The 7th International Conference On Rabbit Production In Hot Climate, 8-12 September, 2014, 321-334

EFFECT OF FEEDING GUAR KORMA MEAL WITH OR WITHOUT β-MANNNASE SUPPLEMENTATION ON PERFORMANCE OF NEW ZEALAND WHITE GROWING RABBITS.

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ASBSTRACT

This experiment was carried out to study the effect of using two levels from guar korma meal (25 or 50% from soybean meal in the diet), 4 or 8% in the diet with or without adding enzyme Hemicell® (β- mannanase enzyme) at a level (0.3kg/kg diet) on growth performance and carcass traits of growing rabbits. Sixty weaned New Zealand White (NZW) rabbits, six weeks old, with an average live body weight ranging from 772.2 to 785.6 g were randomly divided into five groups (twelve rabbits each). Each group was divided into three replicates, (four rabbits each).

The results indicate that *there were insignificant (P>0.05) differences in average body weight and daily weight gain among rabbits groups fed control diet (without guar korma meal), 25% guar korma meal with adding β- mannanase enzyme and 50% guar korma meal with adding enzyme β- mannanase. Feeding rabbits on 25 or 50% guar meal without enzyme β- mannanase significantly (P>0.05) decreased the average body weight and average daily gain, compared to those fed control diet. Rabbits group fed 50% guar korma meal with enzyme achieved the best feed conversion. Using guar meal at 50% level with adding enzyme β- mannanase slightly improved digestibility coefficients of organic matter, crude fiber, ether extract and nitrogen free extract. Nutritive value was improved when rabbits fed diets containing 25 or 50% guar korma meal with enzyme compared to the other tested experimental groups. There were insignificant differences in empty carcass and dressing percentages when rabbits fed on 25 or 50% guar korma meal with or without enzyme compared to the control group. Moreover, growing rabbits feeding diets containing 25 or 50% guar korma meal with or without enzyme insignificantly decreased total volatile fatty acid and ammonia concentration compared to the control group. Results given also indicated that groups fed 25 or 50% guar korma meal with enzyme were achieved the highest economic efficiency (5.55 and 6.82) and relative economic efficiency (119.35 and 146.6).*

Conclusively*, it is concluded that guar korma meal can be used in growing rabbit diets up to 8% in the diet (50% of soybean meal) with β- mannanase enzyme to reduce fed costs without adverse effects on performance of rabbits.*

Key words: Guar meal korma, β- Mannanase, soybean meal, rabbits, growth, digestibility, carcass traits and cecum characteristics.

