

Response of Egg-type Chicks to Dietary Inclusion of Heat -Treated Guar Seeds (*Cyamopsis tetragonoloba*) as Protein Source Fortified with Natuzyme

Elamin Khidir Elfadil¹, Bushra Elhady Hussies², Mutaz Saeed Babiker², and Asma Ali Tameem eldar²

¹Sudanese Nile Poultry, Northern Sudan State, Korti- Sudan

²Faculty of Animal Production, University of Gezira, Wad madani- Sudan

Corresponding author email: Alaminkheder622@gmail.com

ABSTRACT

The study was carried out to investigate the response of Egg-type Pullets to Dietary Inclusion of Heat-Treated Guar Seeds (*Cyamopsis tetragonoloba*) as Protein Source Fortified with Enzyme. the guar seeds were heat processed (boiling) in water for 20 minutes and then dried using solar radiation after water drainage, ground and subjected to chemical analyses. A (2 × 4) factorial arrangement was used in a completely randomized design (CRD) to study the effect of four different levels of Heat-Treated Guar (0, 5, 10, and 15 %) and two levels of enzyme supplementation (0 and 500 mg/kg) on pullets' performance. The control diet contained 0% of Heat-Treated guar and 0% Enzyme. A total of 240 one day-old (Hy-Line W-98) chicks were allotted to 8 treatments and each treatment was replicated three times with 10 birds each. Results showed that guar phytate and tannin content were reduced by boiling processing. During the entire growing period, WG and FCR were deteriorated as the dietary level of guar increased ($p \leq 0.01$). The WG and FCR were improved when diets were supplemented with Natuzyme ($p \leq 0.05$). Feed consumption was not affected by experimental treatments. At the end of developer period, protein, cholesterol, calcium and phosphorus were not influenced by Natuzyme. However, cholesterol and calcium were affected by incorporation of guar. Hematological parameters at 18 week of age were not affected by experimental treatments The only exception was the white blood cells account (WBC) which affected by dietary guar. Ages at onset of egg were postponed as the level of guar increased. Birds fed on diets supplemented with multienzyme had earlier age of onset of egg production.

Key words: Chicks, Cholesterol, Gaur seeds, Feed consumption, Weight gain.

INTRODUCTION

Protein quality is most important factor in poultry nutrition. The major objective of poultry production is to produce meat and eggs efficiently at economical rate which is only possible by using cheaper locally available feed ingredient because feed alone act as 70-75 percent of the total cost (Panda and Mahapatra, 1989). The use of locally available protein source will exclude the imported concentrates expenditure. There has always been interest in legume grain protein source for meat type chicken as an alternative to soybean meal (Robinson and Singh, 2001). The enzyme supplementation preparations improve nutrient utilization and growth of young poultry (Friesen *et al.*, 1992) protein and amino acid requirements vary considerably according to the productive state us of the bird that is the rate of growth or egg production. Guar meal is considered as a potential unconventional feed resource for livestock, (Couch *et al.*, 1967). Dry matter content of guar meal may vary due to difference in the processing technique adopted and seasonal condition. Nadeem *et al.* (2005) found 96.7% DM during their study of true metabolizable values of poultry feed. Lee *et al.* (2009) observed that DM content for germ, hull and combined guar by product being 93.2%, 95.4% and 94.8, respectively. Whistler and hymowitz (1979) reported that guar seed contains 4% oil. Verma and McNab, (1984) reported 5.5%, 5.7% and 5.9% while Lee *et al.* (2004) report 5.8%, 2.8% and 4.5% EE in guar germ, hull and combined guar by product, respectively. This study had been carried out to investigate the response of Egg-type Pullets to Dietary Inclusion of Heat-Treated Guar Seeds as Protein Source Fortified with Enzyme.

MATERIALS AND METHODS

Housing and management of the birds

A total of 240 one day-old (Hy-Line W-98) chickss were allotted to 8 treatments and each treatment was replicated three times with 10 birds in each replicate. A total of 24 pens were divided inside the house. All pens were covered with clean wheat straw as litter. The light regiment during the rearing period was carried out to Elshaheed for food production and distribution recommendation Company.

