Comparison between effects of Complex enzyme and Multi enzyme supplementation on the Productive Performance of Broiler

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A B S T R A C T

This study was conducted to evaluate the effect of two feed additives commercially produced, the complex enzymes and the multi enzymes on the weekly and finally productive performance of broiler chicks. A total of 600 broiler cobb chicks, housed in an experimental unit, with stocking density 10/ m^2, using 10 pens, 60 chicks for each which was used as replicates. Feed and water were provided ad libitum through feeders and bell drinker. Birds were divided into two equal groups.(T1 and T2) each of them 300 chicks and five replicates, the first group T1 group chicks fed the basal diet with complex enzymes Allzyme SSF® 0.2 gm/kg feed that composed from Phytase, Protease, Cellulase, Xylanase, Beta-glucanase, Amylase, and Pectinase , the second T2 group was fed on the basal diet with Multi enzymes Natuphos® 0.05 gm/kg feed composed of Phytase plus Zympex 008® 0.5 gm/kg feed composed of Alpha-galactosidase, Protease, Beta-mannanase, Cellulase, Xylanase, Beta glucanase, Amylase, and Protease. Productive performance was evaluated by determining the weekly feed intake, body weight, FCR, and final mortality rate and European efficient index. Results revealed significant difference between the two tested groups within the different weeks the second group showed higher average body weight and lower FCR, compared with the first group finally, there was no significant difference in mortality rate and European efficient index between the two tested groups. It can be concluded that both complex enzymes and multi enzymes have beneficial effects on the broiler performance parameters

Key Words: Complex enzymes, Multi enzymes, Broiler, feed additives

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1. INTRODUCTION

The aim of nutritionist is not only enhancing bird performance but also improving nutrients availability of feed to produce meat economically and maintain health condition of animal or poultry by increasing the digestion of low quality products by reducing nutrients loss through excreta allowing the reduction of recommended nutritional levels in the diet but also reducing the environmental problems through minimizing the output excreta. Enzymes are made from chains of amino acids. They speed up or catalyze reactions by binding to their substrate and stabilize the entire process through a product formation, which decrease the activation energy that required to move the reaction forwards. As a result, the rate of reaction progression is greatly increased for any given energy status (Sheppy, 2001). There were various types of Enzymes available for poultry and have been used over the past several years with high potentiality for use in the feed industry, included Cellulase (ß-glucanases), xylanase and associated enzymes, phytase, proteases, lipases, and galactosidase, these enzymes were used particularly either as single enzyme or in mixed types (Khattak et al 2006).

The present work was designed to evaluate the effect of two types of enzymes (Complex enzymes represented by Allzyme SSF® and Multi enzymes system represented by Natuphos® plus Zympex 800®) on broiler chick's growth performance parameters,

2. MATERIALS AND METHODS

2.1. Birds, housing and management

A total of 600 broiler chicks of the Cobb strain were obtained from a commercial source were reared conventionally in floor pens. The day-old broiler chicks were housed in clean well ventilated room previously fumigated with formalin and potassium permanganate then the chicks were housed in floor cages. Artificial lighting was provided for 24 hours over the experimental Period (45 days). At one day old the ambient temperature was 35°C and gradually decreased to reach 25°C on day 21 and then kept constant.

Ventilation of the brooder house was adequate to remove moisture; carbon dioxide expired by the birds, ammonia from feces and carbon dioxide from gas flame brooders. The broiler chicks were vaccinated against the most common viral diseases as shown in Table (1).

