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USING DIETS BASED ON SORGHUM/SOYBEAN MEAL SUPPLEMENTED WITH COMMERCIAL MIXTURE AND PHYTASE ENZYMES AND THEIR EFFECTS ON PERFORMANCE OF HUBBARD BROILER CHICKENS.

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ABSTRACT

This study was carried out at the Poultry farm, Faculty of Agriculture, Minia University. This experiment was designed to study the effects of diets based on sorghum/soybean meal which having different levels of protein and energy with constant C/P ratio, mixed with a commercial mixture of enzymes (pectinases, ß-glucanases and hemicellulases) and phytase enzyme on performance of Hubbard commercial broiler chickens. The traits studied in this experiment were, Live Body Weight (LBW), Body Gain (BG), Feed Intake (FI), Feed Conversion Ratio (FCR), Protein Efficiency Ratio (PER), Energy Efficiency Ratio (EER) and Nutrients Digestibility (ND). The results revealed that: enzymes supplementation improved ($p<0.05$) LBW, BG, feed conversion ratio, the utilization of protein and energy, digestibility coefficients of crude protein and crude fiber. However, enzymes supplementation decreased ($p<0.05$) feed consumption by about 3.16%. Moreover, decreasing the level of protein and energy by 2% and by 300 kcal ME/kg with constant C/P ratio improved protein and energy efficiency ratios.

From the present experiment it could be concluded that:-

1- It's generally not advisable to reduce the dietary CP% and ME by more than 2 % and 300 k cal /kg diet, respectively, with constant C/P ratio to avoid their negative effect on growth performance and nutrients digestibility of Hubbard broiler chickens.

2- Sorghum grains could be economically incorporated into diets of boiler chickens to ease the demand pressure on corn that have favorable price.

INTRODUCTION

All types of poultry require a diet contains a large percentage of cereal grains to provide the required protein and energy. The primary cereal grains used in poultry rations around the world include corn, wheat, barley, rice and sorghum. However, Sorghum is still the second most used cereal grain for commercial growers of broilers, turkeys and egg layers. The nutrient profile of sorghum is complementary to protein sources typically formulated in poultry rations anywhere in the world and is very similar to corn (maize). Amino acid digestibility compares favorably with corn. The fat content of grain sorghum and thus the energy value for poultry is slightly lower when compared to corn

The proximate analysis of sorghum compared to corn indicates that the cereal grains are similar, with sorghum containing less oil and slightly more non-phytate phosphorus. The reduced oil results in slightly less energy value for poultry (as measured by TMEn). However, the average protein content of sorghum indicates that sorghum contains more protein than corn. Although the lysine and methionine levels are lightly lower for grain sorghum compared to corn. (NRC ,1994)

Kriegshauser, *et al.* (2006) indicated that sorghum had higher values of protein, while the energy or fat content of sorghum was slightly lower than that of corn . The results of their work indicated that the nutritional value of sorghum is similar to corn in many nutrient values. Huang, et al., in 2006 conducted a unique study to compare the apparent ileal digestibility of sorghum to corn using broilers, layers, and mature leghorn roosters. Crude protein digestibility of sorghum versus corn in all three classes of birds was similar between the grain sources. However, the amino acid lysine and methionine were slightly more digestible in the corn sample. Dominguez et. al., (2009) studied the effect of adding a commercial mixture of pectinases, a-glucanases and hemicellulases to sorghum-soy feed rations for broilers, and found that ileal amino acid digestibility increased 3%, while the ME was increased by over 6% when used in rations that were marginal in nutrients. They demonstrated that enzymes can be used to get more nutrients from sorghum. Therefore, the present work was carried out to study(a) the effects of diets based on sorghum/soybean meal having different levels of protein and energy with constant C/P ratio, and (b) the effects of adding commercial mixture of enzymes (pectinases, ß-glucanases and hemicellulases) and phytase enzyme on performance of Hubbard commercial broiler chickens.

MATERIALS AND METHODS

This study was carried out at the Poultry farm, Faculty of Agriculture, Minia University to study the effect of diets based on sorghum/soybean meal having different levels of protein and energy with constant C/P ratio with

supplemented commercial mixture of enzymes (pectinases, a-glucanases and hemicellulases) and phytase enzyme and to evaluate on performance of Hubbard commercial broiler chickens. One hundred ninety two (192), unsexed, day old Hubbard broiler chicks were randomly distributed into six (6) groups with four (4) replicates each with eight (8) chicks (3 diets × 2 levels of enzymes mixture × 4 replicates × 8 chicks = 192 chicks). Three diets based on sorghum-soybean meal were formulated to have recommended, medium or low levels of both crude protein and metabolizable energy as shown in Table (1). Chicks were housed in tow-tiers wire floor batteries located in an open house under similar managerial conditions. Dietary treatment (D1) was served as control. The second grower diets were formulated to have gradually decreasing levels of both crude protein by 2% and 4% and metabolizable energy about 300 and 600 kcal/kg diet (D2 and D3), respectively. The traits studied in this experiment were, Live Body Weight (LBW), Body Gain (BG), Feed Intake (FI), Feed Conversion Ratio (FCR), Protein Efficiency Ratio (PER, Energy Efficiency Ratio (EER), and Nutrients Digestibility (ND). At the beginning of the 7th weeks of age digestible trial was carried out to calculate Nutrients Digestion Coefficients (NDC).

RESULTS AND DISCUSSION

1. Live body weight and body gain:

1.1. Effects of enzymes:

The obtained results showed that enzyme supplementation improved ($p<0.05$) live body weight and body weight gain by about 9.44% and 9.55%, respectively. These improvements in body weights of broiler chicks resulted by enzyme supplementation was due to the improvements in feed conversion ratio, protein and energy utilization and higher digestibility of CP and CF. These results agree with results of Ghazalah et al., (2008). (Engster,2008) indicated the beneficial effect of adding enzymes to poultry diets due to improving utilization of substrate in feeds, reducing intestinal viscosity by depolymerization of NSPs and improving nutrient digestibility.

1.2. Effect of diet:

As illustrated in Table (2) birds fed on the diet contained medium levels of energy and protein (D_2) recorded higher ($p<0.05$) body weight and gain, followed by those fed on recommended levels of energy and protein (D_1). This could be attributed to higher ($p<0.05$) feed intake and the improvement in ($p<0.05$) feed conversion ratio for birds fed on recommended (D_1) medium (D2) than those fed on low (D_3) .These results agree with results of Abd El-Gawad et al., (2004).

The effect of interaction (Diet × enzyme) on live body weight and weight gain were significant ($P<0.05$or $P<0.01$). From these results, it could be concluded that improved both live

body weight and weight gain resulted from supplementation of either multi enzyme plus phytase may be due to the improvements in the availability and absorption of nutrients through increasing the digestibility of the ingested diets as proposed by Attia (2003) and Abudabos (2012) .

2. Feed consumption:

2.1. Effect of enzymes

The obtained data resulted that enzyme supplementation decreased ($p<0.05$) feed consumption by about 3.16% compared to birds fed the unsupplemental diets, this may be due to that enzymes reduced the passage of digesta in the digestive tract. These result agree withresults of Selle et al., (2006). On another side, Salem et al., (2008) showed that, addition of enzyme mixture to diets of broiler chicks did not alter feed intake.

2-2- Effect of diet:

As shown in Table (2), the reduction trend of feed consumption was observed with slightly significant differences. Reduction in feed consumption for low protein and energy diet (D3) represented about 5.30% compared to those fed the optimal protein and energy diet (control D1). These results are in agreement with results of Shaldam (2003). On contrary, Abd El-Raheem (2001) found that feed intake was insignificantly decreased by the decrease in dietary protein and energy levels during growing period. As illustrated in Table (2) the decreasing effect of feed intake was slightly dependent on the level of both protein and energy in the diet.

3-Feed Conversion Ratio (FCR):

3-1- Effects of Enzyme :-

Enzyme supplementation had highly significant effect ($P<0.01$) on feed conversion ratios. Addition of enzymes mixture to broiler diets improved ($p<0.01$) feed conversion ratios. This improvement represented about 21.23% compared to broilers fed on the un- supplemented diets. These improvements in feed conversion ratios of broiler chicks resulted by enzymes supplementation could be attributed to the higher body weight gain and high digestibility of CP and CF, protein and energy utilization and at the same time to the decreasing in feed consumption. These results are in full agreement with results of Ramesh and Devegowda (2005)

3-2- Effect of diet

Birds fed on the diet (D_2) achieved the best ($p<0.05$) feed conversion ratio, while those fed on the low levels of protein and energy (D_3) recorded the worest ($p<0.05$) values. The values of feed conversion were 2.12, 1.99 and 2.35 units for birds fed on recommended (D_1), medium (D_2) and low (D_3), respectively.

Enzymes mixture supplementation improved ($p<0.05$) feed conversion of broiler chicks fed on diets had recommended (D_1), medium (D_2) and low (D_3) levels of both protein and energy . The

improvement in feed conversion ratios resulted from adding enzyme mixture to broiler diets were 6.39%, 12.15% and 16.41% for diets 1, 2 and 3, respectively, compared to unsupplemental diets. This could be due to the fact that, enzyme supplementation increased the digestibility and availability of nutrients in imbalanced diet which deficient in protein and energy more than that in balanced diet which permit the birds to utilize such nutrients (CP+E).

4- Protein Efficiency Ratio (PER), (CP intake gm/ gain gm):

4-1- Effect of enzymes

Enzyme supplementation to diets improved ($p<0.05$) the utilization of protein by about 8.08%. This improvement attributed to the increase ($p<0.05$) in protein digestibility (Table 3). These results agree with results of Ghazalah et al., (2008).

4-2- Effect of diet

The efficiency of protein utilization was improved ($p<0.05$) with decreasing the levels of both protein and energy (D_2 and D_3) down recommended level (D_1). The improvements in protein utilization by birds resulted from decreasing the level of both protein and energy in the diets 2 and 3 represented about 13.33% and 8, 05%, respectively, compared to birds fed on recommended protein and energy diet (D_1). From these results, it could be concluded that decreasing the level of protein by 2% and energy by 300 kcal ME/kg with constant C/P ratio improved protein efficiency ratios. These results agree with that results obtained by Sklan and Plavnic (2002). Also, Abd El -Fattah (2002) indicated that, lowering protein level in the diet was more pronounced in improving ($p<0.05$) the efficiency of protein utilization than that of lowering both energy and protein levels.

5- Energy efficiency ratio:

5-1- Effect of enzymes:

Enzyme supplementation improved ($p<0.05$) energy efficiency ratios compared to unsupplemental dietary treatment. These improvements in caloric efficiency ratios by dietary enzyme supplementation represented about 11.95% . The improvement in energy efficiency ratio resulted by enzyme supplementation may be due the increase in nutrients digestibility. Increasing availability of carbohydrates for energy utilization is associated with increasing energy digestibility. Almiral et al., (1995) stated that enzyme supplementation to poultry diet improved energy utilization and reduced gut viscosity.

5-2- Effect of diet:

As illustrated in Table (3) birds fed on medium (D2) or low (D3) levels of both protein and energy utilized energy more efficiently than those fed on recommended levels of protein and energy (D1) by about 11.67%. From these results, it could be concluded that the positive effect of enzymes supplementation on energy utilization was more pronounced in

deficient energy and protein diet compared to balanced diet.

6. Nutrients digestibility :

6.1. Effect of enzymes:

Enzyme supplementation improved (P<0.05) the digestibility of CP (84.98% vs 81.27%) and CF (44.55% vs 36.90). From these results, it could be concluded that, enzymes supplementation improved (P<0.05) the digestibility of crude protein and crude fiber by about 3.71% and 7.65%, respectively. This improvement in nutrients digestibility resulted by enzymes addition may be due to that, enzymes cleave NSPs into smaller polymers, thereby removing their ability to form viscous digesta wich enhanced nutrient digestibilities (Khattak et al., 2006) or due to the hydrolysis of phytate protein which increase availability of amino acids (Hassan et al., 2011) These results agree with results of Ghazallah and Al Saady (2008).

6-2- Effect of diet:

Birds fed diet of medium protein and energy level (D_2) recorded higher (P<0.05) CF digestibility (49.05%), followed by those fed on the control diet (40.86%). However birds fed on the low level of protein and energy (D_3) recorded the worst (P<0.05) value of C.F digestibility (32.19%). Birds fed on the diets of medium (D_2) and low (D_3) protein and energy had similar EE digestibility, but lower value (P<0.05) than those fed on the control dietary treatment (D_1).

From these results, it could be observed that decreasing dietary protein and energy level deteriorated the digestibility coefficients of all dietary nutrients and this detrimental effect increased with the progressive decrease of protein and energy levels. . These results agree with results of El-Mallah et al., (2005) . The effect of interaction (Diet x enzymes), enzyme supplementation to diets of medium (D_2) or low (D_3) levels of both protein and energy insignificantly improved it`s nutrients digestibility rather than that of high protein and energy levels.

Table (1): levels of metabolizable energy (ME) and crude protein (CP) used in the experiment:

	Starter diet			Grower diet		
Item	Level 1	Level 2	Level 3	Level 1	Level 2	Level 3
	D1	D2	D3	D1	D2	D3
C.P %	23	21	19	20	18	16
M.E kcal/kg	3100	2830.44	2560.87	3200	2880	2560
C/P ratio	134.78	134.78	134.87	160	160	160

Table (2): Averages of LBW (gm), BWG (gm), FI (GM) and FCR Intake/gain ± SE as affected by enzymes supplementation into different sorghum-soybean meal based diets.

treatments	LBW (gm)	BWG(gm)	FI (gm)	FCR Intake/gain
	At 42 days	1 -42 days	1 -42 days	At 42 days
Effect of enzymes				
Without	1803.56 b	1759.49 b	4008.52 a	2.29 a
With	1973.81 a	1927.51 a	3882.00 b	2.01b
SE±	20.35±	19.98±	38.29±	0.029±
Signi.	**	**	**	**
Effect of diet				
Diet 1	1944.50 b	1903.80 b	4033.12 a	2.12 b
Diet 2	2042.36 a	1995.65 a	3988.45 a	1.99 c
Diet 3	1679.18 c	1631.04 c	3819.23ab	2.35 a
SE±	24.91±	24.47±	46.89±	0.035±
Signi.	**	**	*	**
Interaction (D×E)				
Diet 1 without E.	1919.05b	1883.09b	4103.61	2.19b
Diet 1 with E.	1969.95b	1924.53b	3962.63	2.05bc
Diet 2 without E.	1907.53b	1859.40b	3989.10	2.14b
Diet 2 with E.	2177.20a	2131.90a	3987.78	1.88c
Diet 3 without E.	1584.10d	1535.98d	3932.85	2.56a
Diet 3 with E.	1774.28c	1726.10c	3705.60	2.14bc
SE±	35.24±	34.61±	66.32±	0.05±
Signi.	*	**	NS	*

Means in the same columns for each treatment having different letter(s) are significantly different ($p<0.05$). NS = not significant ($p>0.05$), * = significant at ($p<0.05$) level, ** = significant at ($p<0.01$) level.

Table (3):- Averages of Protein Efficiency Ratio (PER,) ±SE and Energy Efficiency Ratio (EER) as affected by enzymes supplementation into different sorghum-soybean meal based diets.

	1-42 days (PER,)	1-42 days (EER)
Effect of enzymes		
Without	0.421 a	6.61 a
With	0.387 b	5.82 b
SE±	0.009	0.087
Significant	*	**
Effect of diet		
Diet 1	0.435 a	6.870 a
Diet 2	0.377 b	5.717 c
Diet 3	0.400 b	6.068 b
SE±	0.011	0.107
Significant	*	**
Interaction (D×E)		
Diet 1 without E.	0.430	7.04a
Diet 1 with E.	0.440	6.107bc
Diet 2 without E	0.403	6.687ab
Diet 2 with E.	0.350	6.697ab
Diet 3 without E.	0.430	5.327cd
Diet 3 with E.	0.370	5.450c
SE±	0.015	0.151
Significant	NS	*

Means in the same columns for each treatment having different letter(s) are significantly different ($p<0.05$). NS = not significant ($p>0.05$), * = significant at ($p<0.05$) level, ** = significant at ($p<0.01$) level.

Table (4) Averages of nutrients digestibility ±SE as affected by enzymes supplementation into different sorghum-soybean meal based diets.

Items	Nutrients digestibility					
Trea.	DM %	OM %	CP %	CF %	EE %	NFE %
Effect of enzymes						
Without	73.61 a	77.32 a	81.27 b	36.90 b	83.78 a	77.04a
With	76.62 a	79.21 a	84.98 a	44.55 a	85.52 a	79.69 a
SE±	1.16±	1.23±	0.962±	1.71±	1.04±	1.24±
Significant	NS	NS	*	**	NS	NS
Effect of diet						
Diet 1	80.24a	83.44 a	86.92 a	40.86 b	90.95 a	79.59 a
Diet 2	77.16 a	79.76 a	84.00 b	49.05 a	82.65 b	81.92 a
Diet 3	67.95 b	71.59 b	78.48 c	32.19 c	80.36 b	73.60 b
SE±	1.43±	1.51±	1.17±	2.09±	1.23±	1.18±
Significant	**	**	**	**	**	**
Interaction (D×E)						
Diet 1 without E.	79.52	83.59	86.26	37.48	90.69	78.27
Diet 1 with E.	80.97	83.29	87.58	44.25	91.19	80.90
Diet 2 without E	75.45	78.08	80.94	42.90	81.53	80.36
Diet 2 with E.	78.96	81.44	87.90	55.21	83.77	83.47
Diet 3 without E.	65.97	70.29	76.59	30.18	79.12	72.48
Diet 3 with E	69.93	72.89	80.36	34.20	81.59	74.72
SE±	2.02±	2.13±	1.66±	2.96±	1.81±	2.16±
Significant	NS	NS	NS	NS	NS	NS

Means in the same columns for each treatment having different letter(s) are significantly different ($p<0.05$). NS = not significant ($p>0.05$), * = significant at ($p<0.05$) level, ** = significant at ($p<0.01$) level.

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الملخص العربي

استخدام علائق الذرة الرفيعة (السورجم)/ كسب فول الصويا المضاف إليها خليط الإنزيمات التجارية وأنزيم الفايتيز و تأثيراتها على أداء كتاكيت الهابرد

خيرى عبد الحميد محمد، احمد محمد احمد عثمان، شاكر عبد التواب عبد اللطيف، كوثر عبد الرحمن غالى، مها احمد عبد اللطيف

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أجريت هذه الدراسة فى مزرعة الدواجن كلية الزراعة– جامعة المنيا . وصممت هذه التجربة لدراسة تأثيرات علائق الذرة الرفيعة (السورجم)/ كسب فول الصويا ذات المستويات المختلفة من البروتين والطاقة مع ثبات نسبة البروتين/والسعرات الحرارية . وكان من أهداف الدراسة أيضا دراسة إضافة مخلوط الأنزيمات وأنزيم الفايتيز لتقييم تأثيراتها علي سلالة دجاج اللحم الهبارد التجارية . وكانت الصفات التى تم دراستها هى: وزن الجسم الحى، الزيادة فى وزن الجسم، كمية الغذاء المأكول، نسبة التحويل الغذائي، نسبة كفاءة البروتين والطاقة ومعاملات هضم العناصر الغذائية . وأظهرت النتائج ما يلى :–

إضافة الأنزيمات حسنت كل من وزن الجسم الحى والزيادة فى وزن الجسم ، ونسبة التحويل الغذائي ، الاستفادة من البروتين والطاقة ومعاملات هضم البروتين الخام والألياف الخام ولكن أظهرت النتائج أيضا انخفاض في كمية الغذاء المأكول وعلاوة على ذلك أظهرت النتائج أيضا أن انخفاض مستوى البروتين بمقدار 2% والطاقة بمقدار 300 كيلو كالورى طاقة ممثلة /كجم عليقه مع ثبات نسبة البروتين والسعرات الحرارية.

حسنت من معدلات كفاءة البروتين والطاقة ومن التجربة الحالية يمكن استخلاص الآتى:–

1– بصفة عامة لا يمكن النصيحة بخفض النسبة المئوية للبروتين الخام والطاقة الممثلة بأكثر من 2% بروتين خام وأكثر من 300 كيلو كالورى طاقة ممثلة /كجم عليقه وذلك لتجنب التأثير السلبي على النمو وعلى معاملات هضم العناصر الغذائية .

2– أنه يمكن إضافة الذرة الرفيعة (السورجم) من الناحية الاقتصادية إلى علائق دجاج اللحم وذلك لتخفيف الطلب الضاغط على الذرة الصفراء فى حالة أفضلية سعر الذرة الرفيعة.