Egypt. J. Anim. Prod., Vol. 28, No. 2, pp. 245-254 (1991)

Using Enzyme Preparations in Corn-Soybean Meal Broiler Rations

M. A. Mohamed[1], and Akila S. Hamza [2]
(1) *Dept. Anim. & Poult. Nutr. & Prod., National Research Centre, Cairo, Egypt.* (2) *Central Lab. for Food & Feed, Agric. Res. Centre, Cairo, Egypt.*

AN EXPERIMENT was conducted to study the effect of adding commercial enzyme preparations to corn - soybean meal based rations on the performance of broiler chicks. Weights of dressing, giblets and abdominal fat were determined. Length of the different segments of the alimentary canal was also measured. Two levels (0.3 and 0.5 kg / ton) of each of a carbohydrase and a proteolytic preparation were added to the experimental rations. A number of 216 one day old Arbor-Acres broiler chicks was fed the experimental rations for a period lasting 7 weeks.

Average live body weight at the end of the experimental period was 1585, 1540 and 1540 g for the control group and those fed rations of low and high supplementation levels, respectively, without significant differences. The control group consumed 3460 g feed which was significantly ($p < 0.05$) higher than the consumption of birds that received low and high supplementation levels (3295 and 3340 g, respectively). Feeding of rations with low level of supplementation resulted in better feed conversion ratio (2.14) than the control (2.18) and those of high supplementation level (2.17). These differences were not significant.

The results recorded throughout the experimental period indicated that enzyme preparations had a remarkable effect on reducing mortality.

Dressing, liver and abdominal fat of birds fed high supplementation level recorded significantly ($p< 0.05$) lower weight than the control, while low supplementation level had no significant effect on such measurements. No significant differences due to the enzyme supplementation were observed among weights of gizzard, stomach or spleen.

Length of duodenun, ileum and caecum did not significantly vary, while jejunum and colon length were significantly ($p < 0.05$)

affected by enzyme supplementation . Birds fed rations of high supplementation level had significantly ($p < 0.05$) longer jejunum than the control birds , while birds fed low supplementation level had significantly ($p < 0.05$) shorter colon than the control birds or those fed high level of supplementation .

Key Words : Enzyme supplementation , Corn - soybean rations , Broiler performance .

In recent years it has been possible to ferment certain microorganisms on an industrial scale , extract and use their enzymes in a wide range of processes for the production of feed and natural products. These enzyme preparations can improve the nutritional quality of poultry feeds by different ways : improving the efficiency of feed utilization , upgrading the poorly digested feed and providing additional digestive enzymes to help the host to overcome stress conditions .

Burnett (1966) reported that the benefit gain resulting from enzyme supplementation could be largely due to the partial degradation of the soluble glucan chain , reducing the viscosity of the intestinal contents and improving nutrient absorption. Some additional benefits are also gained by the breakdown of the endosperm cell walls surrounding the starch granules in the grain , making starch more succeptible to enzyme effect (Mannion , 1981and Hesselman and Aman , 1986) Also , Chesson (1987) revealed that the nutritional advantage of adding enzymes could be attributed to the enzymatic destruction of antinutritional factors , saccharification of non - starch polysaccharides and /or augmentation of the host digestive enzymes .

The addition of amylolytic enzyme preparation to improve the utilization of grain-based feeds of poultry has been reported although the results are not wholly consistent. Weight gain and efficiency of feed conversion of corn-soybean meal diets of broiler chickens were found to be substantially enhanced by the addition of α –amylase preparation (Parkany-Gyarfas and Toth, 1978). In contrast, Moss et al. (1977) found no significant increase in body weight or in feed conversion efficiency of broiler chicks at eight weeks of age when fed on a similar diet supplemented with a food grade diastase (α-amylase). Reese *et al.* (1983) used diets and enzyme preparations similar to those of Parkany-Gyarfas and Toth (1978) and failed to gain an appreciable effect of such supplementation.

The present experiment was conducted to study the ability of two enzyme preparations of improving the nutritional quality of corn-soybean meal based rations commonly used in broiler feeding. One of these preparations has the activity to break the branched pectin-like substances in the cell wall of soybean meal and also able to improve corn. The other preparation has the capability of improving the overali protein

utilization. Effect of such preparations on dressing, giblets and abdominal fat and length of the different segments of the alimentary canal was also studied.

Material and Methods

TWO enzyme preparations being Energex® and Bio-Feed Pro® were examined. Energex® is a carbohydrase preparation produced by submerged fermentation of a selected strain of *Aspergillus niger* group. This multi-enzyme complex hydrolyses a broad range of carbohydrate polymers and contains cellulase and improves the overall utilization of energy sources. Bio-Feed Pro® is a proteolytic enzyme prepared by submerged fermentation of a selected strain of *Bacillus licheniformis*. The major enzyme component is subtilism *Carlsberg*, which is an endoproteinase of serine type. It works in conjunction with the proteases produced by the host to improve overall protein utilization.

Commercial corn-soybean meal-based rations being starter, grower and finisher were used without or with enzyme supplementation. Formulation and composition of such basal rations are given in Table 1. Each basal ration and the same ration supplemented with two levels of each preparation were used. The low level of supplementation was 0.3 kg of Energex and 0.3 kg of Bio-Feed Pro per ton ration, while the high level was 0.5 kg of each enzyme preparation per ton ration. Table 2 indicates those levels of supplementation used.

Two hundred and sixteen one-day old unsexed Arbor Acres broiler chicks were divided into three groups of six replicates each (12 birds per replicate). Each group received one of the experimental treatments i.e. control (basal ration), low or high level of supplementation for 7 weeks. Replicates were randomly allocated in batteries in which feed and water were supplied *ad lib.* and light was provided 24 hr daily . Throughout the experimental period , body weight , feed consumption and mortality were recorded fortnightly . Feed conversion ratio was calculated as unit feed consumed per unit body weight . At the end of the experimental period , a sample of 3 broilers from each replicate , randomly taken , was weighed , slaughtered , feathered and kept overnight in 4 °C to allow the abdominal fat to be hard. Carcasses were then evicerated and weights of dressing and giblets and length of the different segments of the alimentary canal were measured . Abdominal fat was also excited and weighed . The abdominal fat that was removed and weighed was the fat pad within the body cavity and surrounding the gizzard , bursa of Fabricus and cloaca . Data were statistically analyzed by the analysis of variance while the significant differences among the means were determined as described by Steel and Torrie (1980) .

® Supplied by NOVO Nordisk, Enzyme Process Division, DENMARK.

TABLE 1. Formulation and composition of basal rations.

Ingredients	Starter 1 day-3wks	Grower 4-6 wks	Finisher 7 week
Yellow corn	61.4	64.6	70.4
Soybean meal (48%)	27.5	25.0	19.0
Wheat bran	2.4	3.0	4.0
Corn glutin meal	1.0	1.0	0.7
Corn glutofeed (14%)	2.0	2.0	2.0
Fish meal (72%)	1.0	--	--
Meat and bone meal (55%)	2.0	1.7	1.2
Bone meal	1.9	1.9	2.08
Salt	0.27	0.3	0.3
Vit & Min mix*	0.3	0.3	0.3
Lime stone	0.10	0.10	--
DL-Methionine	0.10	0.07	0.02
L-Iysine	0.03	0.03	--
Proximate Composition:			
Crude protein%	22.5	20.5	18.0
Ether extract %	3.12	3.20	3.24
Crude fiber %	2.96	2.92	2.98
ME (k cal/kg) Calculated	3000	3000	3000

* Supplied (per 3 kg of mix.) : Vit. A, 12'000'000 I.U.: Vit. D_3, 2'000'000: Vit. E, 40'000 mg: Vit. K_3,4000 mg: B_1,3'000 mg; $B_2$6'000 mg; B_6 4'000 mg: B_{12}, 30 mg: Niacin 30'000 mg; Calpan 12'000 mg : Folic acid 1'500 mg: biotin, 80 mg; choline chloride 700'000 mg: mn, 80'000 mg ; Cu, 10'000 mg; Fe, 40'000 mg; Zn, 70'000: Se, 200 mg;I, 1500 mg;Co, 250 mg.

Results and Discussion

Mean values of live body weight , feed consumption , feed conversion ratio and mortality rate throughout the experimental period are shown in Table 2 . Birds fed the control rations gave significantly ($P< 0.05$) higher mean live body weights than those fed low level of enzyme supplementation during the successive periods of 2 , 4 and 6 weeks of age . High level of supplementation gave slightly lower (but not significant) values than the control group. At the end of the 7-week experimental period no significant differences in live body weight were detected among the control group and

those fed rations with either low or high level of enzyme supplementation. Such results indicated that the tested enzyme preparations had no beneficial effect on mean live body weight of broiler chicks at marketing age . These results are in agreement with those reported by Moss *et al* ., (1977) and Reese *et al*., (1983) who failed to obtain a significant increase in body weight of broiler chicks when fed rations supplemented with enzyme preparation .

TABLE 2. Average live body weight, feed consumption, feed convertion ratio and mortality of broiler chicks fed rations supplemented with enzymes.

Age		Rations		
Level of supplementation	Energex Bio-feed pro	Control 0 0	low 0.3 0.3	high 0.5 kg / ton 0.5 kg / ton
2 weeks				
Live body weight (g)		335a	320b	330a
Feed consumption (g)		415a	400b	415a
Feed conversion		1.24a	1.25a	1.24a
Mortality%		2.78	1.39	1.39
4 weeks				
Live body weight (g)		880a	850b	850b
Feed consumption (g)		1380a	1320b	1360a
Feed conversion		1.57a	1.57a	1.60a
Mortality%		4.17	1.39	2.78
6 weeks				
Live body weight (g)		1315a	1270b	1300ab
Feed consumption (g)		2685a	2560b	2605c
Feed conversion		2.04a	2.02a	2.01a
Mortality%		11.11	4.17	5.56
7 weeks (entire period)				
Live body weight (g)		1585a	1540a	1540a
Feed consumption (g)		3460a	3295b	3340b
Feed conversion		2.18a	2.14a	2.17a
Mortality%		12.50	5.56	8.33

a...b Means within the same row with no common superscripts are significantly different ($p<0.05$).

The accumulative average feed consumption at the 2nd ,4th and 6th weeks of age indicated that the control group consumed significantly ($P< 0 . 05$) higher amounts than birds fed rations of low supplementation level . On the other hand , no significant differences in feed consumption were observed between the control group and that fed rations of high supplementation level at 2nd and 4th weeks of age. At the 6th week of

age , feed consumption varied significantly (P< 0 . 05) among the experimental treatments . Regarding the entire period (7 weeks) , the control group consumed significantly higher (P < 0 . 05) feed than those fed rations with enzyme supplementation . No significant difference in feed consumptin was detected between birds fed rations with high or low level of enzyme supplementation .

The resulted values of feed conversion ratio (feed body weight) for the entire period showed that birds fed low supplemented rations gave the best value being 2.14 , while the control group and that fed the high supplemented rations recorded values of 2.18 and 2.17, respectively. However, no significant differences were detected in feed conversion ratio at 2nd , 4th and 6th weeks of age or for the entire period.

Theperformance results indicated that enzyme supplementation had no beneficial effect on weight gain and efficiency of feed utilization of broiler chicks fed on corn-soybean meal based rations. This could be due to the higher digestibility of ingredients used in formation of the experimental rations. The present rations are mainly consisted of corn which is well known as an excellent source of energy in poultry rations and not considered as a target for improvement. In this regard, Rexen (1981) suggested that adding enzymes to barleybased diets have a beneficial effect on feed utilization only if the feed mizture is made up of ingredients of low digestibility. Onthe same point of view, Suga *et al.*, (1978) found that when enzyme preparation was supplemented to broiler diets containing about 60% barley, body weight gain and feed conversion were significantly ($p<0.05$) improved. Such supplementation improved the feed efficiency of barleybased rations to achieve the value of corn based rations. .

Pommer (1990) used dosages higher than normal i . e . 1 kg /ton feed of each of Energex or Bio-Feed Pro® in examining the possibilities of improving the corn-soybean meal diets. The results showed that the addition of Energex® improved feed conversion ratio and further addition of Bio- Feed Pro® improved the feed efficiency by another 3 - 4% .

Mortality rate recorded throughout the experimental period showed that such supplementation markedly reduced the number of dead birds . This observation could not absolutely taken since the number of birds used in this experiment was not enough to generalize this finding . Further studies must be done to prove if there are antibiotics and / or antibiotic like substances yielded during the submerged fermentation of the microorganism used in producing the enzyme preparations . These expected produced substances , if present, may protect birds against heat stress or infections .