2.2. Experimental design

The chicks were randomly arranged into two dietary treatment groups. Each treatment group contained 300 birds which were allotted into five replicates, each replicate contained 60 birds. The first group of chick was fed the basal diet with the complex enzymes, while the second group was fed on the basal diet with the Multi enzymes as described in Table (2). The chicks were allowed to ad-libitum access of feed and water

2.3. Diet and feed additives

The diets were mixed to cover starter, grower and finisher recommended by the cobb catalogue table (3) fed all over the experimental period. The first group was fed diet with complex enzymes (Allzyme 0.2 gm/kg diet) produced by Alltech company while The second group was fed diet contained the multi enzymes products consisted of two separated enzymes. provide energy zympex008 used 0.5 gm/kg diet produced by Impextraco company and phytase enzyme Natophus used 0.05 gm/kg diet produced by BASF company which provide 0.1% available phosphorus. The chemical composition of the basal diet was calculated according to the NRC. Two types of dietary enzymes were used Allzyme SSf® as complex enzymes Table (4). Natuphos® plus Table (5) and Zympex008® as multi enzymes Table (6).

2.4. productive performance

The chicks were weighed individually each week and the live body weight changes were taken as a measure for growth. Body weight gain of chicks (expressed in grams) was calculated as a difference between two successive weights. The experimental diets were provided regularly at morning and the daily feed intake was calculated by difference between the weight of offered feed and remained portion, then divided by the number of the birds in each group per day and totalized to be per week. Feed conversion ratio was calculated by dividing the amount of feed consumed (g) during the week by gain in weight (g) during the same week. (Lambert *et al.*, 1936). Daily mortality was recorded for each treatment, and the weekly mortality rate was calculated by subtracting the number of dead chicks from the number of live chicks.

European efficiency index was calculated according to Mahmoud et al., 2009.

2.5. Statistical analysis

The data obtained in this study were statistically analyzed for variance ANOVA with confidence limits set at 95 % (Significance at $P \leq 0.05$ probability level) and critical difference as described by (Duncan, SPSS Student Version 10.0.7, 1955).

The results were reported as the mean ± standard error (SE), also multiple range tests should be performed to compare among different groups or different weeks of experiment.

Table (1): Vaccination program of broiler chicks

Age (in days)	Name of vaccine	Type of vaccine	Route of vaccination	Company
7	Hitchner IB	Living vaccine (mild strain)	Drinking water	Intervet
9	AI h9 +ND	In activated killed vaccine	Injection	Merial
13	Gumboro (Bursin2)	Live vaccine (Inter mediate)	Drinking water	Zeotis
20	Avenue(ND+ Bursin 2 (IBD)	Live ND + live gumboro	Drinking water	Merial Zeotis

Table (2): the experimental groups with different treatments

Group	Number of birds	Enzymes type	dietary levels of enzymes (g /kg diet)		
1	300	Complex enzymes	0.2g	---	---
2	300	Multi enzymes	--	0.05g	0.5 g

Table (3): The composition of the experimental diets.

Ingredients	Starter group 1	Starter group 2	Grower group 1	Grower group 2	Finisher group 1	Finisher group2
Yellow Corn	576.4	576.0	637.0	636.6	681.5	681.1
Soyabean meal	346.0	346.0	270.0	270.0	208.0	208.0
Gluten meal	30.00	30.00	43.40	43.40	59.40	59.40
Lime stone	13.10	13.10	13.10	13.10	10.50	10.50
Di Calcium phosphate	14.00	14.00	12.00	12.00	11.00	11.00
Soya bean Oil	5.000	5.000	10.00	10.00	15.00	15.00
common Salt	3.860	3.860	3.640	3.640	3.680	3.680
L-lysine-HCL	3.760	3.760	3.400	3.400	4.540	4.540
Premix***	3.000	3.000	3.000	3.000	3.000	3.000
DL.Methionin	2.220	2.220	1.860	1.860	0.960	0.960
Therionin	0.840	0.840	0.420	0.420	0.620	0.620
Allzyme ssf	0.200	0.000	0.200	0.000	0.200	0000
Zympex008	0.000	0.500	0.000	0.500	0.000	0.500
Natuphos	0.000	0.050	0.000	0.050	0.000	0.050
Maxiban	0.500	0.500	0.500	0.500	0.500	0.500
Maxus	0.100	0.100	0.100	0.100	0.100	0.100
MTB	0.500	0.500	0.500	0.500	0.500	0.500
Bio Mos	0.500	0.500	0.500	0.500	0.500	0.500
Total	1000	1000	1000	1000	1000	1000