INTRODUCTION

The price of the main ingredients in poultry and rabbits diets is constantly growing. So, new unconventional local sources of low price ingredients need to be identified and validated. The feed cost of rabbits nutrition represents more than 70% of the total production cost. It is now urgent to look for alternative feedstuffs to compensate the high cost of the conventional feedstuffs. Guar, *Cyamopsis tetragonoloba* L. (syn. *C. psoraloides*) or cluster bean is a drought-tolerant summer annual legume native to India and Pakistan (Rahman and Shafivr, 1967). Guar meal usually sells for almost half price that of soybean meal and is most commonly used in cattle feedlot operations. Increased production of guar beans may offer expanded opportunities for use in least cost poultry feeds. Guar meal is a relatively inexpensive high protein meal produced as a by-product of guar gum manufacture. Guar meal is a by-product of gum extraction and contains both hulls and germ (an approximate ratio of 25% germ to 75% hull) of the ground seed (Lee *et al*., 2004). The protein content of guar meal ranges between 33 to 45% depending on fraction type (Conner 2002). The germ contains most of the protein in seed while the endosperm contains the galactomannan gum. Guar gum is very rich in *β*- mannanase (Choct, 2002). and contains other types of antinutritional factors: trypsin inhibitors, saponin, haemagglutinins, hydrocyanic acid and polyphenols have been identified (Gutierrez *et al*., 2007). However, anti-trypsic activity was found to be lower than in heat-treated soybean meal and therefore not the main cause of antinutritional effects in poultry (Lee *et al*., 2004). The large saponin content of guar seed (up to 13% DM) could have both antinutritionals effect and a positive antimicrobial activity (Hassan *et al*., 2010). Excessive concentrations of guar meal in poultry diets cause diarrhea, depresses growth rate and increases mortality of broilers (Rahman and Leighton, 1968) and decreases egg production and feed efficiency of laying hens (Vohra and Kratzer, 1964). Severe depression in egg production to cessation of lay were observed by (Zimmermann *et a*l., 1987) who fed laying hens 10 and 15% guar meal to induce a molt, and later obtained a satisfactory post-molt laying performance. (Couch *et al*., 1967) who can also be found in chickens fed un-heated soybean meal. However, the trypsin inhibitor was not universally accepted as a primary factor for the deleterious effects of feeding guar product to poultry Vohra and Kratzer (1964). Several treatments, including enzymes (cellulase, hemicellulase, *β*- mannanase), heat treatments and fermentation have been proposed to improve the nutritive value of guar. Autoclaving guar meal can destroy the haemagglutinins and trypsin inhibitors but does not change much the saponin and phytate contents (Rajput *et al*., 1998). Feed additives like enzymes (Zangiabadi and Torki (2010), organic acids (Mahdavi and Torki, 2009) or medicinal plants (Ghasemi *et al*., 2010; Najafi and Torki 2010) has been reported by other researchers. A patented enzyme product (*β*-mannanase, Hemicell) has been shown to improve feed conversion in corn soybean diets fed to layers (Zangiabadi and Torki, 2009). Lee *et al*., (2005) reported that guar meal can be used at up to 5% with *β*- mannanase enzyme in broilers.

Therefore, the objectives of the present study were to investigate effects of dietary inclusion of guar meal with or without β-mannanase enzyme on performance rabbits.

MATERIALS AND METHODS

The experimental work of this study was carried out at Kefir EL-Sheik Governorate, Poultry Research Station, Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture, Egypt,. Guar korma meal was obtained from local market (Imported from India). Enzyme Hemicell® - HT feed (β- mannanase was obtained from Hemgen corp. U.S.A. (160 million units/kg, Extraction from Bacillus Lentus).

Diets and treatments:

Sixty weaned New Zealand White (NZW) rabbits, six weeks old with an average live body weight ranging from 772.20 to 785.60 *g* were allotted randomly to five groups (twelve rabbits /treatment in 3 replicates). All animals were receiving control diet for one week before the start of the experimental period. Feed and water were offered *ad libitum.*

Five experimental diets were formulated; including the control diet without adding guar korma meal while the other four diets were of guar korma meal at 4 or 8% in the diet (25 or 50% of soy bean meal with or without β-mannanase enzyme (0. 3g/kg diet) as shown in Table 1. All the experimental diets were formulated to be iso-nitrogenous and iso-caloric, and to meet all the essential nutrient requirements of growing rabbits according to NRC (1977). However, chemical analyses of guar korma meal and soy bean meal are presented in Table 2. The digestible energy (DE kcal /kg) of guar korma meal and soy bean meal was calculated according to the equation of Fekete and Gippert (1986) as follows: DE (kcal /kg) = 4253 - 32.6 (CF %) - 144.4 (ash %).
While, composition and chemical analyses of the experimental rations are presented in Table 1.

Growth performance:

Feed intake and weight gain were recorded weekly, while feed conversion was calculated accordingly as gram of feed per gram of gain. The experimental period lasted for 8 weeks. At the end of the experimental period, a digestibility trial was conducted to determine the digestibility coefficient of the nutrients according to (Fekete, 1985). Also, 3 animals from each group were slaughtered to study Cecum Characteristics (total volatile fatty acids were determined according to Eadie *et al*. (1967) and ammonia was determined by applying Conway method (1958). Carcass characteristics. head, heart, kidneys, and liver were weighed and dressing percentage were calculated ′according to Steven *et al*. (1981)**.**

Chemical analyses:

Chemical analyses of moisture, CP, CF, EE, NFE and ASH for feed and feces were done according to the methods recommended by A.O.A.C (1990).

