzyme significantly ($p<0.01$) reduced, while T_3 insignificantly reduced compared with control diet. The mean PCV% ($p<0.01$) increased while, Hb reduced significantly ($p<0.01$) compared with control diet while, no significant differences were detected in RBC's and WBC's counts.

From the present results it can be concluded that using grade levels (5, 10 and 15%) of DDGS in broiler diets as untraditional ingredient (as a replacement of corn and soybean ingredients of diet) led to improve the physiological and immunological responses.

Keywords: Broiler chicks - DDGS and avizyme enzyme - Physiological responses.

INTRODUCTION

As known, the feed represents approximately 60-70% of the production cost. Therefore, the nutritionist must consider cost, nutrient content of the ingredient and the quantity available for use as well as consistency of supply (Wang et al., 2007).

Nowadays, many attempts are usually made to reduce feed cost without adversely effect on performance and/or product safety by using some nontraditional ingredients in the diets. Moreover, enzymes were used most commonly to aid digestion of diets where improvements are seen in dry matter digestibility (Lesson and summers, 2005).

Recently, Batal and Dale (2003) stated that the increased emphasis on ethanol production as biofuel in the United States and other countries has and will continue to lead to significant increase in the dried distillers grains amount to the feed industry with soluble (DDGS). DDGS has been a by-product of the beverage industry, for the most part, with several different grains used in the fermentation process. Production of ethanol from 100 kg of corn using the dry-milling method produces approximately 34.4 kg of ethanol, 34.0 kg of carbon dioxide and 31.6 kg of distillers dried grains with soluble (Renewable Fuels Association, 2005). Distillers dried grains with soluble are higher in non-starch polysaccharides (NSP), crude protein (CP), crude fat, and minerals than the parent grain. However, monogastric do not digest feedstuffs high in NSP efficiently.

Enzymes are now being manufactured specifically for feed use, and can be broadly categorized as carbohydrates, proteinases and lipases. Increasing the digestibility of various carbohydrate fractions of cereals and plant proteins has received most attention, although there is growing interest in potential for improving digestibility of both plant and animal proteins, and saturated fatty acids for young birds. Examples of enzymes used in poultry

diets include: amylase, protease, xylanase. Beta-glucanase, mixtures of enzymes activities (Cowieson and Ravindran, 2008). The results of Liu et al. (2008) indicated that the broiler diets supplemented with phytase improved body weight, feed intake and feed conversion values than those fed control diet. Therefore, supplementing monogastric diets with exogenous enzymes may improve the available energy of DDGS by degrading the fiber content and increasing the digestibility of other components. Also, amylase improves starch digestion, xylanase reduces gut viscosity and breaks down cereal cell walls and protease affects soybean meal anti-nutritional factors and storage proteins (Graham and Aman, 1991). The objective of this experiment was to study the effect of replacing DDGS of corn and soybean meal at levels of 0, 5, 10 and 15% with or without enzyme (Avizyme 1500) at levels of (0 or 0.1g/kg diet) supplementation on some physiological responses.

MATERIALS AND METHODS

This experiment was carried out at the Poultry Farm, Faculty of Agriculture, Minia University, Egypt. It aimed to study the effect of using dried distillers grains with soluble (DDGS) at different levels (0, 5, 10 and 15 %) treated without or with enzyme (avizyme 1500) at level 0 and 1g / kg diet on some physiological and immunological responses of broiler chicks. Two hundred and sixty five unsexed, Arbor Acres broiler chicks, one day old were randomly distributed into 8 treatment groups with 32 chick per each i.e. (8 group's × 4 replicates × 8 chicks). The birds were housed in battery cages with dimensions (1 m length × 0.4 m wide × 0.6 m height). The experimental diets and fresh tab water were available ad-libitum during the experimental period. All chicks were kept under similar managerial and hygienic conditions. They were reared

at 32°C during the first week and gradually decrease untilabout 24°C at the 4th week up to the end of the experiment (6 weeks of age). All chicks were daily exposed 23 lighting hours thorough the experimental period.