** * Vitamin-mineral mixture was composed of: **n:** Vitamin A = 12,000,000 IU, D3 = 2,200,000 IU, E = 10,000 mg, K3 = 2,000 mg, B1 = 1,000 mg, B2 = 5,000 mg, B6 = 1,500 mg, B12 = 10 mg, Niacin = 30,000 mg, Biotin = 50 mg, Folic acid = 1,000 mg, Pantothenic acid = 10,000 mg, Zinc = 50,000 mg, Manganese = 60,000 mg, Iron = 30,000 mg, Copper = 4,000 mg, Iodine = 1,000 mg, Selenium = 100 mg, Cobalt = 100 mg, Calcium carbonate to 3 Kg. Purchased by Multivita for animal nutrition, 6th October city, Egypt, registered by Adisseo combany, France. maxiban^{R} (narasin 40mg/kg + nicarbazin 40mg/kg) .it is combination of chemical and ionophore Maxus^{R} (avilamycin 20mg/kg). it ia AB controlling necrotic enteritis. MTB^{R} (prebiotic derived from yeast).it is make cleaning to the intestine from mycotoxin. Biomos^{R} (prebiotic derived from yeast). It is preventing colonization of salmonella by agglutination to salmonella receptors

Table (4) Types of enzymes in allzyme SSF added to the diet (0.2 gm/kg diet)

Enzyme	Biological origin	Minimal guaranteed enzyme activity
Phytase	(non-GMO) Aspergillus Niger	300 SPU/ g
Protease		700 HUT/g
Cellulase		40 CMCU/g
Xylanase		100 X U/ g
Beta glucanase		200 BGU/g
Amylase		30 FAU/g
Pectinase		4000 AJDU/g

Table (5) Natuphos® added to the diet 0.05g/ kg.

Enzyme	IUB Nomenclature	Biological origin	Minimal guaranteed enzyme activity
Phytase	Mio-inositolhexaphosphate phosphohydrolase	*Aspergillus niger*	10000FTU/g

Table (6) Types of zympex ® added to the diet 0.5g/ kg.

Enzyme	Biological origin
Alpha galactosidase	(microorganism)
Beta mannanase	
Cellulase	
Xylanase	
Beta glucanase	
Amylase	
Protease	

3. RESULTS

3.1. Effect of the Enzymes products on the weekly Broiler performance:

According to the obtained results presented in Table (7), and figure (1) the analysis of variance of showed a great significant difference at $P \leq 0.05$. The results at the first week revealed that group two fed diet with Natuphos® and Zympex 800®. Natuphos^{R}. showed the highest average body weight 154.04 ±0.043 gm/bird and the lowest FCR 0.96±0.024, compared with group one fed on diets with Allzyme SSF® as the average body weight was 145.47 ± 0.033 gm/bird and FCR was 1.1±0.027. The second week performance parameter in table (7) and figure (1) there was significant differ between the two treatment groups. As group two showed higher average body weight and lower FCR respectively 412.5 ±0.058 gm/bird and 1.45±0.022 compared with group one which recorded 391.75 ±0.038 gm/bird as average body weight and 1.46±0.03 as FCR.