Table 1. Composition and chemical analysis of the experimental diets (on DM basis).

Ingredients	Control	Guar korma meal without enzyme		Guar korma meal with enzyme	
		25 %	50%	25%	50%
Clover hay	35.50	35.50	35.00	35.50	35 .50
Yellow corn	20.50	20.50	20.50	20.50	20.50
Barely	12.60	12.60	12.60	12.60	12.60
Wheat bran	9.35	9.35	9.35	9.35	9.35
Soy bean meal	16.00	12.00	8.00	12.00	8.00
Guar korma meal	---------	4.00	8.00	4.00	8.00
Molasses	3.00	3.00	3.00	3.00	3.00
$CaCO_3$	2.20	2.20	2.20	2.20	2.20
NaCl	0.30	0.30	0.30	0.30	0.30
Premix*	0.30	0.30	0.30	0.30	0.30
Methionine	0.20	0.20	0.20	0.20	0.20
Anticoccidia(Diclazuril)	0.05	0.05	0.05	0.05	0.05
Total	**100**	**100**	**100**	**100**	**100**
Chemical analysis (%)					
CP	16.72	17.04	17.54	17.00	17.43
CF	12.30	13.12	13.18	13.10	13.22
Ash	10.75	11.24	11.00	10.95	11.32
EE	2.50	2.63	2.53	2.06	2.67
NFE	46.53	45.87	44.75	45.59	43.86
Calculated digestible energy (DE)					
DE(Kcal/kg)**	2543	2514	2515	2518	2514

***Each kg of Vitamins and Minerals mixture contains**: Vit. A 2.000.000 IU, Vit. B_1 0.33g, Vit. B_2 1.0g, Vit. D_3 150.000 IU, Vit E 8.33g, Vit. K 0.33 g, Pantothenic acid 3.33g; Nicotinic acid, 30.00g; Vit. B_6 2.00g; Vit. B_{12} 1.7 mg, Folic acid 0.83g, Biotin 33 mg, Cu 0.5g, choline choloride 200mg,Mn 5.0g, Fe 12.5g, Mg 66.7mg, Co 1.33 mg, Se 16.6 mg, Zn 11.7g,Iodine 16.6 mg and Antioxidant, 10.0g .

**DE calculated according to Cheek (1987). DE = 4.36 – 0.0491X NDF %, NDF % = 28.92+0.657X CF%

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Statistical analysis:

The experimental data were analyzed using general linear model using ANOVA procedures of SAS (1999). Means were separated using Duncan's (1955). Multiple range tests when the main effect was significant. using the following model:

$$Y_{ij} = \mu + T_i + e_{ij}.$$

Where: μ= Overall mean of Y_{ij}. T_i = Effect of treatment, I = (1,….5), e_{ij} =Random error .

RESULTS AND DISCUSSION

Chemical composition:

The chemical analyses of guar korma meal are presented in (Table 2). The results showed that guar korma meal, is a good alternative source for soybean meal, where it contained comparable crude protein (49.22 *vs*. 44.00%), DE (3149.81 *vs*.3183.7), CF (8.53 *vs*. 3.90%), EE (5.10 *vs*. 1.90), NFE (24.42 *vs*. 32.30) as compared with soy bean meal. The obtained results are in agreement with those analyzed by Ambegaokar *et al*., (1969) and Conner (2002) who stated that crude protein content of guar meal varies from 35 to 47.5% on a dry matter basis and also Nagpal *et al.*, (1971) reported that gross energy of raw and autoclaved guar meal were reported to be 4.837 and 4.861 kcal/g.

Table 2. Chemical analysis of guar korma meal and soybean meal (on DM basis).

