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PERFORMANCE OF BROILER CHICKS AFFECTED BY DIETARY SUPPLEMENTATION WITH COMMERCIAL ENZYMES OR PROBIOTICS

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ABSTRACT

The present study was carried out to investigate the effect of using graded levels of Bio-Nutra 200 and Natuzyme with plant protein diets on the performance of broiler chicks. three dietary levels (0.25, 0.50 and 0.75g/kg) of either Bio-Nutra 200 (probiotic) or Natuzyme (enzyme preparation) in addition to the control without supplementation were used. Therefore, seven experimental diets were formulated to have similar crude protein and metabolizable energy contents during both starter and grower periods. Three hundred thirty six one-day-old unsexed Hubbard broilers were randomly distributed to seven equal experimental groups. The chicks were fed the experimental starter diets from one day to 21 days of age and switched to feeding the experimental grower diets from 22 to 42 days of age. All chicks were managed similarly and had free access to feed and water during both the starter and grower periods. The criteria of response were live body weight, weight gain, feed intake, feed conversion, economical efficiency of growth, carcass traits, nutrient digestibility [dry matter (DM), organic matter (OM), crude protein (CP), ether extract (EE), crude fiber (CF) and nitrogen-free extract (NFE), and ash retention], some blood plasma parameters [total protein, albumin and cholesterol , and activity of alanine aminotransferase (ALT) and aspartate aminotransferase (AST) in blood plasma].

The obtained results for the whole experimental period could be summarized as follows: Birds fed either the probiotics- or enzymes-supplemented diets had significantly higher means of final live body weight, weight gain, feed conversion, economic efficiency of growth, nutrient digestibility (*i.e.* DM, OM and CF), with insignificant differences among them, compared with their control counterparts.

In general, birds fed either probiotics- or enzymes supplemented diets achieved significantly higher means of most carcass traits and some blood parameters compared with birds fed control diets; however, AST and ALT were negatively affected. The other criteria were not affected by level of both feed additives. In conclusion, the current study may indicate beneficial effects of adding probiotics and exogenous enzymes (particularly with the level of 0.075 g/ kg) to broiler diets.

Keywords: Bio-Nutra 200, Natuzyme, broiler performance, carcass traits, blood parameters.

INTRODUCTION

Nowadays, most nutritionists formulate diets destined for poultry based completely on oil-seed meals, cereal grains and their by-products. Such plant feed ingredients naturally contain a variety of antinutritional substances that cannot be digested by monogastric animals, because of the lack or insufficiency of endogenous enzyme secretions. In addition to being unavailable to poultry, these components also lower the utilization of other dietary nutrients, leading to depressed performance. Recently, the inclusion of commercial enzymes into poultry diets has become a common practice, with different degrees of success depending upon the stress, health and nutritional status of the bird. The main targets for using feed enzymes are to increase digestibility or availability of nutrients, to break down the antinutritional factors, to achieve the least cost feed formulations and for environmental reasons (Bedford, 1996 and Bedford and Morgan, 1996).

The use of natural components in poultry diet is now practiced worldwide. Probiotics are live, nonpathogenic bacteria that contribute to the health and balance of the intestinal tract of the host animal. They are given orally to poultry to help the birds fight morbidity and disease (Miles and Bootwella, 1991). Prebiotics are non-digestible foods or nutrients that probiotics need to stimulate metabolism. Prebiotics are used by the beneficial bacteria and modify the composition of intestinal microflora, so probiotics can predominate (Makled, 1991; Mohan *et al*, 1996). Therefore, probiotics have been used as natural compounds in poultry diets to improve the bird performance.

The present study was carried out to investigate the impact on broiler chicks' performance of including an enzyme preparation (Natuzyme[1]) and a probiotic (Bio-Nutra 200[2]) into their diets.

MATERIALS AND METHODS

The current study was carried out at the Poultry Research Unit, Agricultural Research and Experiment Center, Faculty of Agriculture, Mansoura University. The aim of present study was to investigate the effect of including different levels of Natuzyme and Bio-Nutra 200 in plant protein broilers' diets on their performance, digestibility of nutrients, certain carcass traits, some blood parameters and economical efficiency.