Results of carcass characteristics measured as absolute and relative weight of dressing , liver , gizzard , stomach ,spleen and abdominal fat to live body weight (LBW) are presented in Table 3. There were no significant differences in dressing weight between the control group and those fed the low supplementation level rations . Birds

fed the high supplementation level ration gave significantly (P<0. 05) lower dressing value than the control birds. No significant difference was detected between the two supplementation level treatments. The same trend was observed for liver weight since liver weight of birds fed the high supplemented ration was significantly (P < 0 . 05) lower than those of birds fed the control rations , while no significant difference in liver weight was observed between the control birds and those fed the low supplemented rations . No significant difference was detected between the two supplemented rations .

TABLE 3. Absolute and relative weight of dressing, liver, gizzard, stomach, spleen and abdominal fat to live body weight.

Item	Control	Low Supplementation	High Supplementation
	a	ab	b
Dressing W. (g)	1148 ± 12.2	1122 ± 18.3	1092 ±15.3
% LBW*	72.10	72.15	71.82
	a	ab	b
Liver (g)	30.6 ± 0.8	29.2 ± 0.7	28.5 ± 0.6
% LBW	1.92	1.88	1.87
	a	a	a
Gizzard (g)	34.0 ± 0.8	33.3 ± 0.9	32.1 ± 1.0
% LBW	2.07	2.12	2.16
	a	a	a
Stomach (g)	6.0 ± 0.2	5.8 ± 0.2	5.7 ± 0.2
% LBW	0.38	0.38	0.37
	a	a	a
Spleen (g)	2.4 ± 0.2	2.1 ± 0.1	2.1 ± 0.1
% LBW	0.15	0.14	0.14
	a	a	b
Abdominal fat (g)	45.2 ± 1.8	44.9 ± 3.0	38.6 ± 3.0
% LBW	2.84	2.87	2.53

a...b Means within the same row with no common superscripts are significantly different (P<0.05).

* Live body weight.

Although weights of gizzard , stomach and spleen of birds fed the unsupplemented control ration recorded the highest values , no significant differences were detected among the different groups . Meanwhile , increasing level of supplementation slightly decreased the absolute weight of gizzard and stomach .

The abdominal fat was measured since it is highly correlated with the total body fat (Becker *et al* ., 1979) .The results showed that using high level of supplementation significantly (P < 0 . 05) reduced abdominal fat measured either as absolute weight or percent of live body weight. This could introduce a new way in ameliorating the problem of increasing carcass fat which adversely affects consumer acceptance and health. Meanwhile , it also affects the end product , waste management and by - product composition. It is well known that nutritional factors can be manipulated to some extent to reduce body fat. In this regard , Mabray and waldroup (1981) summarized the nutritional factors influenced the degree of fatness in broilers. Narrow calorie to protein ration and balanced amino acid diet were the most important factors in reducing fat deposition. Using enzyme preparations could join those factors as a nutritional tool to reduce carcass fat .

Table 4 shows the length of the different segments of the alimentary canal . Length of duodenum , ileum and caecum did not significantly vary for birds fed no , low or high level of enzyme supplementation . However , jejunum length showed a significant (p< 0 . 05) difference between birds fed the control ration and those fed the high supplementation level ration . But , jejunum length of birds fed low supplementation level ration showed no significant difference compared with that of the control and those received high supplementation level . Regarding colon length , birds fed the low supplementation level had significantly (P < 0 . 05) smaller colon than those fed either the control or ration of high supplementation level .

TABLE 4 . Length (cm) of the different segments of the alimentary canal.

Item	Control	Low Supplementation	High Supplementation
Duodenum	a 25.5± 0.5	a 24.1± 1.0	a 25.5± 0.4
Jejunum	a 94.8 ± 2.4	ab 99.6 ± 3.4	b 105.4± 3.6
Ileum	a 16.5 ± 0.8	a 17.1 ± 0.4	a 16.6 ± 0.8
Caecum	a 16.6 ± 0.4	a 16.4 ± 0.3	a 16.3 ± 0.6
Colon	a 9.4 ± 0.3	b 8.6 ± 0.1	a 9.3± 0.3

a...b Means within the same row with no common superscripts are significantly different (P<0.05).