Items	Guar korma meal	Soybean meal (44%)
DM	92.90	88.5
OM	94.37	93.60
CP	49.22	44.00
CF	8.53	3.90
EE	5.10	1.90
Ash	5.63	6.40
NFE	24.42	32.30
DE (Kcal/kg)	3149.81	3183.7

Growth performance traits:

The effects of the experimental diets on average body weight gains, feed intake and feed conversion values of the growing rabbits are shown in (Table 3). The results indicate that there were numerical (P>0.05) differences among rabbits groups fed control diets, 25% guar korma meal with enzyme and 50% guar korma meal with enzyme in average body weight (1720.60, 1700 and 1692.00gm, respectively) and average daily gain (16.93, 16.33 and 16.32gm, respectively). While, feeding rabbits on 25% guar korma meal without enzyme or 50% guar korma meal without enzyme significantly (P>0.05) decreased the average body weight and average daily gain, compared to those fed control group. There was insignificant improved in feed conversion ratio, when rabbits were fed diets containing 25% guar korma meal with

Table 3. Effect of guar korma meal with or without enzyme supplementation on growth performance of New Zealand White rabbits.

Items	Control	Guar korma meal without enzyme		Guar korma meal with enzyme		SEM
		25%	50%	25%	50%	
Initial L.B.W. (g)	772.20	777.30	765.60	785.60	778.30	6.59
Final L.B.W. (g)	1720.40^{a}	1662.30^{b}	1563.83^{c}	1700.00 ^{ab}	1692.00^{ab}	15.61
Average daily gain/ (g)	16.93^{a}	15.80^{b}	14.25^{c}	16.33^{a}	16.32^{a}	0.25
Average Feed intake, g/h/d	79.13^{a}	77.41^{bc}	78.83^{ab}	76.60^{c}	75.70^{c}	0.57
Feed conversion (g Feed/g Gain)	4.67^{bc}	4.90^{b}	5.53^{a}	4.69^{bc}	4.64^{c}	0.13

a,b,c--- Means in the same row with different superscripts are significantly different (P<0.05).

enzyme compared to the rabbits fed on control diets and 50% guar korma meal with enzyme. Nevertheless, feeding rabbits on 25% guar korma meal without enzyme or 50% guar korma meal without enzyme significantly worsen the feed conversion ratio compared with those fed diets 25% guar korma meal without enzyme and 25% guar korma meal with enzyme. In contrast, we observed a decrease weight gain and body weight as guar korma meal in rabbit diets. These results agreed with those reported by Kamran *et al*., (2002) who found that adding 5 % guar meal in chicks diet reduce body weight and feed efficiency. In contrast, Gharaeil *et al*., (2012) found that birds received 9 % guar meal in the diets had a significantly lower (P< 0.05) weight gain during starter and total periods and they also had significantly (P<0.05) lower body weight in day 42. There was a trend to significant increase (P<0.10) in body weight gain with enzyme supplementation. The interaction effect of guar meal and enzyme supplementation indicated received 9 % guar meal without enzyme had significantly lower feed intake and higher FCR at all periods of experiment compared with those fed control diet. Lee *et al*., (2003) also in their previous studies reported that there were no negative impacts on productive performance after adding guar meal without enzyme to diets at concentrations only up to 2.5 % in broiler chicks. Lee *et al*., (2005) reported that guar meal can be used at up to 5% with β-mannanase enzyme in broilers. Jackson *et al*., (2004) reported that Hemicell improved weight gain and FCR of broilers.

In general growth depression in rabbits fed diets containing guar meal may be attributed to the residual gum content of guar meal which decreases the nutrient absorption in the gastrointestinal tract (Rainbird *et al*., 1984). The increase in viscosity can reduce glucose absorption up to 35% and water absorption up to 40% (Rainbird *et al*., 1984). But there were an improvement in growth of rabbits fed diets containing guar meal with enzyme. This may be due to that enzyme reduce

intestinal viscosity and improve growth. These results agreed with those of Lee *et al*., (2003) who found that supplementation of the broiler's diet with *β*-mannanase enzyme decreased intestinal viscosity and increased growth and feed efficiency. Patel and McGinnis (1985) also showed that autoclaving or adding hemicellulase enzyme improved growth performance of chickens fed guar meal. Verma and McNab (1982) also found that the inclusion of enzymes such as hemicellulase or *β*-mannanase improved feed utilization.

Nutrients digestibility:

The effects of the experimental diets on digestion coefficients and nutritive values of the growing rabbits are shown in (Table 4). These results indicate that using guar meal at level 50 % with adding, enzyme *β*-mannanase slightly improved digestibility coefficients of organic matter, crude fiber, ether extract, NFE and nutritive values of TDN and DE improved when rabbits feeding diets contain 25 or 50% guar meal korma with enzyme compared to the other tested experimental groups. The reduction in digestion coefficients of the guar meal experimental diets without enzyme could be attributed to the residual gum content of guar meal which may delayed gastric emptying and increased small intestinal transit time, hence inhibiting the absorption of nutrients. (Blackburn and Johnson 1981). Lee *et al*., (2009) reported that increases viscosity in the intestine, resulting in lower digestibility.

The improvement in digestion coefficients when adding enzyme may be attributed to: 1- Enzyme *β*-mannanase or Hemicell is a fermentation product of *Bacillus lentus* hydrolyze polysaccharides from these ingredients and reduce viscosity. 2- Its active ingredient is *β*-mannanase, which can hydrolyze *β*-mannan in feed. *β*-Mannan in ingredients such as guar, soybean meal, and sesame meal, is a powerful antinutritional factor. In these respect, Vohra and Kratzer (1964) reported that OM digestibility are 76% and 71% for the processed and unprocessed meal respectively. Also, El- Manylawi and El-Banna (2013) showed that adding Allzyme® SSF to the rabbits diets containing 10 or 20% date stone meal resulted in numerical increases in the digestibility of most nutrients compared to the other tested diets included the control. Omer *et a l*., (2010) showed that addition 0.5% of dried yeast to rabbit diets improved DM, OM, CP, CF, EE and NFE digestibility compared with the control group.

Cecum characteristics

Rabbit is a small non- ruminant herbivore, Rabbit feeding is more similar to ruminant feeding as rabbit digestive physiology shows some similarity to ruminant, particularly ceacal processes (Marounnek *et al*., 2000). Fermentation pattern in rabbit cecum resembles that in the rumen; however it shows lower fibrolytic microbial activity and relatively higher amylolytic and proteolytic microbial activity Gidenne, 1997). The results of the total volatile fatty acid and ammonia (concentration of caecal contents as shown in Table 5. Recorded values in Table 5 were 3.96, 3.76, 3.73, 3.93 and 3.97 mleq/100ml caecal juice for total volatile fatty

Table 4. Effect of guar korma meal with or without enzyme supplementation on digestion coefficients and nutritive value of New Zealand White rabbits.

Items	Control	Guar korma meal without enzyme		Guar meal korma with enzyme		SEM
		25%	50%	25%	50%	
Digestion coefficients (%)						
DM	60.98	60.73	58.26	60.26	60.79	0.44
OM	63.03 ^{ab}	60.75^{b}	60.74^{b}	65.25^{a}	64.08^{a}	0.60
CP	62.85 ^{ab}	59.27b^{c}	58.30 ^{c}	63.06 ^{a}	62.14 ^{ab}	0.67
CF	39.36^{a}	36.57^{b}	36.28^{b}	39.48^{a}	39.60^{a}	0.49
EE	79.43 ^{ab}	78.45 ^{b}	78.43^{b}	79.80^{ab}	80.43^{a}	0.29
NFE	68.20^{ab}	67.16 ^{b}	66.21^{b}	70.46^{a}	70.23^{a}	0.44
Nutritive value (%)						
DCP	11.20	10.28	10.15	11.12	11.20	0.22
TDN	59.96 ^{a}	57.86^{ab}	56.24^{b}	60.03^{a}	59.96^{a}	0.48
DE	2656.22^{a}	2563.19^{ab}	2491.43^{b}	2659.32^{a}	2656.99^{a}	21.27

DE = TDN X 44.3 according to (Schneider *and flatt* 1975).

a,b---Means in the same row with different superscripts are significantly different (P<0.05).

Table 5: Effect of guar korma meal with or without enzyme supplementation on cecum characteristics of New Zealand White rabbits.