Experimental design and diets

A (2 × 4) factorial arrangement was used in a completely randomized design (CRD) to study the effect of four different levels of Heat-treated Guar (0, 5, 10, and 15 %) and two levels of enzyme supplementation (0 and 500 mg/kg) on pullets' performance. The control diet contains 0% of Heat-treated guar and 0% Enzyme. Guar seeds were purchased from Singa Town-Sinnar State in the central of Sudan. The guar seeds were heat-Treated (boiling) in water for 20 minutes and after water drainage then dried using solar radiation, ground and subjected to chemical analyses to be included in the experimental rations. Samples of raw and heat-treated (boiling) guar seeds were subjected to proximate analysis according to (AOAC, 2005) (Table 1). The experimental rations were formulated to be iso-energetic iso-nitrogenous to meet or exceed the requirements of pullets' growing phases (starter, grower and developer). according to (NRC, 1994). Analysis of anti-nutritional factor was done to guar (Table 2). Water and feed were offered *ad libitum*.

Table 1. Approximate analysis of guar seeds before and after boiling

approximate analysis of guar seeds before boiling		approximate analysis of proceed guar seeds	
Compounds	Percent%	Compounds	Percent%
DM	97.5	DM	95
EE	8.5	EE	8.1
CP	28.9	CP	26.9
CF	8.5	CF	12.06
Ash	6.6	Ash	7
NFE	39.3	NFE	40.6
ME (Kcal/kg)	2954.51	ME (Kcal/kg)	2897.01

¹ME calculated according to equation of Lodhi *et al.* (1970)

Table 2. Analysis of anti-nutritional factor

	Before the boiling mg/100g	After boiling mg/100g
Tannin	0.0493	0.0478
Polyphenol	3.6297	2.5777
Phytic acid	1.7586	1.5288

Table 3. composition of experimental diets ingredient %as fed (starter pullets)

Treatments	Experimental diets			
	0%	5%	10%	15%
Ingredients				
Sorghum	50.45	50	50	50
Ground nut meal	12.7	10.6	8	5.9
Wheat bran	28.78	26.55	24.15	21.38
Guar seed	0	5	10	15
Supper concentrate	5	5	5	5
Di- calcium	1.02	1	1.1	1.05
L-stone	0.5	0.45	0.45	0.47
Salt	0.3	0.3	0.3	0.3
Lysine	0.5	0.5	0.4	0.3
Methionine	0.25	0.1	0.1	0.1
V-oil	0	0	0	0
Premix	0.5	0.5	0.5	0.5
	Calculated			
ME (k cal/kg)	3037.29	3042.01	3042.91	3046.91
PROTEIN	20.86	20.68	20.29	20.09
	Analysis			
ME (k cal/kg)	3027.3	3035.03	3037.29	3034.26
PROTEIN	19.12	19.4	18.9	19.16

Table 4. Composition of experimental diet ingredient% as fed (grower pullet)

Treatments	Experimental diets			
	0%	5%	10%	15%
Ingredients				
Sorghum	51.15	52.5	51.8	51.3
Ground nut meal	7.5	5.7	4	2.1
Wheat bran	29.78	25.45	22.85	20.38
Guar seed	0	5	10	15
Supper concentrate	5	5	5	5
di- calcium	1.02	1	1.1	0.95
L- stone	0.5	0.45	0.45	0.5
Salt	0.3	0.3	0.3	0.3
Sand	3.5	3.5	3.5	3.5
Lysine	0.5	0.3	0.2	0.2
methionine	0.25	0.3	0.3	0.3
v- oil	0	0	0	0
Premix	0.5	0.5	0.5	05
Calculated				
Protein	18.49	18.38	18.31	18.19
ME(kcal/kg)	2944.16	2956.26	2952.75	2954.28
Analysis				
Protein	18.32	18.04	18.2	18.32
ME(Kcal /kg)	2941.525	2947.49	2943.21	2936

Performance parameters

Feed consumption, body weight and weight gain were recorded weekly and at the end of the growing period. Feed conversion ratio (FCR) was also calculated weekly and at the end of the growing period. During the experimental period, records were kept for Hen- day egg production, egg weight, Mortality rate was recorded daily when occurred.

Table 5. Composition of experimental diets ingredient% as fed (developer pullets)

Treatments ingredients	Experimental diets			
	0%	5%	10%	15%
Sorghum	50.1	51.82	52	41.4
Ground nut meal	6.5	4.8	3.6	0.5
Wheat bran	28.97	24	20.02	30.23
Guar seed	0	5	10	15
Supper concentrate	5	5	5	5
di- calcium	0.55	0.8	0.8	0.8
L- stone	6	6	6	60
Salt	0.3	0.3	0.3	0.3
Sand	1.81	1.51	1.51	0
Lysine	0.02	0.02	0.02	0.03
methionine	0.25	0.25	0.25	0.03
v- oil	0	0	0	0.24
premix	0.5	0.5	0.5	0.5
Calculated				
ME (kcal/kg)	2856.11	2864.61	2864.18	2885.72
Protein %	17.68	17.66	17.83	17.81
Analysis				
ME (kcal/kg)	2821.55	2816.36	2811.32	2807.22
Protein%	17.02	17.27	17.43	17.2

Serum biochemical indices

Samples without anti-coagulant were centrifuged in test tube for ten minutes (hetlich EBA 20-Germany) at 2000 rpm at room temperature to separate the cells from the plasma for serum biochemical indices. Serum samples were collected and kept for analysis. All tested blood

cholesterol; tri-glycerides, blood protein, calcium and phosphorus were determined spectrophotometrically by using commercial kits.