Experimental diets:

Starter and grower basal diets composed mainly of yellow corn, soybean meal and corn gluten meal were formulated to ensure an adequate intake of all nutrients for broiler chicks, as recommended by the National Research Council (NRC, 1994), for both starting and growing periods. Ingredient composition and calculated analysis of the basal diets are shown in Table 1. The Bio-Nutra 200 and Natuzyme were added to the basal diet at different levels as follows: Diet 1 (no addition, control), Diets 2, 3 and 4 contained Bio-Nutra 200 at levels of 0.25, 0.50 and 0.75 g/kg, respectively, and Diets 5, 6 and 7 contained Natuzyme at levels of 0.25, 0.50 and 0.75 g/kg, respectively.

Birds and management:

Three hundred thirty-six, one-day-old unsexed Hubbard chicks were utilized in this study. The chicks were wing-banded, weighed and randomly divided into seven equal experimental groups. Chicks of each group were subdivided into three equal replications and housed in battery cages. Chicks were received their experimental starter diets [containing 23% crude protein (CP) and metabolizable energy (ME) of 3100 kcal/kg] from one to 21 days of

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[1]- Natuzyme (was added at 1 g/kg) is a multifunctional feed enzyme mixture containing cellusase, xylanase, β-glucanase, α-amylase, protease, pectinase and phytase.

[2]- It also contains hemicellulases, amyloglycosidases and pentosanases activity.

age. Then, they were switched to experimental grower diets (containing 21% CP and ME of 3100 kcal/kg) from 22 to 42 days of age. Feed and water were offered *ad libitum*. All chicks were kept under the same managerial, hygienic and environmental conditions.

Criteria of response:

All birds were individually weighed at one-day old, and on weekly basis thereafter. Records on live body weights (LBW) and feed intake (FI) were maintained weekly. Thus, body weight gain (BWG) and feed conversion (FC) were determined weekly. Economical efficiency of growth (EEG) of birds was also determined for the entire experimental period; thereby relative economical efficiency was calculated.

When the birds were five weeks of age, seven digestion trials were run for three consecutive days during which feed intake and droppings voided for each replicate group within the same treatment were quantitatively estimated. Representative samples of droppings of each treatment were pooled, carefully mixed, oven-dried and stored for later analysis. The proximate analysis of the experimental diets and dried droppings was performed according to the official methods of analysis (AOAC, 1990). Nutrient digestibility and ash retention of the experimental diets were determined.

Table (1): Ingredient composition and calculated analysis of the basal diets

Ingredient (%)	Starter diet	Grower diet
Yellow corn	63.40	67.27
Soybean meal 48% CP	16.50	15.86
Corn gluten meal 60% CP	16.00	12.27
Dicalcium phosphate	1.60	1.70
Ground limestone	1.50	1.40
Common salt (NaCl)	0.30	0.30
Vit. & min. premix[§]	0.30	0.30
DL-Methionine	0.10	0.10
L-Lysine Hcl	0.30	0.30
Total	100	100
Calculated analysis (NRC, 1994)		
ME (kcal/kg)	3100	3100
Crude protein (%)	23	21
Calcium (%)	1.00	0.97
Available phosphorus (%)	0.66	0.48
Lysine (%)	1.10	1.10
Methionine (%)	0.55	0.55
Clean sand	_	0.5
Determined analysis (AOAC, 1995)		
DM (%)	97.42	88.97
CP (%)	22.82	20.85
EE (%)	3.75	3.43
CF (%)	3.78	3.47
Ash (%)	9.81	8.97
NFE (%)	69.29	63.28

[§]: Supplies the following per kg of formulated diet: Vit. A, 1000 IU; Vit. D_3, 2000 IU; Vit. E, 10 mg; Vit. K_1, mg; Vit. B_1, 5 mg; Vit. B_2, 5 mg; Vit. B_6, 1.5 mg; Vit. B_{12}, 0.01 mg; Folic acid, 0.35 mg; Biotin, 0.05 mg; Pantothenic acid, 10 mg; Niacin, 30 mg; Choline chloride, 250 mg; Fe, 30 mg; Zn, 50 mg; Cu, 4 mg and Se, 0.1 mg.