Items	Control	Guar korma meal without enzyme		Guar korma meal with enzyme		SEM
		25%	50%	25%	50%	
TVFA*	3.96	3.76	3.73	3.93	3.97	0.06
Ammonia	8.27	7.10	7.86	8.05	8 .14	0.33

a,b---Means in the same row with different superscripts are significantly different (P<0.05).

TVFA :Total volatile fatty acid.

acid concentration.; 8.27, 7.10 , 7.56, 8.05 and 8.14, mg/100ml caecal juice for ammonia concentration respectively.

Analysis of variance revealed that when growing rabbits fed diets containing 25 or 50% guar meal with or without enzyme insignificantly decreased total volatile fatty acid and ammonia concentration compared to the control group. This result agreed with that found by Maertens *et al*., (1994) who found that adding probiotic in rabbi rations did not affect pH or VFA caecal levels. Also, Abdal-Rahman *et al*., (2010) found that addition of enzyme to rabbit rations decreased ammonia concentration.

Carcass characteristics:

Carcass characteristics at 14 weeks of age of rabbits are presented in Table 6. The obtained results showed that replacing guar meal at levels 25 or 50% with or without supplementation enzyme in the diets, led to insignificant differences in dressing % compared to the control groups. In these respect, Conrad (1964) found that dressing percentage and carcass grades tended to be higher in steer calves fed the processed guar and cottonseed meals compared with the steer calves fed unprocessed guar meal. El-Manylawi and El-Banna (2013) showed that replacing date stone meal at levels 10 or 20% without or with Allzyme® SSF in the diets, led to insignificantly decreased in % dressing.

Table 6. Effect of guar korma meal with or without enzyme supplementation on carcass characteristics of New Zealand White rabbits.

Items	Control	Guar korma meal without enzyme		Guar korma meal with enzyme		SEM
		25%	50%	25%	50%	
Live body weight (Pre slaughter)(g)	1720.40[a]	1662.30[b]	1563.83[c]	1700.0 [ab]	1692.00[ab]	5.61
Empty carcass (%)	54.08	52.41	53.08	53.94	53.25	0.63
Head (%)	6.19	6.24	6.14	6.27	6.27	0.03
Liver (%)	2.81	2.80	2.89	2.81	2.78	0.23
Kidney (%)	0.723	0.750	0.767	0.752	0.753	0.14
Heart (%)	0.379	0.381	0.380	0.381	0.390	0.025
Giblets (%)	3.91	3.93	4.03	3.94	3.92	0.32
Dressing (%)	57.94	56.32	58.43	57.73	57.17	0.37

a,b,c--- Means in the same row with different superscripts are significantly different (P<0.05).

Economic efficiency:

Data presented in Table (7) showed that, the lowest total feed cost / rabbit (10.39 LE) was / rabbit (10.39 LE) was observed with rabbits fed the diets contained 50% guar meal with enzyme followed by that fed 25% guar meal without enzyme (11.34 LE). Results also, indicated that groups fed 25 or 50% guar meal with enzyme were achieved the highest economic efficiency (5.55 and 6.82) and relative economic efficiency (119.35 and 146.6) followed by a decreasing order by groups fed control diet or 25% guar meal without enzyme and the least was the group fed 50% guar meal without enzyme .

Generally, It can be noticed that rabbit fed on 25 or 50% guar meal with enzyme had the best economic return over other treatments one, these results agreement with those of El-Manylawi and El-Banna (2013) who reported that adding Allzyme® SSF in rabbit

Table 7. Effect of guar korma meal with or without enzyme supplementation on economic efficiency of New Zealand White rabbits**.**

Items	Control	Guar korma meal without enzyme		Guar korma meal with enzyme	
		25%	50%	25%	50%
Total feed consumption/rabbit (kg)	4.431	4.334	4.414	4.289	4.239
Price/kg feed (LE)	2.77	2.67	2.57	2.68	2.58
Feed cost/rabbit (LE)	12.27	11.57	11.34	11.49	10.39
Total cost (LE) (A)	34.6	33.90	33.67	33.82	33.26
Final body weight (kg)	1.720	1.662	1.563	1.700	1.692
Cost/kg body weight(LE)	20.11	20.39	21.54	19.89	19.65
Total revenue(LE) (B)	36.12	34.90	32.82	35.70	35.53
Net revenue (LE) (1)	1.61	1.00	0.85	1.88	2.27
Economic efficiency (2)	4.65	2.94	2.52	5.55	6.82
Relative economic efficiency (3)	100	63.22	54.19	119.35	146.6