Table 6. Composition of experimental diet ingredient% as fed (layer hens)

Treatments	Experimental diets			
	0%	5%	10%	15%
Ingredients				
Sorghum	48.1	49	42.3	41.4
Ground nut meal	13	7.2	5.27	3.5
Wheat bran	25.47	26.12	29.58	27.23
Guar seed	0	5	10	15
Supper concentrate	5	5	5	5
di- calcium	1.02	0.8	0.8	0.8
l-stone	6	6	6	6
Salt	0.3	0.3	0.3	0.3
Lysine	0.01	0	0	0
Methionine	0.1	0.08	0.05	0.03
v-oil	0.5	0	0.2	0.24
Premix	0.5	0.5	0.5	0.5
Calculated				
Protein	20.08	18.81	18.83	18.83
ME(kcal/kg)	2911.33	2899.25	2882.54	2881.2
Analysis				
Protein	20.32	18.72	18.65	18.56
ME(kcal/kg)	2897.64	2886.15	2865.36	2863.21

Statistical analysis

Experimental data presented as mean \pm standard errors of the mean. Statistical analysis was carried out by using SPSS 21.0 program package (SPSS, 2010). The significance of the differences among means has been determined by Duncan's multiple range tests (Petrie and Watson, 1999).

RESULTS AND DISCUSSION

Effect of dietary inclusion of Heat -Treated Guar Seeds with Enzyme on pullet's performance during starter period (0-6weeks)

Table 7 showed that dietary inclusion of treated guar and enzyme were not affected on feed consumption, while weight gain and feed conversion ratio were highly significant ($p \leq 0.01$) affected by guar treatments. highly significantly ($p \leq 0.01$) interactions were observed between guar and enzyme on weight gain and feed conversion ratio. These results agree with (Odetallah *et al.*, 2002) whom reported that there were no significant different on feed consumption by enzyme supplementation. Also, agree with Gutierrez *et al.* (2007) whom they report that hens fed guar treatment not necessarily decrease the feed consumption of laying hens when added at low level.

Effect of dietary inclusion of Heat -Treated Guar Seeds with Enzyme on pullet's performance during grower period (7-12 weeks)

Table 8 showed that guar treatments and enzyme highly significantly ($p \leq 0.01$) affected on weight gain and feed conversion ratio. The lowest weight gain and feed conversion ratio were recorded with birds fed 15% guar diet. No interactions effects were observed between guar and enzyme. These results in line with Gutierrez *et al.* (2007) whom reported that the body weight decreased as guar meal concentration increased.

Effect of dietary inclusion of Heat -Treated Guar Seeds with Enzyme on pullet's performance during developer period (13-18 weeks)

Table 9. showed that guar treatments highly significantly ($p \leq 0.01$) affected on weight gain and feed conversion ratio. In contrast enzyme was not affected on feed conversion ratio but weight gain significantly ($p \leq 0.05$) affected by enzyme treatments. Highly significantly ($p \leq 0.01$) interactions effects were observed between guar and enzyme on weight gain. These results

disagreed with (Annison and Choct, 1995) and MC Naughton *et al.* (1998) whom stated that enzyme supplementation of poultry ration has been widely review and well documented to

Table 7. Effect of dietary inclusion of Heat- treated guar seeds and enzyme supplementation on pullet's performance during starter period (0-6 week)

Treatment	Items		
	Feed consumption(g)	Weight gain(g)	F.C. R(g:g)
Guar 0% enzyme	179.9	55.8	3.12
Guar 0% no enzyme	178.2	56	3.09
Guar 5% enzyme	179.2	51	3.42
Guar 5% no enzyme	178.2	48.9	3.52
Guar 10% enzyme	178.8	44.5	3.85
Guar 10% no enzyme	178.5	48.2	3.54
Guar 15% enzyme	178.9	44.1	3.88
Guar 15% no enzyme	178.1	41.7	4.21
SEM	6.03	0.97	0.086
Guar effect			
0% guar	179.1	55.9 ^a	3.11 ^d
5% guar	178.6	50 ^b	3.47 ^c
10% guar	178.6	46.4 ^c	3.69 ^b
15% guar	178.5	42.9 ^d	4.04 ^a
SE M	4.3	0.684	0.061
Sig	NS	**	**
Enzyme effect			
Supplemented	179.2	48.8	3.57
Enzyme free	178.2	48.7	3.59
S E M	3.01	0.484	0.043
Sig	NS	NS	NS
Guar × enzyme Interaction	NS	**	**