During the third week the performance results revealed that there was a great significance different at $P \leq 0.05$ between the treatment groups. Multi enzymes group showed the higher average body weight 798.13 ±0.85 gm/bird and lower FCR 1.28±0.02, compared with Complex enzymes group 772.55 ±0.9 gm/bird and FCR 1.36±0.04. The fourth week results come in parallel with the first, second and third week, as Multi enzymes group showed the highest average body weight 1281.35 ±1.2 gm/bird and the lowest FCR 1.42±0.025, compared with Complex enzymes group 1256.56 ±0.9 gm/bird and FCR 1.47±0.03. Finally, the final performance parameters at the end of the fifth week were significantly differ, the group fed diet with Natuphos® and Zympex 008® recorded higher average final body weight 1716.61 ± 2.86 gm/bird, followed by Allzyme SSF® group 1691.07 ±3.65 gm/bird, higher feed intake 2681.83 ±3.33 gm/bird in group two and 2642.63±4.75 gm/bird in group one, in the same time no significance difference between two groups in the final FCR and final mortality rate. Figure (2) the results revealed that the complex enzyme minimizes the feed intake and improve the feed efficiency. This was clear through the weekly cumulative feed intake from the first week of experiment to the fifth week respectively 160±0.054, 571.95±0.42, 1050±0.52, 1847.14 ±1.025 and 2642.63±4.75. While in the Multi enzyme group the cumulative feed intake were 147.87±0.062, 598.12±0.39, 1021±0.75, 1819.5±1.25, and 2681.83 ±3.33 gm/ bird from the first week to the fifth week respectively.

3.2. Effect of the Enzymes products on final Broiler performance

From table (8), figure (4), figure (5) and figure (6) there was a great significant difference at $P \leq 0.05$ between the group of multi enzymes and the other group of complex enzymes in the final body weight. The group fed diet by multi enzymes showed higher final body weight (1716.61± 1.85) gm/bird, compared with the complex enzymes group (1691.07± 2.025) gm/bird. But in the same time there was no statistical significant difference at $P \geq 0.05$ in the total feed intake. Also there was no difference in feed conversion Ratio, mortality rate, and European efficient index the values were 1.56321±0.022, 1±0.25 and 305.9±1.55 in group fortified by complex enzymes respectively, and there were 1.56273±0.032, 1.7±0.32 and 308.4±1.42 respectively in the group fed by multi enzymes.

Table (7) weekly performance parameters in different groups

Parameter/week	Treatment 1 Complex Enzymes	Treatment 2 multi Enzymes
Initial Body weight (gm)	45 ±0.00	45±0.00
1^{st} WeekBody Weight (gm)	145.47 ± 0.033	154.04 ±0.043*
1^{st} Week Feed intake (gm)	160±0.054*	147.87±0.062
1^{st} Week Feed conversion Ratio	1.1±0.027	0.96±0.024
1^{st} Week Mortality rate %	0.7±0.09	1±0.025
2^{nd} Week Body Weight (gm)	391.75 ±0.038	412.5 ±0.058*
2^{nd} Week Feed intake (gm)	571.95±0.42	598.12±0.39*
2^{nd} Week Feed conversion Ratio	1.46±0.03	1.45±0.022
2^{nd} Week Mortality rate %	1±0.066	1.3±0.053
3^{rd} Week Body Weight (gm)	772.55 ±0.9	798.13 ±0.85*
3^{rd} Week Feed intake (gm)	1050±0.52*	1021±0.75
3^{rd} Week Feed conversion Ratio	1.36±0.04*	1.28±0.02
3^{rd} Week Mortality rate %	1±0.018	1.7±0.02
4^{th} Week Body Weight (gm)	1256.56 ±0.9	1281.35 ±1.2*
4^{th} Week Feed intake (gm)	1847.14±1.025*	1819.5±1.25
4^{th} Week Feed conversion Ratio	1.47±0.03	1.42±0.025
4^{th} Week Mortality rate %	1±0.024	1.7±0.03
5^{th} Week Body Weight (gm)	1691.07 ±3.65	1716.61 ±2.86*
5^{th} Week Feed intake (gm)	2642.63±4.75	2681.83 ±3.33*
5^{th} Week Feed conversion Ratio	1.56 ±0.044	1.56±0.035
5^{th} Week Mortality rate %	1±0.018	1.7±0.00*