(A) Including fixed cost (22.33 LE/rabbit), (B) Assuming that the selling price is (21 LE)., (1) Net revenue=B–A.
(2) Economic efficiency = (B -A / A).
(3) Relative Economic Efficiency = Economic efficiency of treatments other than the control / Economic efficiency of the control group.

diets containing 10% date stone meal achieved good economical efficiency compared to control group.

Conclusively, The results indicated that guar korma meal can be used with enzyme supplementation up to 8% (50% of soy meal) in pelted diets for growing rabbits to reduce fed costs without harmful effects on performance.

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تأثير التغذية على كسب الجواركورما مع أو بدون اضافة انزيم البيتا مانينيز على الأداء الانتاجى للأرانب النيوزيلاندى الأبيض النامية

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أجريت هذه التجربة لدراسة استخدام ٤ ،٨% (٢٥ ،٥٠% كسب الجواركورما من كسب فو الصويا فى العليقة مع أو بدون اضافة الأنزيم هيمى سيل انزيم (بيتا مانينيز) بمستوى 0.3جم\كجم عليقة) على أداء النمو وصفات الذبيحة فى الأرانب النامية . تم استخدام عدد ٦٠ أرنب نيوزيلاندى أبيض مفطوم عمر ٦ أسابيع بمتوسط وزن يتراوح بين 772.20 إلى 785.60 جراما وزعت عشوائيا على خمس مجموعات بكل مجموعة ١٢ أرانب مقسمة إلى ٣ مكررات بكل مكرر ٣ أرانب. أوضحت النتائج انه لايوجد فرق معنوى فى وزن الجسم ومعدل النمو اليومى بين الأرانب المغذاه على عليقة الكنترول والعليقة التى تحتوى على ٢٥،٥٠ % كسب الجوار كورما المضاف لها الأنزيم) . بينما انخفض وزن الجسم ومعدل النمو اليومى معنويا بتغذية الأرانب على ٢٥،٥٠% كسب الجواركورما الغير مضاف لها أنزيم بالمقارنه بعليقه الكنترول .أعطت المجموعه المغذاة على ٥٠ % كسب الجوار كورما المضاف لها الأنزيم أفضل النتائج فى كفاءة التحويل الغذائي .وقد تحسنت معاملات هضم المادة العضوية والألياف الخام ومستخلص الأثير والمستخلص الخالى من الأزوت تحسنا طفيفا مقارنة بالمجموعات التجريبية الأخرى .وقد تحسنت القيمة الغذائية عند تغذيه الأرانب على ٥٠% كسب الجواركورما مضاف له الأنزيم مقارنة بالمجموعات التجريبية الأخرى وقد وجد انه عند تغذيه الأرانب على ٢٥% كسب الجوار مضاف له الأنزيم فرق غير معنوى فى النسبة المئوية لنسبة التصافى وكان هناك فروق غير معنوية فى نسبة الأحماض الدهنية الطيارة والأمونيا بالمقارنه بعليقه الكنترول . وقد أشارت النتائج أن المجموعات التى غذيت على ٢٥، ٥٠ % كسب الجوار كورما المضاف لها الأنزيم حققت أعلى كفاءة إقتصادية 5.55 و 6.82 وأعلى كفاءة إقتصادية نسبية 119.35 و 146.6 .

التوصية:- يستخلص من نتائج التجربة بأنه يمكن استخدام كسب الجوار كورما فى علائق الأرانب النامية حتى نسبة ٨% (٥٠% من كسب فول الصويا) مع أضافة أنزيم بيتا مانينيز لخفض تكلفة العليقة بدون أي تأثيرسلبى على الأداء الأنتاجى للأرانب.