At the end of the experimental period (6 weeks of age), three birds from each treatment were randomly selected, weighed (after a 12-hr-fasting period) and slaughtered. Immediately after complete bleeding, their feathers were plucked and reweighed. Then, the hot carcasses were eviscerated and weighed. Records on liver, gizzard and heart, and the front and hind parts of carcass were also maintained. The percentages of carcass yield and edible organs to live body weight were calculated.

At slaughtering, blood samples were collected from the birds in heparinized tubes. Plasma was separated by centrifugation at 4000 rpm for 10 minutes and stored rapidly at -20ºC until the time of analysis. Blood plasma concentrations of total protein (Henry, 1964), albumin (Doumas *et al.*, 1971), cholesterol (Allain *et al.*, 1974), and activity of alanine aminotransferase (ALT) and aspartate aminotransferase (AST) in blood plasma (Reitman and Frankel, 1957) were determined.

Data were analyzed by the Statistical Analysis System (SAS, 1990). Duncan's new multiple range test (Duncan, 1955) was used to separate significant differences (at a probability level of 0.05) among means of criteria of response.

RESULTS AND DISCUSSION

Growth Performance:

The effects of using different levels of probiotics and enzymes on growth performance are shown in Table 2. Final LBW, BWG and EEG were significantly improved ($P<0.05$) with increasing the level of feed additives in the diets. However, birds received the diet containing 0.75 g probiotics/kg diet had significantly the highest ($P<0.05$) LBW, BWG and EEG while the birds fed the control diet had the lowest corresponding values (Table 2). The present results revealed that chicks fed the diets supplemented with probiotics or enzymes consumed significantly less feed ($P<0.05$) compared with their control counterparts. It was observed that the lowest ($P<0.05$) amount of feed intake was recorded for birds fed the diet containing 0.75 g probiotics/kg. It is interesting to note that the best value of feed conversion was attained by birds fed the diet containing 0.75 g probiotics/kg. The improved feed conversion of this dietary treatment is mainly attributable to higher BWG and lower feed intake compared with those of other dietary treatments. The improvement in BWG and FC, reported herein, was associated with a positive impact on EEG.

Such improvements in LBW, BWG and FC may be due to the improvement in the digestion, absorption and utilization of nutrients in response to supplemental feed additives (Table 2). It is well known that most growth promoters act by modifying the intestinal flora, especially targeting gram-positive bacteria, which are associated with poorer health and performance of poultry. Indeed, many so-called non-pathogenic bacterial species improve feed conversion and growth in chickens due to competition with the host for the nutrients in the intestinal tract, degradation of host enzymes and increasing of the absorptive surface area (Bedford, 2003).

These results are in agreement with the findings of Tawfeek *et al.* (1993), Cavazzoni *et al.* (1998), Abd-Elsamee (2001) and Salim (2004) who found significant increases in growth performance, net revenue and economical efficiency, in response to dietary supplementation with probiotics. In addition, significant improvements in growth performance of broilers fed Natuzyme-supplemented diets were achieved by Khan *et al.* (2006) and Sherif (2009). On the other hand, Subrata *et al*. (1996), Senani *et al*. (1997) and El-Ghamry *et al.* (2002) indicated that there were no significant differences in live body weight and weight gain of broilers due to dietary supplementation with yeast culture.

Table (2): Average of body weight, body weight gain, feed intake, feed conversion and economic efficiency of broiler chicks as affected by experimental diets

Tr	Initial weight g	Final body weight (6 wk)g	Gain g/ bird	feed intake g/ bird	Feed conversion g/g	Economical efficiency of growth	Relative economic efficiency %
T1	45.00	1870^{c}	1825^{c}	3995^{a}	2.19^{a}	83.26^{b}	100.00
T2	45.00	1935^{bc}	1890^{b}	3783^{b}	2.00^{b}	88.49^{ab}	106.28
T3	45.00	1965^{b}	1920^{b}	3758^{b}	1.95^{b}	92.88^{a}	111.55
T4	45.67	2050^{a}	2007^{a}	3583^{c}	1.78^{c}	94.72^{a}	113.76
T5	45.33	1905^{c}	1859^{bc}	3876^{b}	2.08^{ab}	92.39^{a}	110.96
T6	45.00	1920^{bc}	1875^{b}	3835^{b}	2.04^{b}	93.87^{a}	112.74
T7	45.0	1950^{b}	1905^{b}	3720^{b}	1.95^{b}	92.14^{a}	110.66
SEM	0.24	12.20	12.17	27.80	0.02	1.01	
Prop.	NS	*	*	*	*	*	*

Means within the same column having different superscripts differ significantly (P≤ 0.05).
T1: control, T2= probiotic 0.25, T3= probiotic 0.500, T4= 0.750g/kg, T5= enzyme 0.25 , T6= enzyme 0.500 , T7= enzyme 0.750

Nutrient digestibility:

Feeding the probiotics- or enzyme-supplemented diets whatever was the level of addition significantly (P<0.01) improved the digestibility of OM and CF as compared to those of the control group while digestibility of EE and NFE, and ash retention were not significantly affected by feeding the experimental diets (table 3) .

The improvement in nutrient digestibility by broiler chicks fed probiotics-supplemented diets might be due to an increased permeability of the gut enhanced by supplemental probiotics, and thus increasing uptake of nutrients, as suggested by Mulder *et al.* (1997). Probiotics has also been reported to have a positive impact on the intestinal balance and the competition between useful and pathogenic bacteria and thus enhancing the efficiency of feed utilization in favor of the bird (Fuller, 1989; Rolfe, 2000). In addition, exogenous enzymes have been reported to improve digestion by removing antinutritional factors which interfere with the normal processes of digestion, by digesting the fiber components of the diet, or by creating an environment which encourages minimal bacterial fermentation in small intestine while encouraging beneficial bacterial fermentation in the caeca (Bedford, 1996 a, b; Bedford and Partridge, 2003). In this regard, Bedford

(1996 a, b) stated that alteration of the fermentation profiles in the bird can significantly benefit the performance by more effective partitioning of ileal nutrients between the bird and resident flora, provision of nutrients in the caeca from fiber digestion, and by reduction in immunological challenge.

Table (3): Nutrient digestibility (%) and ash retention of broiler chicks as affected by experimental diets.

Tr	DM (%)	OM (%)	CP (%)	CF (%)	EE (%)	NFE (%)	Ash retention (%)
T1	77.72	73.83^{b}	87.30	20.08^{b}	77.46	75.76	81.60
T2	77.87	75.73^{a}	87.30	33.76^{a}	79.50	77.56	80.00
T3	78.41	76.96^{a}	88.26	34.63^{a}	79.56	77.70	79.86
T4	79.53	77.76^{a}	88.53	36.92^{a}	79.63	77.86	81.30
T5	77.28	75.33^{a}	88.50	35.13^{a}	75.16	78.26	79.23
T6	78.29	76.53^{a}	87.90	35.20^{a}	76.53	78.36	80.06
T7	78.24	77.16^{a}	88.33	36.83^{a}	77.90	78.96	79.33
SEM	0.26	0.302	0.127	1.285	0.410	0.213	0.23
Prop.	NS	*	NS	*	NS	NS	NS

Means within the same column having different superscripts differ significantly (P≤ 0.05).
T1: control, T2 = probiotic 0.25, T3 = probiotic 0.500, T4 = 0.750 g/kg, T5 = enzyme 0.25, T6= enzyme 0.500, T7 = enzyme 0.750

Carcass traits:

The effects of different treatments on carcass characteristics (as percent of live body weight) are shown in Table 4. Results indicated that means of carcass traits including dressed carcass, liver, gizzard, heart, front and hind parts were positively affected (P<0.05) by feeding diets supplemented with feed additives.

These results agree with the findings of Sonbol (1985), Kumar *et al.* (2003) and Salim (2004) who found that adding probiotic to broiler diets increased the relative weights of internal organs (liver, gizzard, heart and spleen) as a percentage of body weight. However, Ali (1999), Abd-Elsamee (2001) and El-Ghamry *et al.* (2002) found that feeding yeast culture-supplemented diets had no significant effects on carcass traits in broiler chicks.

Table (4): Carcass traits of broiler chicks (% of LBW at slaughter) as affected by experimental diets

Tr	LBW (g)	Dressing %	Liver %	Gizzard %	Heart %	Front part %	Hind part %
T1	1870^{c}	69.48^{c}	1.93^{c}	2.10^{c}	0.507^{c}	37.77^{c}	31.68^{b}
T2	1935^{bc}	71.28^{bc}	2.21^{bc}	2.55^{bc}	0.552^{c}	41.73^{b}	29.77^{c}
T3	1965 1^{b}	71.35^{b}	2.32^{b}	2.72^{b}	0.592^{b}	42.93^{b}	32.40^{b}
T4	2050^{a}	74.83^{a}	2.55^{a}	2.95^{a}	0.641^{a}	45.71^{a}	35.74^{a}
T5	1905^{c}	72.70^{b}	2.35^{ab}	2.85^{ab}	0.582^{b}	43.08^{b}	32.88^{b}
T6	1920^{bc}	72.81^{b}	2.30^{b}	2.68^{b}	0.612^{a}	43.10^{b}	31.69^{b}
T7	1950^{b}	74.10^{a}	2.45^{a}	2.90^{a}	0.612^{a}	44.27^{a}	34.36^{a}
SEM	3.088	0.545	7.61	7.87	1.907	0.807	0.699
Prop.	*	*	*	*	*	*	*

Means within the same column having different superscripts differ significantly (P≤ 0.05).
T1: control, T2= probiotic 0.25, T3= probiotic 0.500, T4= 0.750g/kg, T5= enzyme 0.25 , T6= enzyme 0.500 , T7= enzyme 0.750

Blood parameters:

The results revealed that feeding probiotics- or enzyme-supplemented diets predeceased significant increases (P<0.05) in the concentration of total protein and albumin in blood plasma while cholesterol concentration and activity of AST were negatively affected compared with their control counterparts. Activity of ALT was inconsistently affected due to feed additives (Table 5).

The high concentration of plasma total protein and albumin in broiler chicks in response to feeding probiotics- or enzyme-supplemented diets, observed in the present study, are in agreement with the findings of Abd El-Rahman *et al.* (1994) who indicated that broilers fed probiotics had higher levels of serum total protein, albumin and lower levels of cholesterol compared with the control birds. However, El-Ghamry *et al*. (2002) found a significant increase in serum cholesterol and activity of ALT of Hubbard broiler chicks treated with yeast culture.

Table (5): Blood parameters of broiler chicks as affected by experimental treatments.

Tr	T. protein g/100ml	Albumin g/100ml	AST (IU/L)	ALT(IU/L)	Cholesterol g/100ml
T1	2.52^{b}	1.10^{b}	8.25^{a}	103.75^{a}	157.75^{a}
T2	2.80^{b}	1.09^{b}	4.75^{c}	103.25^{a}	131.50^{b}
T3	3.22^{a}	1.19^{a}	4.75^{c}	92.75^{b}	130.75^{b}
T4	3.15^{a}	1.25^{a}	4.25^{c}	91.75^{b}	128.00^{b}
T5	2.87^{b}	1.16^{ab}	6.25^{b}	93.25^{b}	147.75^{a}
T6	2.87^{b}	1.12^{b}	6.75^{b}	101.50^{a}	132.25^{b}
T7	3.12^{a}	1.11^{b}	6.75^{b}	102.50^{a}	131.25^{b}
SEM	6.696	1.88	0.51	1.97	42.64
Prop.	*	*	*	*	*

Means within the same column having different superscripts differ significantly (P≤ 0.05).
T1: control, T2=probiotic 0.25, T3= probiotic 0.500, T4= 0.750g/kg, T5= enzyme 0.25, T6=enzyme 0.500, T7= enzyme0.750

Probability taking the economical aspect into account, the present results indicated that dietary supplementation with Bio-Nutra 200 or Natuzyme (particularly at the level of 0.0750 g/ kg) had positive effects on growth performance and carcass traits of broiler chicks.

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تــأثر الأداء الانتــاجي لكتاكيــت التســمين بالتغذيــة علــي علائــق مدعمــة بمخلــوط الانزيمات التجارية او البروبيوتك.

فــوزي صــديق عبــد الفتــاح إســماعيل ،هيــام محمــد عبــده ابــو المعــاطي و أحمد عبده محمد السيد
قسم انتاج الدواجن – كلية الزراعة – جامعة المنصورة

أجريت هذه الدراسة بهدف بحث تأثير استخدام مستويات مختلفة من مركب البيونترا 200 والمركب الإنزيمي الناتوزيم مع العلائق المحتوية علي مصادر بروتين نباتي علي الأداء الإنتاجي لكتاكيت التسمين ، حيث تم استخدام ثلاثة مستويات من كلا من هذه الإضافات (0.25-0.50-0.75جم/كجم) بالإضافة لعليقة الكنترول الخالية من هذه الاضافات ولذلك تم تكوين عدد سبع علائق تجريبية متساوية في البروتين والطاقة الممثلة في مرحلتي البادئ والنامي . تم استخدام عدد 336 كتكوت من سلالة الهابرد التجارية غير مجنسة قسمت إلى سبع مجموعات تجريبية بالتساوي وغذيت الكتاكيت علي علائق البادئ من عمر يوم وحتي عمر 21 يوم ثم غذيت علي علا كل ةمنها في ثلاث مكررات وغذيت الكتاكيت علي علائق النامي من عمر22يوم وحتي عمر 42 تحت ظروف رعاية موحدة مع التغذية الحرة في المرحلتين. تم اخذ القياسات المختلفة ومنها وزن الجسم الحي , الزيادة في وزن الجسم , معدل التحويل الغذائي, معدل استهلاك العلف, الكفاءة الاقتصادية للنمو, مقاييس جودة الذبيحة, معاملات الهضم وبعض مقاييس الدم ونشاط إنزيمات الكبد في البلازما.

ويمكن تلخيص النتائج المتحصل عليها خلال الفترة التجريبية فيما يلي :

حققت الطيور المغذاه علي العلائق المضاف إليها البروبيوتك أوالإنزيمات أعلى المتوسطات بالنسبة لوزن الجسم الحي والزيادة في وزن الجسم ومعامل التحويل الغذائي والكفاءة الاقتصادية للنمو ومعاملات هضم المادة الجافة والمادة العضوية والألياف الخام مقارنة بالعليقة الكنترول، بينما لم تظهر فروق معنوية بين المعاملات التجريبية المدعمة بالبروبيوتك أو الإنزيم و بين بعضها البعض فى حين تأثر نشاط إنزيمات الكبد سلبيا بالمعاملات الغذائية.

أعطت العلائق التجريبية المحتوية علي البروبيوتك أو الإنزيم بصفة عامة مستوي عالي من المعنوية لمتوسطات مقاييس جودة الذبيحة وبعض مقاييس الدم مقارنة بتلك المغذاه علي عليقة الكنترول، بينما لم تتأثر باقى المقاييس بالمعاملات التجريبية مقارنة بعليقة الكنترول. وتخلص هذه الدراسة إلي أن إضافة البروبيوتك أو الإنزيمات إلي علائق كتاكيت التسمين يمكن أن تؤدي إلي تحسن الأداء الإنتاجي لها(خاصة عند مستوي 0.75جرام / كجم علف)

قام بتحكيم البحث

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