^{a b} Means values within a column with no common superscript differ significantly

*: Significant with (p<0.05), **: Significant with (p<0.01), NS: Not significant

improve efficiency of converting feed stuffs into broiler tissue and improve metabolizable energy, growth and feed conversion.

Table 8. Effect of dietary inclusion of Heat- treated guar seeds and enzyme supplementation on pullet's performance during starter period (7-12 week)

Treatment	Items		
	Feed consumption(g)	Weight gain(g)	F. C. R (g:g)
Guar 0% enzyme	360.2	100.3	3.68
Guar 0% no enzyme	360.5	95.4	3.91
Guar 5% enzyme	357.4	91.4	3.99
Guar 5% no enzyme	359.1	87.2	4.23
Guar 10% enzyme	357.5	82.7	4.48
Guar 10% no enzyme	357.6	79.6	4.64
Guar 15% enzyme	355.8	76.9	4.78
Guar 15% no enzyme	357.7	75.3	5.12
S E M	2.41	1.065	0.077
Guar effect			
0% guar	360.4	97.9 ^a	3.79 ^d
5% guar	358.3	89.3 ^b	4.11 ^c
10% guar	357.5	81.2 ^c	4.56 ^b
15% guar	356.7	76.13 ^d	4.94 ^a
S E M	1.7	0.753	0.054
Sig	NS	**	**
Enzyme effect			
Supplemented	357.7	87.9 ^a	4.23 ^b
Enzyme free	358.7	84.4 ^b	4.47 ^a
S E M	1.2	0.532	0.038
Sig	NS	**	**

Guar × enzyme Interaction	NS	NS	NS
---------------------------	----	----	----

^{a b} Means values within a column with no common superscript differ significant
*: Significant with (p<0.05), **: Significant with (p<0.01), NS: Not significant

Table 9. Effect of dietary inclusion of Heat- treated guar seeds and enzyme supplementation on pullet’s performance during starter period (13-18 week)

Treatment	Items		
	Feed consumption(g)	Weight gain(g)	F.C. R(g:g)
Guar 0% enzyme	444.8	72.9	6.17
Guar 0% no enzyme	443	70.2	6.32
Guar 5% enzyme	443.2	72.4	6.15
Guar 5% no enzyme	443.4	72	6.16
Guar 10% enzyme	443.2	70.9	6.26
Guar 10% no enzyme	442.9	70.7	6.28
Guar 15% enzyme	442.7	68.8	6.43
Guar 15% no enzyme	444.2	70.2	6.38
S E M	2.49	0.293	0.053
Guar effect			
0% guar	443.94	71.5 ^b	6.24 ^{bc}
5% guar	443.28	72.2 ^a	6.15 ^c
10% guar	443.06	70.9 ^c	6.27 ^b
15% guar	443.43	69.5 ^d	6.41 ^a
S E M	1.76	0.207	0.037
Sig	NS	**	**
Enzyme effect			
Supplemented	443.48	71.3 ^a	6.25
Enzyme free	443.37	70.8 ^b	6.29
S E M	1.25	0.147	0.027
Sig	NS	*	N S

Guar × enzyme	NS	**	NS
Interaction			

^{a b} Means values within a column with no common superscript differ significant

*: Significant with (p<0.05), **: Significant with (p<0.01), NS: Not significant

Effect of dietary inclusion of Heat -Treated Guar Seeds with Enzyme on pullet’s performance during developer period (0-18 weeks)

Table 10 showed that neither guar nor enzyme had affected on feed consumption. However, guar treatments highly significantly affected on weight gain and feed conversion ratio. Enzyme supplementation significantly (p≤0.05) affected on weight gain and feed conversion ratio. No interactions effects were observed between guar and enzyme. These finding agreed with Rainbird *et al.* (1984) whom reported that the Poor growth observed after guar meal feeding is attributed to the residual gum contained in guar meal.

Effect of dietary inclusion of Heat-Treated guar seeds and enzyme supplementation on serum characteristics of pullets (12 week of age)

Table 11 showed that total protein and pH were not affected by guar treatments, while cholesterol, triglyceride, and Ca were significantly (p≤0.05) affected by guar diets. