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INFLUENCE OF DIFFERENT DIETARY FIBER SOURCES AND LEVELS AND KEMZYME ON GROWTH PERFORMANCE, CARCASS CHARACTERISTICS AND BLOOD CONSTITUENTS OF BROILER CHICKS

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ABSTRACT

The present study was conducted to evaluate two dietary fiber sources (sunflower meal and berssem hay), three dietary crude fiber (CF) levels (2.5, 7 and 9 %). Each dietary fiber level was supplemented with or without Kemzyme H.F. A total number of 480 unsexed day-old Ross broiler chicks were divided into 12 treatments of 40 chicks each in two replicates (20 chicks each). Diets were formulated to contain 20 % CP and 3000 Kcal ME /Kg (starter) and 18 % CP and 3100 Kcal ME /Kg (finisher). Body weight, feed conversion, carcass characteristics and some blood constituents were measured.

Increasing CF level from 2.5 to 7or 9 % significantly ($P<0.01$) reduced body weight and economical efficiency (E.E.). However, feed intake and feed conversion increased at 7 weeks of age. Also, feed conversion increased at 4 weeks of age. However, supplementation of enzyme preparations improved body weight and feed conversion at 4 and 7 weeks of age. Performance of chicks fed sunflower meal was significantly ($P<0.01$) higher than those fed berssem hay. Carcass characteristics and blood constituents were not affected by dietary fiber sources, dietary fiber levels or enzyme supplementation. Using berssem hay decreased economical efficiency compared to sunflower diets.

n conclusions using high level of dietary fiber from sunflower meal had no negative impact on body weight or feed conversion, however a significant ($P<0.01$) decrease in body weight and feed conversion were observed using high dietary fiber from berssem hay.

Keywords: Broilers, fiber, sunflower meal, berssem hay, kemzyme, performance carcass, blood.

INTRODUCTION

Crude fiber is non starch polysaccharide (NSP) that include cellulose, hemicellulose, pectic substance, and beta–glucans. The digestive juices of chicken don't contain enzymes capable of breaking down fiber, although some breaking down may perhaps occur in the two blind caecal tubes. Fiber is, however, thought to play a part in helping peristaltic movement of the digestive tract and thus assists in maintaining muscle tone. Source of dietary fiber determines the beneficial response in broiler chicks (Ricke *et al.*, 1982). The best level of dietary fiber, which achieves acceptable performance in broiler chicks is 3 to 5 % (Feltwell and Fox, 1978). Deaton *et al.*, (1977) verified that laying hens fed diets with a CF content of 8.07 % were not different in performance when compared to those fed basal diet containing 2.55 % CF. Also, Holder (1980) reported that there no significant difference in

body weight gain and feed efficiency for broiler chicks fed diets containing clover hay at level of 0 to 7.5 % compared to the control diet. Moreover, Abbas (1992) reported no adverse effect on performance of broiler chicks fed 7 % CF. In another study, Deaton *et al.* (1979) added a high fiber sunflower meal to laying hen diets until a level of 30 % was reached (8.79% CF) and they observed no differences in performance when compared with hens fed corn soybean meal diet. However, Raharjo *et al.* (1987) fed diets containing 0, 10, 20, and 30% alfalfa meal to broilers from 1 day to 27 day of age. They found that growth was significantly reduced only at 30 % inclusion level.

Therefore, the present study was aimed to evaluate the effect of two sources of dietary fiber (sunflower meal and berssem hay) used by three level with or without enzyme supplementation on growth performance, carcass characteristics and some blood constituents of broiler chicks.

MATERIALS AND METHODS

The present experiment was carried out at Sids Poultry Research Station, Beni Sweef Governorate, Animal Production Research Institute, Agriculture Research Center, Ministry of Agriculture, Dokki, Egypt.