References

Becker , W . A ., Spencer , J . V ., Mirosh , L . W . and Verstrate , J . A . (1979) Prediction of fat and fat free live weight in broiler chickens using backskin fat , abdominal fat and live body weight *Poultry Sci. 58* : 835 .

Burnett, G . S . (1966) Studies of viscosity as the probable factor involved in the improvement of certain barleys for chickens by enzyme supplementation . Br . *poult . sci* . 7 . 55.

Chesson , A . (1987) Supplementation enzymes to improve the utilization of pig and poultry diets In "Recent Advances in Animal Nutrition" : Haresign , w . and Lewis , D . (eds) Butterwort London , P . 7

Hesselman , K . and Aman , P . (1986) The effect of ß - glucanase on the utilization of starch and nitrogen by broiler chickens fed on barley of low or high viscosity . *Animal Feed science and Technology* **15** : 83 .

Mabray , C . J . and waldroup , P . W . (1981) The influence of dietary energy and amino acid levels on abdominal fat pad development of the broiler chicken. *poultry Sci* . **60** : 151 .

Mannion , P . F . (1981) Enzyme supplementation of barley based diets for broiler chickens. *Australian journal of Experimental Agricultuer and Animal Husbandry* , **21** : 296 .

Moss , B. R . Beeckler , A . F ., Newman , C . W . and El - Negoumy , A . M . (1977) Enzyme supplementation of broiler rations. *poultry . Sci* ., **56** : 1741 .

Parkany - Gyarfas , A . and Toth , M . (1978) *Acta Alimintaria* , **17** : 111 Cited from Chesson , A ., (1987) .

Pommer , K . (1990) Application of industrial enzymes in broiler feed. In *" proc . 3rd International Symposium on Feed Manufacturing and Quality Control , "Cairo, 7-9 May, P. 151*

Reese , G . L ., Karg , R . S ., Fancher , B . I . and Waldroup , p . W . (1983) The use of supplemented enzymes in the diet of broiler chickens . *Nutr . Rep . Inter* . **28** : 919 .

Rexen, B . (1981) . Use of enzymes for improvement of feed. *Animal feed sicence and technology*. **6** : 105 .

Steel , R . G . D . and Torrie , J . H . (1980) " Principles and Procedures of statistics , " *2 nd* ed. *Mcgraw - Hill Book co . Inc ., New york , N . Y .*

Suga , Y . Kawai , M . Noguchi , S ., Shimura , G . and Samejima , H . (1978) Application of cellulolytic and plant tissue macerating enzyme of Irpex lacteus Fr . as feed additive enzyme. *Agric . Biol . chem* . 42 : 347 .

استخدام المستحضرات الانزيمية فى علائق دجاج اللحم المكونة من الذرة وكسب فول الصويا .

محمد أمين محمد و عقيله صالح حمزة

قسم تغذية وانتاج الحيوان والدواجن - المركز القومى للبحوث .
المعمل المركزى للاغذية والاعلاف - مركز البحوث الزراعية - الجيزة - مصر .

استهدفت الدراسة معرفة تأثير اضافة بعض المستحضرات الانزيمية التى تنتج تجاريا الى العلائق المكونة أساسا من الذرة الصفراء وكسب فول الصويا على أداء كتاكيت اللحم .

استخدم مستحضران إنزيميان أحدهما خاص بتحليل الكربوهيدرات والاخر خاص بتحليل البروتين وتم اضافتهما إلى العلائق بمستويان ٣ر ، ٥ر كجم/طن علف .

أظهرت النتائج عدم وجود فروق معنوية فى وزن الطيور عند عمر ٧ أسابيع بينما استهلكت الطيور فى مجموعات المقارنة كميات من العلف أكبر معنويا من التى استهلكتها الطيور المغذاه على علائق مضاف إليها الإنزيمات .

سجلت نسبة النفوق فروقا كبيرة بين المجموعات المغذاه على علائق مضاف إليها إنزيمات ومجموعات المقارنة . كما ظهرت فروق معنوية فى أوزا ن التصافى الكبد ودهن التجويف البطنى حيث سجلت المجموعات المغذاه على المستوى العالى من الإضافة أوزان أقل من المجموعات الأخرى. أخذت قياسات طولية للأجزاء المختلفة من القناة الهضمية .