* Means Significance difference at P≤ 0.05

Table (8) Final Performance Parameters in the experimental groups

Parameter	Treatment 1 Complex Enzymes	Treatment 2 Multi Enzymes
Final Body Weight (gm)	1691.07± 2.025	1716.61± 1.85*
Total Feed intake (gm)	2642.63±2.26	2681.83±3.00
Feed conversion Ratio	1.56321±0.022	1.56273±0.032
Mortality rate %	1±0.25	1.7±0.32
European effecient index	305.9±1.55	308.4±1.42

* Means Significance difference at *P*≤ 0.05

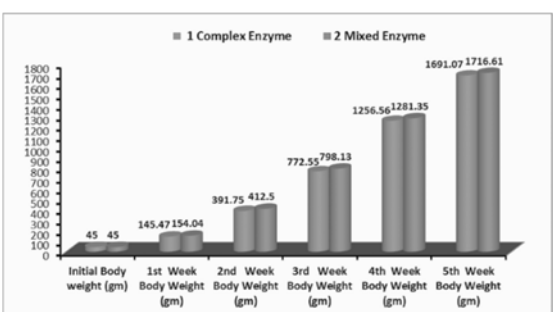

Figure (1) weekly body weight (gm) in different groups

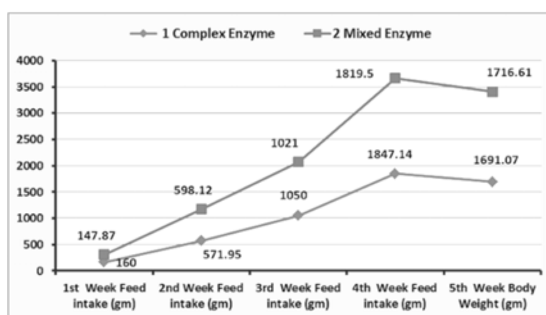

Figure (2) weekly feed intake (gm) in different groups

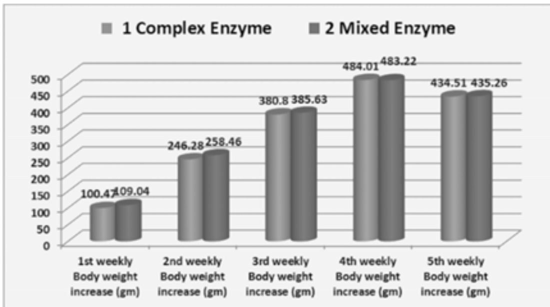

Figure (3) weekly body weight increase (gm) in different groups

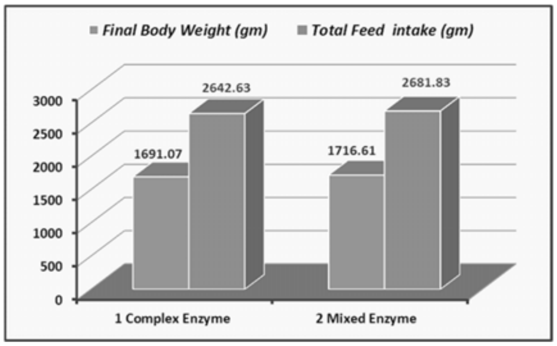

Figure (4) total body weight and total (gm) feed intake in different groups

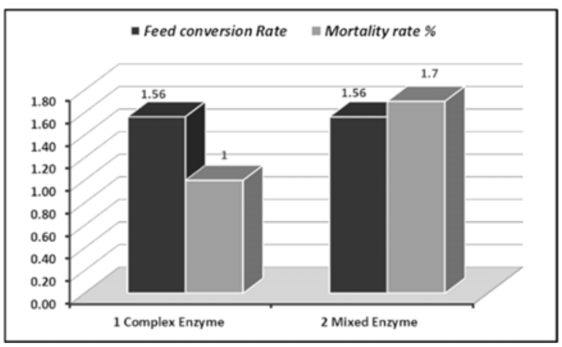

Figure (5) final feed conversion rat and mortality percentage in different groups

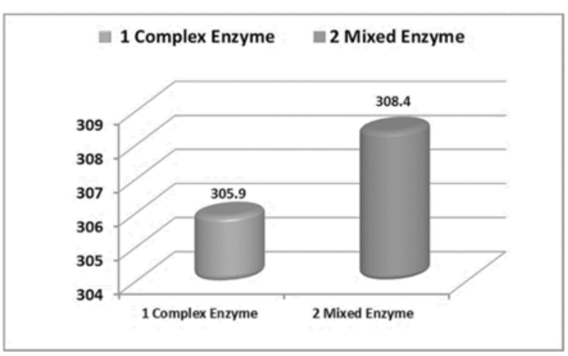

Figure (6) final European efficient index in different groups

4. DISCUSSION

The role of enzymes in animal feed has become increasingly important after the first successful application of β-glucanases to barley-based broiler diets at the end of the 1980's (Ziggers, 1999). According to our results that were presented in Table (1), and figure (1) the analysis of variance of the obtained data showed great significance difference at $P \leq 0.05$. At the first week the results revealed that second group two fed diet by Natuphos® and Zympex 008 This group showed the highest average body weight 154.04 ±0.043 gm/bird and lower FCR 0.96±0.024, compared with group one supplemented with Allzyme SSF® as the average body weight was 145.47 ± 0.033 gm/bird and FCR was 1.1±0.027.

Also in the same time the second week results of the performance parameters of the two treatments were significantly different. As the second group showed higher average body weight and lower FCR respectively 412.5 ±0.058 gm/bird and 1.45±0.022 than the first group (391.75 ±0.038 gm/bird and 1.46±0.03). the synergistic effect of phytase, carbohydrase, and protease were added to the diet according to Simbaya *et al.,* (1996) had a positive response in growth of broilers from d 4 to 11 day .

This result agreed with the Meng *et al.,* (2005). who mentioned that using a combination of cellulase, pectinase, xylanase, glucanase, galactanase, and mannanase improved weight gain, feed efficiency, digestibilities of starch and protein, and apparent total tract digestibility of non-starch polysaccharide. Ghazi *et al., (*1997a & b) confirmed our result through his conclusion that Chicks fed diets supplemented with protease and/or α-galactosidase increased body weight gain, apparent nitrogen retention, and apparent and true metabolizable energy without alteration of feed conversion ratio.

From figure (3) we can observe that there was no significant difference between two groups in the weekly body weight increase as both types of enzymes supplement either through complex enzyme (Allzyme SSF®) and Multi enzyme (Natuphos® and Zympex 008®) achieve the same weekly body weight increase. This agree with Silva et al. (2003) who referred that broiler chicks fed diets supplemental with three commercial enzymes products contained only phytase activity; or an enzyme that contained both xylanase and β-glucanase activities; and a multi-enzyme mixture that contained cellulase, xylanase, β-glucanase, and α-amylase. Birds fed on enzyme-containing diets, grew faster and had better feed conversion ratio. These results come in parallel with Ghazi *et al., (*1996). Who revealed that the improvement of performance was due to the increased nitrogen digestibility by supplementing the protease.

Also our results agreed with Ghazi *et al., (*1997) who stated that Chicks fed diets supplemented with protease and/or α-galactosidase increased body weight gain, apparent nitrogen retention, and apparent metabolizable energy without alteration of feed conversion ratio. In most reported studies, enzyme supplementation improves nutrient digestibility. The mechanism by which enzymes provide this improvement are not fully elucidated but may include altered gastrointestinal activities of absorption, secretion, and immune response or increased total digestive enzyme activity. Evidence of each of these mechanisms exists in the literature. In birds, amylase activity in crop, pancreas, and small intestine was not consistently changed by dietary supplementation of amylase and xylanase (Ritz *et al.,* 1995), Bedford and Classen (1992) also found improvement in weight gain and feed conversion ratio of broiler chicks with increasing both xylanase and β-glucanase) and this agreed with our findings which also come in accordance with Francesch et al., (1995) who referred that Supplementation of an enzyme complex containing β-glucanase, xylanase, and cellulase activities in laying diets significantly improved feed efficiency and reduced water: feed ratio.

5. CONCLUSION

It can be confirmed that Complex enzyme and Multi enzyme addition to the broiler diet improve the productive performance. In addition, mixed enzyme achieves higher final body weight but both complex enzyme and multi enzyme lead to the same feed conversion ratio.

6. REFERNCES.

Duncan, D.B. 1955. Multiple range and muliple F tests. Biometrics. 11, 1- 42.

Francesch, A.M., Almirall, M., Perez-Venderell, M., Brufau, J. and Esteve-Garcia, E. 1995. The differences in intestinal viscosity produced by barley and ß-glucanase alter digesta enzyme activities and ileal nutrient digestibilities more in broiler chicks than in cocks. Journal of Nutrition 125, 947–955.

Ghazi, S., Rooke, J.A., Galbraith, H. and Bedford, M.R. 1996. The potential for improving soya-bean meal in diets for chickens: treatment with different proteolytic enzymes. Br. Poult. Sci. 37, S54-S55.

Ghazi, S., J. A. Rooke, H. Galbraith, and M. R. Bedford. 1997a. Effect of adding protease and alpha-galactosidase enzyme to soybean meal on nitrogen retention and true metabolizable energy in broilers. Br. Poult. Sci. 38, S28.

Ghazi, S., Rooke, J.A., Galbraith, H. and Bedford, M.R. 1997b. Effect of feeding growing chicks semi-purified diets containing soybean meal and different amounts of protease and alpha-galatosidase enzymes. Br. Poult. Sci. 38, S29.

Khattak F.M., Pasha T.N., Hayat Z. and Mahmud A. 2006. Enzyme in poultry Nutrition. J. Anim. Pl. Sci. 16(1-2), 1-7

Lambert W.V., Ellis N.R., Black, W.H. and Titus, H.W. 1936. The sole of nutrition in genetic research. The American Society of Animal Production 29, 236. http://jas.fass.org/cgi/reprin/1936b/1/236a

Mahmoud, S., Hassan, M.M., Alam, M., Ahmad, F. 2009. Comparative Efficacy of Nigella sativa and Allium sativum as Growth Promoters in Broilers. Int. J. Agric. Biol. 11, 775–778.

Meng, X., B.A. Slominski, Nyachoti, C.M., Campbell, L.D. and Guenter, W. 2005. Degradation of cell wall polysaccharides by combinations of carbohydrase enzymes and their effect on nutrient utilization and broiler chicken performance. Poult. Sci. 84, 37–47

Ritz, C.W., Halet, R.M., Self, B.B. and Denbow, D.M. 1995. Endogenous amylase levels and response to supplementation feed enzymes in male turkeys from hatch to eight weeks of age. Poult. Sci. 74, 1317-1322

Sheppy, C., 2001. The current feed enzyme market and likely trend. In: "Enzymes in farm animal nutrition". Bedford, M. R. and partrige, G. G., CASI, Walling Ford, PP: 4-10

Silva, J.H.V.; Albino, L.F.T. and Nascimento, A.D. 2003. Estimativas da composição anatômica da carcaça de frangos de corte com base no nível de proteína da ração e peso da carcaça. Revista Brasileira de Zootecnia 32, 344-352

Simbaya, J., Slominski, B.A., Guenter, W., Morgan, A. and Campell, L.D. 1996. Animal Feed Science and Technology, 61, 219-234

Ziggers, D. 1999. Enzymes: hidden catalysts come out of the dark. Feed Tech. 3(6), 23–33.