A total number of 480 unsexed day-old Ross broiler chicks were divided into 12 treatments (two replicates and 20 chicks /replicate). The chicks were housed in an open-sided house and kept under similar conditions of management all over the experimental period which lasted for 49 days. The twelve experimental treatments (Table 1) were arranged as 2x3x2 factorial design with two dietary sources (sunflower meal and berssem hay), three levels of CF (2.5,7 and 9 %) and each level was fed with or without Kemzyme H.F. Diets were formulated to contain 20 % CP and 3000 Kcal ME /Kg (starter) and 18 % CP and 3100 Kcal ME /Kg (finisher) and supplemented with DL-methionine and L-lysine-HCl to meet the requirements of chicks during the experimental periods as recommended by NRC, (1994). The tested enzyme preparation was supplemented to diets at level of 1g/Kg diet (Kemzyme H.F., mixture of alpha-amylase, beta-glucanase, protase, lipase and cellulase complex). Feed and water were offered *ad libitum*. Live body weight and feed consumption were recorded weekly and body weight gain and feed conversion (g feed/g gain) were calculated. The tested raw materials were analyzed for the official methods outlined by A.O.A.C. (1990).

At the end of the experiment, four birds from each treatment were chosen randomly for slaughter test and values were calculated as percentage of live body weight. Moreover, blood samples were taken and plasma samples were assigned for determination of total protein (Weichselbaum, 1946), albumin (Doumas, 1971) and total cholesterol (Siedel, 1983). The economical efficiency (the net revenue per unit feed cost) was calculated from input–output analysis. The data were subjected to a factorial (2x3x2), statistical analysis using General Linear Model of SAS software ® (SAS Institute, 1990). Means were separated by Duncan Multiple Range Test (Duncan, 1955).

Table (1): Formulation and composition of starter and finisher diets (%).

Ingredients	Starter					Finisher				
	Control 2.5%	Sunflower		Berssem hay		Control 2.5%	Sunflower		Berssem hay	
		7%	9%	7%	9%		7%	9%	7%	9%
Yellow corn	67.82	57.25	50.06	48.06	37.08	74.25	60.61	52.90	51.33	40.40
Soybeen meal (48%)	25.78	4.13	-	10.70	9.14	18.33	2.64	-	9.28	7.75
Corn glutein (60%)	2.29	10.0	10.0	10.0	10.0	4.38	8.0	6.89	8.00	8.0
Sunflower meal	-	22.24	31.7	-	-	-	22.28	31.62	-	-
Berssem hay	-	-	-	22.39	31.94	-	-	-	22.43	31.97
Corn oil	-	1.90	3.74	5.32	8.60	-	3.15	5.29	6.59	9.87
Limestone	1.37	1.37	1.34	0.68	0.36	1.33	1.30	1.27	0.61	0.29
Dicalcium phosphate	1.80	1.87	1.8	1.74	1.69	1.04	1.09	1.09	0.95	0.91
Premix *	0.25	0.25	0.25	0.25	0.25	0.30	0.30	0.30	0.30	0.30
Salt	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
DL-methionine	0.25	0.163	0.15	0.21	0.22	-	-	-	-	-
L- lysine	0.14	0.53	0.58	0.41	0.42	0.07	0.33	0.34	0.21	0.21
Total	100	100	100	100	100	100	100	100	100	100
Calculated analysis:										
CP	20	20	20	20	20	18.0	18.0	18.0	18.0	18.0
ME	3000	3000	3000	3000	3000	3100	3100	3100	3100	3100
EE	2.89	4.74	6.43	8.05	11.15	3.11	6.06	8.01	9.39	12.48
CF	2.53	7.0	9.0	7.0	9.0	2.4	7.0	9.0	7.0	9.0
NDF	8.46	15.68	18.48	18.39	22.37	8.72	15.62	18.30	18.34	22.31
Cellulose	3.14	5.96	7.33	8.89	11.51	2.19	5.86	7.25	8.81	11.57
Ca	1.0	1.0	1.0	1.0	1.0	0.8	0.80	0.80	0.80	0.80
P(Av.)	0.45	0.45	0.45	0.45	0.45	0.3	0.30	0.30	0.30	0.30
Methionine	0.57	0.57	0.54	0.56	0.57	0.32	0.36	0.36	0.33	0.32
Methionine+ Cystine.	0.90	0.90	0.90	0.90	0.90	0.64	0.69	0.69	0.64	0.63
Lysine	1.10	1.10	1.10	1.10	1.10	0.85	0.85	0.85	0.85	0.85

Supplied per kg of diets: 12000 IU vit. A, 2200 ICU vit.D , 10 mg vit E., 10 mg vit. K_3, 1 mg vit. B_1, 5 mg vit. B_2, 1.5 mg vit B_6, 10 Mcg vit. B_{12} , 30 mg Nicotinic acid, 1 mg Folici acid, 10mg Pantothenic acid, 50 Mcg Biotin, 500 mg Choline cholride, Mn, 60 mg, Zn 50 mg, Fe 30 mg, Cu 10mg, I 1 mg, SE 0.1 mg and 0.1 mg Co.

RESULTS AND DISCUSSION

Growth Performance:

The results (Table 2), indicated that increasing CF level from 2.5 to 7 or 9 % significantly ($P<0.01$) reduced body weight (BW) and increased feed intake (FI) and feed conversion (FC) at 7 weeks of age. The same trend was observed with feed conversion at 4 weeks of age. Using 7 or 9 % dietary fiber exhibited inferior results of BW and FC compared to those fed 2.5 % CF indicating that the chicks could not express their potential at such levels. This may be due to a reduction in the utilization of the basal portion in such high fiber diet. This interpretation is based on that high fiber diets may increase rate of passage of the feed through the digestive tract, thereby reducing the time of ingesta exposure to enzymatic degradation and the time of nutrients contact with the absorptive membranes. These results are in agreement with

those reported by Davorak and Bray (1978). Abbas (1992) also found depression in BWG and FC of broiler chicks with 9 % dietary CF. Similar results were observed by Raharjo *et al.* (1987) who found that growth significantly reduced with 30 % alfalfa meal. Sibbald *et al.* (1957) also reported a significant decrease in apparent digestible nitrogen as the indigestible portion of the diet increased. Moreover, the abrasive nature of fiber and greater volume of digesta could have caused an increase in metabolic nitrogen excretion (Hedge *et al.*, 1978).

Table (2): Live body weight, body weight gain, feed intake and feed conversion as affected by dietary treatments at 4 and 7 weeks of age.

Diets	4 weeks				7 weeks			
	Body weight (g)	Body weight gain (g)	Feed intake (g)	Feed conversion (feed/gain)	Body weight (g)	Body weight gain (g)	Feed intake (g)	Feed conversion (feed/gain)
Dietary fiber source								
Corn/ Sunflower	1011^{a}	959^{a}	1335^{a}	1.39^{b}	1831^{a}	1788^{a}	3977	2.22^{a}
Corn/hay	840^{b}	798^{b}	1205^{b}	1.52^{a}	1782^{b}	1740^{b}	4078	2.35^{b}
Dietary fiber level								
2.5%	927	887	1164^{b}	1.31^{b}	1889^{a}	1850^{a}	3921^{b}	2.12^{b}
7%	930	886	1322^{a}	1.50^{a}	1755^{b}	1711^{b}	4029^{ab}	2.35^{a}
9%	904	862	1324^{a}	1.55^{a}	1775^{b}	1732^{b}	4132^{a}	2.38^{a}
Enzyme supplementation:								
Unsupple-mented diets	907	865	1277	1.48	1787	1744	4050	2.33^{a}
Supple-mented diets	934	892	1263	1.42	1826	1784	4005	2.25^{b}
Interaction								
Level x source	0.0001	0.0001	0.006	0.04	Ns	Ns	NS	0.01
Level x enzyme	0.02	0.02	0.01	Ns	0.01	0.01	Ns	Ns
Level x source x enzyme	Ns	Ns	Ns	Ns	Ns	Ns	Ns	Ns

a, b..... means with no common superscripts within a column are significantly different (P<0.05).

The results indicated that feed intake from high fiber diet was significantly (P<0.01) greater than that from low fiber diet. This may be presumably because fiber decreased the digestibility and metabolizable energy of the diet and more feed is needed to satisfy physiological requirements. These results are in agreement with those reported by Savory and Gentla (1976).

Regarding the dietary fiber source, results in Table 2 indicated that chicks fed diets containing sunflower meal recorded significantly (P<0.01) higher body weight gain and lower feed gain ratio compared with those fed diets containing berssem hay at 4 and 7 weeks of age. This may be interpreted on the basis that sunflower meal doesn't contain anti-nutritional factors such as beta-glucan and pectin (Rinder, 1994). Therefore, fiber in sunflower meal may be partially digested and birds used these fractions through a fermentation process with the help of intestinal microbial flora in the

cecum. This may resulted in improvements in both BW and FC. However, berssem hay, contains indigestible polysaccarides (such as, pectin and cellulose). Fiber constituents such as cellulose (Davork and Bary, 1978) and pectin (Ricke *et al.*, 1982) depressed growth, whereas wood hemicellulose extract (Fahey, 1978) and lignin (Rick *et al.*, 1982) stimulated both growth and feed efficiency.

There were significant interactions between CF levels and dietary fiber sources for body weight, body weight gain, feed intake and feed conversion at 4 weeks of age. However, significant interactions between CF levels and dietary fiber sources for feed conversion was only observed at 7 weeks of age. This indicated that using high fiber level either 7 or 9% CF of dietary sunflower seed meal had no negative impact on body weight and feed conversion. However, significant decrease in body weight and inferior feed conversion were observed using berssem hay. This may be attributed to that berssem hay contains high level of NDF (53.22%) and cellulose (30.73 %) as reported by (Nabil, 2002) vs (40 %) NDF and (18.7%) cellulose for sunflower meal according to Egyptian tables for animal and poultry feedstuffs (2001).

Supplementation of enzyme preparation increased BWG by 3.12 % and 2.30% and improved FC by 4.05 % and 3.43 % at 4 and 7 weeks of age, respectively. These results are in a good agreement with those reported by Gropp and Hashish (1992) who found 3-4% improvement in BWG and FC over chicks feed diets supplemented with enzyme preparations. Moreover, addition of enzyme improved the utilization of high fiber ingredients like oat (Cave *et al.*, 1990) barley (Brenes *et al.*, 1993) and sunflower (Vladimirava *et al.*, 1998). Also, Soliman *et al.* (1996) reported that addition of enzymes to diets containing sunflower meal improved BW and BWG. However, EL-Deek *et al.* (1999) reported that optzyme had no additive effect on growth performance of chicks fed diets containing sunflower meal. Also, the lignin in berssem hay may decreased the activity of enzyme preparations and caused slightly improvment in feed conversion. This may be interpreted on the basis of the results of Fahey *et al.* (1993) who showed that the phenolic nature of the lignin itself may act as an inhibitor of the enzymes since most phenolics are known to be enzyme inhibitors.

Significant interactions between CF levels and enzyme supplementations were observed for body weight, body weight gain and feed intake at 4 weeks of age. The same trend was observed with body weight and body weight gain at 7 weeks of age.

Mortality rates were within the normal range. Postmortem investigation indicated no relationship between treatments and mortality rate.

Carcass characteristics:

Percentage of dressing, liver, gizzard, heart, abdominal fat and total edible parts were not significantly affected by the source of dietary fiber, levels, or enzyme supplementation. However, chicks fed berssem hay diets had significantly higher percentage of gizzard than those fed sunflower meal diets (Table 3). These results are in agreement with these reported by Supic *et al.* (1980) who found no significant difference in carcass composition due to sunflower meal. Also, similar results were obtained by Nabil (2002) with

berssem hay. Increasing CF level from 2.5 to 7 or 9 % in the present study had no significant effect on carcass characteristics of broiler chicks. These results are in an agreement with those reported by Soliman *et al.* (1996). However, Abbas (1992) reported that some depression in carcass characteristics with 9% dietary CF. Data also, revealed that the enzyme treatment had no adverse influence on carcass characteristics. The present results agreed with those reported by El-Hussieny *et al.* (1995) who found that Kemzyme did not change the dressing percentage, abdominal fat and total edible parts of broiler chicks.

There were no significant interactions between dietary fiber sources and either dietary fiber levels or enzyme supplementation for all parameters.

Table (3): Carcass characteristics as affected by different dietary treatments.