The experimental period was divided into two feeding phases, starter period from 1-21 days of age then, they were switched to finisher period from 22-42 days of age. The basal experimental diet had 23 and 20% crude protein and 3100 and 3200 Kcal ME/kg diet for the starter and finisher diet, respectively. Experimental diets were formulated to meet the nutrients requirements of the broiler chicks according NRC (1994). Four levels of dried distillers grains with soluble (DDGS) and two levels of Avizyme 1500 were studied i.e. 4×2 factorial design. The DDGS levels were 0, 5, 10 and 15% as substitution of soybean meal and corn in broiler chick diets during starter and finisher periods. While, enzyme levels were 0 and 1g/kg diet. The Avizyme 1500® contained 600 U/g endo- 1, 4 beta xylanase, 1600 U/g alpha amylase and 4000 U/g protease.

The experimental diets and the chemical composition are presented in Table (1).

However, the composition and analysis of DDGS, soybean meal and yellow corn are presented in Table (2).

The sequence of the eight dietary treatments was as follow:-

1- Basal diet without DDGS or enzyme (T1).
2- Basal diet contains 5% DDGS without enzyme (T2).
3- Basal diet contains 10% DDGS without enzyme (T3).
4- Basal diet contains 15% DDGS without enzyme (T4).
5- Basal diet with enzyme (T5).
6- Basal diet contains 5% DDGS with enzyme (T6).
7- Basal diet contains 10% DDGS with enzyme (T7).
8- Basal diet contains 15% DDGS with enzyme (T8).

At the end of experiment (6 weeks), 32 chicks I (4 birds per treatment) were randomly taken, weighted and slaughtered after 12 hour of fasting, 32 blood samples were collected and divided into two parts, the first part was put in heparinized tube (2.25µ heparin / 5 ml blood) for the blood hematology and second sample was put in non–heparinized tube and centrifuged for 15 minutes at 3000 rpm to separate serum which stored at deep freezer (-20ºC) until biochemical measurements. Serum total protein and albumin concentrations were determined according to (Gornal et al., 1949; and Doumas et al., 1971) using commercial kits, while globulin concentration was determined by subtracting albumin from total protein. Serum glucose concentration was determined according to (Trinder, 1969). Glutamic–Pyruvic Transaminase (ALT) and Glutamic –Oxaloacetic Transaminase (AST) were determined according to (Reitman and Frankel, 1957). Serum total lipids, triglycerides and cholesterol were determined according to Zollner and Kirsch (1962), Fassati and Prencipe (1982) and Young (2001). Serum triiodothyronine (T3) and thyroxin (T4) concentrations were determined radioimmunoassay procedures according to Chopra et al. (1971) by using kits purchased from Diagnostic products corporation, United States (USA). T3/T4 ratio = T3 (ng/mg)/ T4 (ng/mg).

Hematological parameters:

Total red blood count ($N\times10^6$): The total red blood (RBC's) and Packed Cell Volume (PCV %) values were counted according to Daice and Lewis (1991). In addition calculation of the absolute values or the erythrocyte indices, namely mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) were calculated according to Konuk (1975).

Immunological parameters:

Total white blood cells count ($N\times10^3$): The WBC'S were counted according to Campbell (1995). The humoral immune response was determined according to Mcewan et al. (1970), Meguire et al. (1976) and Pfeiffer et al. (1977).

Statistical analysis: Statistical analysis was performed by analysis of variance (two way analysis), SAS Institute (2003) with the general liner model (GLM), while the significant mean differences were distinguished by Duncan's Multiple Range Test (Duncan, 1955). The statistical analysis was calculated using the following model:

$Y_{ijk} = \mu + T_i + E_j + T_iE_j + e_{ijk}$

Where: Y_{ijk} = Experiment observations.

μ = the overall mean.

T_i= the effect of DDGS levels (i = 1, 2, 3, 4).

E_j= Effect of enzyme level (j =1, 2).

T_iE_j = Effect of interaction between DDGS and enzyme (ij = 1 ….8)

e_{ijk} = the experimental error.

RESULTS AND DISCUSSION

Effect of dietary treatments on serum biochemical studies:

Data presented in Table 3, revealed that dietary DDGS in broiler diets at 0, 5, 10 and 15% levels recorded a highly significant ($p<0.01$) difference in total protein, albumin , globulin and glucose . The greatest significant ($p<0.01$) value of glucose was recorded for birds fed dietary 15 % DDGS compared with other DDGS levels. The improvement in the blood glucose for broilers fed diet containing DDGS may be due to a valuable source of energy in the DDGS for broilers. These results agree with those of Olentine (1986) and Noll et al. (2003).The present results indicated that higher value of the total protein and globulin concentration were recorded in DDGs treated than those control diet without any significant

differences. These results are in agreement with the findings of El-Abd (2013) who reported that the highest plasma total protein and globulin concentrations for Japanese quail fed the diets containing DDGS with 50 and 100 % than the control diet.

In the present study, it could be noticed that adding enzymes to broiler diet significantly reduced total protein and albumin, while adding enzyme reduce insignificantly globulin. The glucose level in the blood for the broilers fed the diet with adding avizyme 1500 enzyme to diet improved significantly than those of the control diet.

The means of total protein, albumin and glucose for broilers were highly significantly ($p<0.01$) affected by the interaction between dietary DDGS either with or without enzymes. The highest values of total protein treated groups could be attributed to increase of liver enzymes (AST and ALT) values than that of the control.Generally, the enhancement of glucose and total protein as a result of adding enzymes to broiler DDGS diet may be due to that Avizyme 1502 (AZ1502) is an enzyme product containing purified xylanase, amylase, and protease targeted toward markets in which corn- soybean meal (SBM) are the primary feedstuffs used in poultry diets. The findings of Chesson (2001) indicated that, the corn kernel contains 111 g/kg of total NSP, of which 23 and 30% for both of arabinose and xylose. That report could warrant the use of exogenous enzymes to increase digestibility.

On the other hand, Yassein et al. (2004) showed that, turkey plasma total protein, albumin and globulin concentration were not differ significantly as birds fed barley based-diets supplemented with or without enzymes (optizyme-p5) 1kg/ ton.

The data presented in Table 3, revealed that the total lipids, triglyceride and cholesterol for broilers fed dietary DDGS at different levels were significantly ($p\geq0.05$) affected, while creatinine value was not affected. The highly significant ($p<0.01$) value oftotal

lipid was recorded for birds fed dietary 5% DDGS compared to other DDGS levels. However, the highest ($p<0.01$) value of cholesterol was recorded for birds fed dietary 10% DDGS followed by 15% DDGS. It could be noticed that, the highest insignificant value of creatinine was recorded for birds fed dietary 10% DDGS followed by 15% DDGS and control diet. As a result of adding avizyme 1500 in Table 3, it could be noticed that adding enzymes to broiler diet significantly ($p<0.01$) reduced total lipids and triglycerides while, the cholesterol level was increased ($p<0.05$). However, creatinine value was not affected. According to the interaction between DDGS levels and enzyme additions, there were significant ($p<0.01$) differences between DDGS levels either with or without enzyme addition in total lipids and triglycerides values. While, cholesterol or creatinine values were not affected. These results agree with Zeweil et al. (2005), who stated that the plasma total lipids concentration in Japanese quails fed different levels of rice bran with or without Optizyme at level of 0.5g/kg feed were slightly differed than those of the control diet. Shalash et al. (2009) reported that the plasma cholesterol, lipids or creatinine content for broilers fed dietary 12% DDGS without or with enzyme were not affected than those of the control diet. Yassein et al. (2004) showed that, turkey plasma total lipids concentration was not differ significantly as birds fed barley based-diets supplemented with or without enzymes (optizyme-p5) 1kg/ ton.

The data presented in Table 4 revealed that the birds fed dietary DDGS at different levels recorded highly significant ($p<0.01$) differences in AST and ALT values. Generally, incorporating DDGS as a traditional ingredient to the broiler diet increased ($p<0.01$) AST and ALT at different levels compared to birds fed control diet. In the present study, adding enzymes to broiler diet insignificantly decreased ALT and significantly ($p<0.01$) reduced AST values. These findings are in agreement with those of Makled et al. (2005) who showed that, blood aspartate amino transferase; U/L was significantly increased as affected by adding Optizyme to rabbit's diet at 500 or 750 mg/kg diet. Referringto the effect of interaction between DDGS levels and enzyme additions, the results showed no significant differences between DDGS levels either with or without enzyme addition in AST and ALT values. The results indicated that, in spite of, enzyme addition, using dietary DDGS in broiler diets at different level 0, 5, 10 and 15% recorded a significant ($p< 0.05$) difference in T3/T4 ratio while, no significant differences were detected in T3 and T4 values. Birds fed dietary 5% DDGS recorded the best ($p<0.05$) value of T3/T4 ratio followed by birds fed dietary 10 % DDGS. Interaction between DDGS levels and avizyme 1500 additions, has a significant ($p<0.05$) difference in T4 and T3/T4 ratio among all dietary interaction, while, no significant ($p\geq0.05$) difference was recorded in T3 values. Birds fed dietary 5% DDGS without enzyme addition recorded the greatest ($p<0.05$) value of T4 followed by birds fed control diet without enzyme addition. The highest ($p<0.05$) value of T3/T4 ratio was recorded for birds fed dietary 5% DDGS contributed with enzyme compared with all dietary DDGS levels either with or without enzyme. The results of Yukio Akiba et al. (1982) indicated that, no significant differences were observed in thyroxin (T4) levels among dietary treatments, but plasma triiodothyronine (T3) levels in hens fed 20% DDGS diet was significantly lower than that of hens fed the basal diet. Zhang Shi-yuan et al. (2009) fed ducks on diets contained 0, 5, 8 and 11% DDGS. They concluded that, blood levels of T3 in three trial groups were significantly lower than that in the control group, while, blood T4 concentrations were significantly increased.

The best proportion of DDGS in the broiler diets are 8 and 11%, respectively.

Effect of dietary treatments on some hematological parameters:

The results in Table 5 showed significant differences between DDGS levels in RBC's, PCV, Hb, MCH and MCHC, while, no significant difference was detected in MCV as a result of using. The lowest ($p<0.05$) count of RBC's and Hb value were found forbroilers fed both of control diet and 10% DDGS, respectively compared to other DDGS levels. Generally, birds fed dietary 15% DDGS recorded the highest ($p<0.01$) values of RBC's, PCV%, Hb, MCH and MCHC compared to other treatments. Birds fed 5% and 15% DDGS levels recorded significant ($p<0.01$) differences in MCHC compared to birds fed control diet and 15 % DDGS. The increase in hemoglobin concentration could be attributed to the higher oxygen consumption associated with more hemoglobin saturation and dissociation rates (Yahav et al., 1998). Referring to the effect of adding avizyme, it could be noticed that adding enzyme to broiler diet significantly ($p<0.01$) increased PCV and MCV, while Hb, MCH and MCHC values were significantly reduced ($p<0.01$) compared with control diet. No significant ($p\geq0.05$) differences were detected as a result of adding enzyme to broiler diet in RBC's. These results agrees with Youssef et al. (2013) who indicated that the hemoglobin (Hb) concentration was significantly increased for birds fed all DDGS treated compared to control group. Regarding to the interaction between DDGS levels and enzyme additions, it could be, found that, there is a significant ($p<0.01$) difference in PCV%, Hb, MCH and MCHC. While, no significant ($p\geq0.05$) difference was found in RBC's and MCV values. In general, the highest ($p<0.01$) values of PCV, Hb, MCH as well as MCHC were recorded for birds fed dietary 15% DDGS without enzyme addition as compared with other dietary treatments.

Effect of dietary treatments on some immune parameters:

The effect of dietary DDGS levels, enzymes addition and their interaction on some immune parameters such as total leukocytes (WBC's x 103 /mm3) and total immune globulin (Ig) are presented in Table (5). There are a significant ($p<0.01$) difference between DDGS levels in total Ig. While, no significant difference was detected in WBC'S. The highest value ($p<0.01$) of total Ig was recorded for birds fed dietary 15% DDGS, while the lowest value ($p<0.01$) was obtained in birds fed control diet. It could be noticed that, adding enzyme to broiler diet significantly ($p<0.01$) improved total Ig. However, birds fed dietary incorporated with enzyme had highest insignificant value in WBC's compared to birds control diet. According to the interaction between DDGS levels and enzyme additions, it could be, found that, there is a significant ($p<0.01$) difference in WBC's and total Ig among all dietary interaction treatments. The results showed that the highest value of WBC's were obtained in chicks fed dietary 10% DDGS without enzyme addition, followed by those fed dietary 5% DDGS as compared with different dietary treatments. The total Ig for birds fed dietary 15% DDGS recorded the highest ($p<0.01$) value incorporated with enzyme compared with other dietary DDGS levels either with or without enzyme. The lowest ($p\geq0.05$) vales of WBC's and total Ig were noticed when birds fed control diet.

Barekatain et al. (2013) reported that adding DDGS to the diets improved ($p<0.01$) the IgA and IgG values at 13^{th} day but interacted with the disease challenge, reducing the concentration of IgA at 21day and IgM at 35^{th} day in the infected birds. Zou1 et al. (2006) found that the broiler chicks fed on corn-soybean meal basal diets and supplemented with β-mannanase (Hemi

cell) enzyme at 0, 0.025, 0.05, and 0.075% levels, respectively. They indicated that, hemi cell significantly increased ($p<0.05$) the serum IgM concentration in 3- and 6-wk-old broilers. The results of Ragy (2013) indicated that the antioxidant capacity for quail fed on corn-soybean meal based diets contained 0, 10, 15 and 20% DDGS with or without enzymes significantly differed among treated than that of the control. It can be concluded that using gradually levels (5, 10 and 15%) of DDGS in broiler diets improved the physiological and immunological responses.

Table (1): Composition, calculated and determined analysis of starter (1-21 days of age) and finisher (22-42 days of age) diets

Ingredients	Finisher				Starter			
	Levels of DDGS							
	0 %	5 %	10 %	15%	0 %	5 %	10 %	15%
Yellowcorn,ground	52.17	49.62	46.83	44.29	60.50	57.63	55.08	52.50
Soybean Meal,44%	32.00	29.30	26.80	24.10	23.50	21.00	18.30	15.65
DDGS *	0.00	5.00	10.00	15.00	0.00	5.00	10.00	15.00
Broilerconcentrate,45%	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Cotton seed oil	4.28	4.53	4.82	5.06	4.40	4.72	4.97	5.20
Limestone	0.80	0.80	0.80	0.80	0.85	0.90	0.90	0.90
Vit. Min. Premix **	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Salt, NaCl	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Total	100	100	100	100	100	100	100	100
Calculated analysis								
Crude protein % ***	23.65	23.85	23.30	23.39	20.27	21.09	19.44	19.44
ME (Kcal /kg)	3100	3100	3100	3100	3200	3200	3200	3200
Crude fiber, %* * *	3.03	3.47	4.28	3.57	2.70	3.13	3.94	3.20
Calcium, %	1.01	1.01	1.01	1.01	1.00	1.03	1.03	1.03
Available phosphorus	0.65	0.67	0.68	0.70	0.62	0.64	0.65	0.66
Methionine and cysteine	0.93	0.94	0.95	0.95	0.85	0.86	0.87	0.87
Lysine, %	1.37	1.32	1.28	1.23	1.16	1.12	1.07	1.02

* Dried distillers grains with soluble

** Each 2.5 Kg of vitamins and minerals mixture contains: Vitamin D3, 12000.000 IU; Vitamin E acetate, 10.000 mg; Vitamin K3, 2000 mg; Vitamin B1, 100 mg; Vitamin B2, 4000 mg; Vitamin B6, 1500 mg; Vitamin B12, 10 mg; pantothenic acid, 10.000 mg; nicotinic acid, 20.00 mg; Folic acid, 1000 mg; Biotin, 50 mg; chorine, 500 mg; Copper, 10.000; Iodine, 1000 mg; Iron, 300.00 mg; Manganese, 55.000 mg; Zinc, 55.000 mg; and Selenium, 100 mg.

* * * Determined analysis

Table (2): Proximate analysis (%) of dried distillers grains with soluble (DDGS), Yellow corn and Soybean meal

Ingredients	Dry matter	Organic matter	Ash	Crude Protein	Crude fiber	Ether extract
DDGS	90.53	91.81	8.19	25.7	9.08	9.27
Soybean meal	89.2	94.1	5.9	43.21	6.7	0.95
Yellow corn	88.5	98.1	1.9	8.6	2.4	3.5

Table (3): Effect of dried distillers grains with solubles (DDGS) levels, enzyme preparation and their interaction on total protein, albumin, globulin, total lipid, triglyceride, cholesterol and creatinine of broiler chicks

Traits / Treatment		Blood proteins: Total Protein g/dl	Blood proteins: Albumin g/dl	Blood proteins: Globulin g/dl	Glucose mg/dl	Total lipids (g/dl)	Triglycerides (mg/dl)	Cholesterol (mg/dl)	Creatinine (mg/dl)
(A) Effect of DDGS:									
0%		5.01^{b}	3.29^{c}	1.72^{b}	256.94^{bc}	0.69^{c}	210.00^{ab}	137.50^{c}	0.85
5%		5.29^{b}	3.19^{b}	2.10^{ab}	269.44^{b}	0.81^{a}	208.33^{ab}	147.50^{c}	0.65
10%		5.98^{a}	3.77^{ab}	2.20^{a}	244.44^{c}	0.76^{b}	196.67^{b}	173.83^{a}	1.09
15%		5.72^{a}	3.45^{bc}	2.28^{a}	319.44^{a}	0.76^{b}	225.00^{a}	162.50^{b}	0.93
SE±		0.20	0.15	0.13	7.92	0.01	5.59	3.71	0.20
Significant		**	**	*	**	**	*	**	N.S
(B)Effect of enzyme addition:									
Without enzyme		6.04^{a}	3.86^{a}	2.18	238.89^{b}	0.78^{a}	221.67^{a}	150.67^{b}	0.85
With enzyme		5.45^{b}	3.49^{b}	1.96	306.25^{a}	0.73^{b}	198.33^{b}	160.00^{a}	0.91
±SE		0.14	0.10	0.09	5.60	0.01	3.95	2.62	0.14
Significant		**	*	N.S	**	**	**	*	N.S
(A*B) Interaction:									
Without enzyme	T1 0%	4.58^{bc}	3.10^{dc}	1.48^{d}	238.89^{cd}	0.69^{d}	230.00^{b}	128.33	0.61
	T2 5%	7.29^{a}	4.88^{a}	2.42^{bc}	258.33^{cb}	0.85^{a}	193.33^{d}	146.67	0.77
	T3 10%	4.93^{bc}	3.27^{dc}	1.66^{d}	208.33^{d}	0.84^{ab}	203.33^{cd}	167.67	1.27
	T4 15%	7.37^{a}	4.20^{b}	3.17^{a}	250.00^{c}	0.75^{c}	260.00^{a}	160.00	0.75
With enzyme	T5 0%	5.43^{b}	3.48^{c}	1.95^{dc}	275.00^{cb}	0.69^{d}	190.00^{d}	146.67	1.09
	T6 5%	5.28^{b}	3.51^{c}	1.77^{d}	280.56^{b}	0.68^{d}	223.33^{bc}	148.33	0.54
	T7 10%	**7.02^{a}**	4.28^{ab}	2.74^{ab}	280.56^{b}	0.51^{e}	190.00^{d}	180.00	0.91
	T8 15%	4.07^{c}	2.70^{d}	1.38^{d}	388.89^{a}	0.79^{b}	190.00^{d}	165.00	1.11
±SE		0.28	0.21	0.19	11020	0.02	7.91	5.24	0.28
Significant		**	**	**	**	**	**	N.S	N.S

a, b,c,..etc Means in each column, within each item, bearing the same superscripts are significantly different ($p<0.05$). N.S not significantly different ($p\geq0.05$). (Means ± SE). Avizyme 1500 enzyme at levels of 0 and 1g/kg diet.

Table (4): Effect of dried distillers grains with soluble (DDGS) levels, enzyme preparation and their interaction on liver enzymes and thyroid hormones in broiler chicks

Traits / Treatment		Liver enzymes		Thyroid hormones		T3/T4 Ratio
		AST (IU/L)	ALT (IU/L)	T3 (ng/ml)	T4 (ng/ml)	
(A) Effect of DDGS:						
0%		87.23[b]	6.88[b]	1.02	16.11	0.07[b]
5%		92.58[a]	7.55[a]	1.29	15.48	0.09[a]
10%		92.37[a]	7.32 [a]	1.42	17.52	0.08[ab]
15%		89.07[b]	7.58 [a]	1.20	17.70	0.07[b]
SEM		0.70	0.10	0.09	0.90	0.01
Significant		**	**	N.S	N.S	*
(B)Effect of enzyme addition:						
Without enzyme		93.30[a]	7.35	1.25	18.21[a]	0.07[b]
With enzyme		87.32[b]	7.32	1.22	15.20[b]	0.08[a]
±SE		0.496	0.07	0.07	0.64	0.01
Significant		**	N.S	N.S	**	*
(A*B) Interaction:						
Without enzyme	T1 0%	86.97[b]	6.62[c]	1.00	18.22[ab]	0.06[b]
	T2 5%	99.43[a]	8.16[a]	1.23	19.01[a]	0.06[b]
	T3 10%	88.28 [b]	6.17[d]	1.43	17.82[ab]	0.08[b]
	T4 15%	98.52[a]	8.44[a]	1.34	17.79[ab]	0.08[b]
With enzyme	T5 0%	87.48[b]	7.14[b]	1.04	14.01[bc]	0.07[b]
	T6 5%	85.72[b]	6.93[bc]	1.36	11.95[c]	0.12[a]
	T7 10%	96.45 [a]	8.47[a]	1.41	17.22[ab]	0.08[b]
	T8 15%	79.63 [c]	6.72[bc]	1.06	17.62[ab]	0.06[b]
SEM		0.99	0.14	0.13	1.27	0.01
Significant		**	**	N.S	*	*

[a, b,c,..etc] Means in each column, within each item, bearing the same superscripts are significantly different ($p<0.05$). N.S not significantly different ($p\geq 0.05$). (Means ± SE). Avizyme 1500 enzyme at levels of 0 and 1g/kg diet.

Table (5): Effect of dried distillers grains with solubles (DDGS) levels, enzyme preparation and their interaction on some blood characteristics of broiler chicks

Traits / Treatment		RBC′s x106 /	WBC′s x103/	Total Ig (mg/dl)	PCV%	Hb (g/dl)	MCV X 10-5 (fl)	MCH X10-5 (pg)	MCHC (g/dl)
(A) Effect of DDGS									
0%		3.16^{b}	9.18	182.92^{d}	31.33^{b}	9.30^{c}	99.57	2.96^{b}	0.30^{b}
5%		3.45^{a}	9.68	236.20^{b}	31.83^{b}	11.98^{b}	92.93	3.48^{a}	0.38^{a}
10%		3.38^{ab}	9.87	200.23^{c}	31.00^{b}	9.41^{c}	91.76	2.79^{b}	0.31^{b}
15%		3.62^{a}	9.49	265.45^{a}	34.67^{a}	13.19^{a}	97.82	3.64^{a}	0.38^{a}
SE±		0.09	0.23	5.22	0.48	0.29	2.28	0.09	0.01
Significant		*	N.S	**	**	**	N.S	**	**
(B)Effect of enzyme addition									
Without enzyme		3.45	9.4	202.739^{b}	31.04^{b}	11.91^{a}	90.28^{b}	3.44^{a}	0.38^{a}
With enzyme		3.35	9.71	239.66^{a}	33.38^{a}	10.03^{b}	99.71^{a}	2.99^{b}	0.30^{b}
SEM		0.06	0.15	3.69	0.34	0.20	1.61	0.06	0.01
Significant		N.S	N.S	**	**	**	**	**	**
(A*B) Interaction									
Without enzyme	T1 0%	3.17	8.38^{d}	173.41^{d}	29.50c	9.62^{c}	93.72	3.06^{cd}	0.33^{c}
	T2 5%	3.59	9.05^{c}	228.47^{bc}	30.33c	11.98^{b}	85.06	3.35^{bc}	0.40^{ab}
	T3 10%	3.37	10.63^{a}	180.64^{d}	29.00^{c}	10.82^{bc}	86.06	3.21^{c}	0.37^{b}
	T4 15%	3.67	9.53^{bc}	228.44^{bc}	35.33^{a}	15.21^{a}	96.27	4.14^{a}	0.43^{a}
With enzyme	T5 0%	3.15	9.98^{b}	192.43^{d}	33.17^{ab}	8.98^{d}	105.41	2.86^{d}	0.27^{d}
	T6 5%	3.31	10.30^{ab}	243.94^{b}	33.33^{ab}	11.98^{b}	100.81	3.62^{b}	0.36^{bc}
	T7 10%	3.39	9.10^{c}	219.82^{c}	33.00^{b}	7.99^{e}	97.46	2.36^{e}	0.24^{d}
	T8 15%	3.57	9.45^{bc}	302.46^{a}	34.00^{ab}	11.18^{b}	95.15	3.13^{cd}	0.32^{c}
SEM		0.13	0.31	7.39	0.67	0.40	3.22	0.13	0.01
Significant		N.S	**	**	**	**	N.S	**	**

$^{a, b,c,..etc}$ Means in each column, within each item, bearing the same superscripts are significantly different ($p<0.05$).N.S not significantly different ($p\geq 0.05$). (Means ± SEM). Avizyme 1500 enzyme at levels of 0 and 1g/kg diet

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الملخص العربى

تأثير استخدام مخلفات التقطير الحيوي للحبوب وانزيم الافازيم فى علائق كتاكيت التسمين علي بعض الإستجابات الفسيولوجية

كوثر عبدالرحمن غالي؛ عطيات حسن بغدادي؛ شاكر أحمد عبداللطيف؛ عبدالحميد صلاح عبدالحميد
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إستهدفت هذه التجربة دراسة إحلال مخلفات التقطير الحيوي للحبوب من فول الصويا و الذرة مستويات (صفر، 5، 10، 15%) سواء بإضافة أو بدون إضافة (انزيم الافازيم 1500) عند مستوي (صفر و 1جرام/ كيلوجرام عليقة) على بعض الإستجابات الفسيولوجية والمناعية لكتاكيت التسمين. أجريت الدراسة علي 256 كتكوت تسمين (اربر ايكرز) عمريوم، قسمت بالتساوي إلى 8 معاملات بكل منها 32 طائر، كل مجموعة تحتوي على 8 مكررات وتم تقسيم معاملات التغذية كالأتى: المعاملة الأولي (مجموعة مقارنة) و فيها تم تغذية الكتاكيت علي عليقة كنترول بدون إضافة الانزيم و بدون مخلفات التقطير الحيوى. بينما تغذت مثيلاتها بالمعاملة الثانية والثالثة والرابعة علي عليقة احتوت علي 5 ، 10و 15% مخلفات التقطير الحيوي بدون الانزيم. تم تغذية كتاكيت المعاملة الخامسة والسادسة والسابعة والثامنة علي عليقة الكنترول مضاف إليها الانزيم بمستوى صفر ، 5 ، 10 و 15% من مخلفات التقطير الحيوي.

خلصت نتائج الدراسة إلي ما يلي:

أن الطيور المغذاه على مستويات مختلفة من مخلفات التقطير إزدادت بها و بصورة معنوية (عند مستوى 1%) بروتينات الدم لكتاكيت التسمين مقارنة بالكتاكيت المغذاة على عليقة الكنترول. إختلفت وبصورة معنوية (عند مستوى 1%) متوسطات الدهون الكلية والجليسريدات الثلاثية والكوليسترول وانزيمات الكبد لكتاكيت التسمين المغذاة على عليقة مضاف إليها مخلفات التقطير الحيوي للحبوب، بينما لم يتأثر مستوى الكيراتينين معنوياً بالمقارنة بمجموعة المقارنة. إنخفضت وبصورة معنوية (عند مستوى 1%) متوسطات الدهون الكلية والجليسريدات الثلاثية، بينما إزداد مستوى الكوليسترول معنوياً بالإضافة إلى عدم وجود تأثير معنوى على مستوى الكيراتينين. إنخفض وبصورة غير معنوية مستوى انزيم الكبد ALT، بينما إنخفض معنوياً مستوي الـ AST مقارنة بمجموعة المقارنة. أوضحت النتائج أيضاً أن إضافة الانزيم لعلائق كتاكيت التسمين قلل معنوياً مستوى هرمون الثيروكسين، بينما لم تؤثر إضافته علي هرمون الترای ايودوثيرونين مقارنة بمجموعة الكتاكيت المغذاة على علائق الكنترول و إزداد مستوى الـ PCV معنوياً (عند مستوى 1%)، وقل مستوى الهيموجلوبين بالمقارنة بمجموعة الكنترول، بينما لم يتأثر عدد كرات الدم الحمراء و البيضاء. تحسن مستوى المناعة الكلية معنوياً بإضافة مخلفات التقطير الحيوي للحبوب. بينما لم تتأثر كرات الدم البيضاء. ولقد حسنت إضافة الانزيم من المناعة الكلية معنوياً. عموماً إضافة الانزيم لعليقة التسمين سجلت أعلى قيمة.