Diets	Dressing %	Liver %	Gizzard%	Heart %	Abdo-minal fat %	Total edible parts %
Dietary fiber source						
Corn/Sunflower	69.01	2.11	1.93[b]	0.58	3.15	76.37
Corn/hay	67.55	2.13	2.17[a]	0.62	3.09	75.29
Dietary fiber level						
2.5%	69.03	2.01	2.05	0.58	3.23	76.23
7%	68.54	2.19	1.94	0.57	3.11	76.07
9%	67.26	2.16	2.18	0.64	3.02	75.19
Enzyme supplementation:						
Unsupemented diets	69.11	2.13	2.08	0.62	3.01	76.78
Supplemented diets	67.45	2.10	2.03	0.57	3.23	74.88
Interaction						
Level x source	Ns	Ns	Ns	Ns	Ns	Ns
Level x enzyme	Ns	Ns	Ns	Ns	Ns	Ns
Level x source x enzyme	Ns	Ns	Ns	Ns	Ns	Ns

a, b..... Means with no common superscripts within a column are significantly different (P<0.05).

Blood parameters:

The effect of dietary fiber sources, dietary fiber levels or enzyme supplementation on some blood constituents of broiler chicks are shown in Table 4. Results showed insignificant effect of treatments on either total protein, albumin (A), globulin (G), A/G ratio or cholesterol. However, chicks fed diet containing sunflower meal had significantly (P<0.05) higher level of total protein than those fed diets containing berssem hay. Also, there were no significant interaction between dietary fiber sources and either dietary fiber levels or enzyme supplementation for all parameters.

The present results agreed with those reported by Songailene *et al.* (1988) who reported that the addition of enzyme increased numerically the

total protein, albumin and globulin. Moreover, Pescatore *et al.* (1990) reported that the numerical variations in some blood parameters could be interpreted due to many factors such as genetics, age, sex, physiological state, environmental conditions, nutrition factors as well as pathological factors. Generally, the present values of tested blood protein fractions in broiler chicks which received different dietary treatments were within the normal range published by Meluzzi *et al.* (1992) who reported that reference values of total protein ranged from 2.58 to 5.22 gm/100 ml and those of albumin ranged from 1.17 to 2.74 gm/ 100 ml for broiler chicks.

Table (4):Effect of treatments on some blood constituents of broiler chicks fed different diets.

Diets	Total Protein (g/100ml)	Albumin (g/ml)	Globulin (g/100ml)	A/G (g/100ml)	Cholesterol (mg/100ml)
Dietary fiber source					
Corn/Sunflower	4.13[b]	1.25	2.88	0.51	231
Corn/hay	5.6a	1.74	3.82	0.49	239
Dietary fiber level					
2.5%	4.25	1.54	2.70	0.50	270
7%	5.16	1.42	3.74	0.49	174
9%	5.19	1.54	3.61	0.43	260
Enzyme supplementation:					
Unsupplemeted diets	4.51	1.37	3.14	0.51	225
Supplemented diets	5.22	1.62	3.56	0.49	244
Interaction					
Level x source	Ns	Ns	Ns	Ns	Ns
Level x enzyme	Ns	Ns	Ns	Ns	Ns
Levelxsource x enzyme	Ns	Ns	Ns	Ns	Ns

a, b..... Means with no common superscripts within a column are significantly different (P<0.05).

Economical efficiency:

Results of economical efficiency of broiler chicks fed the experimental diets are summarized in Table 5. The relative economic efficiency of diet supplemented with enzyme preparation was slightly superior (100.2 %). Similar results were reported by Ghazalah *et al.*, (1994) and Soliman *et al.*, (1996). However, inclusion of berssem hay in diets decreased the economical efficiency compared to the control diet. These results agree with those reported by Soliman *et al.* (1996) who reported that increasing sunflower meal in the diets to 25 % decreased economical efficiency. Inclusion of berssem hay in diets decreased economical efficiency compared to sunflower diet. Moreover, increasing CF level from 2.5 to 7 or 9 % decreased economical efficiency.

In conclusion using high level fiber of dietary sunflower meal had no negative impact on body weight or feed conversion, however a significant decrease in body weight and feed conversion were observed using high dietary fiber from berseem hay.

Table (5):Input-output analysis and economical efficiency of different treatments.

Items	Average body wt.	Price/kg live wt L.E	Total/ Revenue/ chick	Total feed intake / chick L.E	Total feed cost/chick L.E	Fixed price/ chick L.E	Total cost/ chick L.E	Net revenue/chick	EE	Relative EE%
Control 2.5%CF	1.819	4.0	7.276	3.851	3.288	1.250	4.538	2.738	0.603	100
Control 2.5%CF+ En	1.960	4.0	7.840	3.991	3.536	1.250	4.786	3.054	0.638	106
Sunflower 7%CF	1.791	4.0	7.164	3.989	3.565	1.250	4.815	2.349	0.488	81
Sunflower7 %CF + En	1.761	4.0	7.044	3.910	3.610	1.250	4.860	2.184	0.449	75
Sunflower 9%CF	1.848	4.0	7.392	4.116	3.757	1.250	5.007	2.385	0.476	79
Sunflower9 %CF + En	1.807	4.0	7.228	4.005	3.772	1.250	5.022	2.206	0.439	73
Berssem 7%CF	1.730	4.0	6.920	4.222	4.017	1.250	5.264	1.656	0.315	52
Berssem 7%CF + En	1.740	4.0	6.960	3.995	3.920	1.250	5.170	1.790	0.346	57
Berssem 9%CF	1.716	4.0	6.864	4.274	4.402	1.250	5.652	1.212	0.214	35
Berssem 9%CF + En	1.728	4.0	6.912	4.135	4.382	1.250	5.632	1.280	0.227	38

Overall effect	Control	Control + enzyme	Sunflower	Berseem hay	2.5%CF	7%CF	9%CF
Economical efficiency	0.419	0.420	0.516	0.390	0.620	0.400	0.340
Relative economical efficiency	100	100.24	100	0.76	100	65	55

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تأثير مصادر ومستويات مختلفة من الألياف الغذائية على الأداء الإنتاجي وصفات الذبيحة ومكونات الدم فى دجاج اللحم

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أجريت هذه الدراسة بهدف تقييم مصدرين من الألياف (كسب عباد الشمس ودريس البرسيم) ، ثلاث مستويات من الألياف (٢,٥ ، ٧ و ٩%) مع إضافة او بدون إضافة مستحضر الكيمزيم (مستحضر انزيمى تجارى). استخدم عدد ٤٨٠ كتكوت روص عمر يوم وزعت على ١٢ معاملة تجريبية بكل مجموعة ٤٠ كتكوت فى مكررين. احتوت عليقة البادئ على ٢٠% بروتين خام ، ٣٠٠٠ كيلو كلورى طاقة ممثلة/كجم علف. تم قياس وزن الجسم ومعامل التحويل الغذائي والكفاءة الاقتصادية وصفات الذبيحة وبعض مكونات الدم.

أوضحت النتائج الأتي:

- أدت زيادة مستوى الألياف الخام من ٢,٥ الى ٧ أو ٩% فى العليقة الى انخفاض معنوى فى وزن الجسم والكفاءة الاقتصادية. بينما زادت كمية الغذاء المستهلك ومعامل التحويل الغذائي فى عمر ٤ أسابيع.
- أدت إضافة الإنزيم الى العلائق الى تحسن وزن الجسم ومعامل التحويل الغذائي فى عمر ٤، ٧ أسابيع.
- أظهرت المجاميع المغذاة على علائق تحتوى على كسب عباد الشمس أعلى أداء إنتاجي بالمقارنة بالمجاميع المغذاة على دريس البرسيم.
- لم تتأثر صفات الذبيحة ومكونات الدم بمصدر ومستوى الألياف الخام أو إضافة الإنزيمات. استخدام دريس البرسيم فى العلائق قلل الكفاءة الاقتصادية بالمقارنة بالعلائق المحتوية على كسب عباد الشمس.
- يستخلص من هذه الدراسة أن استخدام كسب عباد الشمس بمستويات عالية من الألياف الخام ليس له تأثير سلبى على وزن الجسم ومعامل التحويل الغذائى بينما لوحظ انخفاض فى وزن الجسم وزيادة فى معامل التحويل الغذائى مع استخدام دريس البرسيم.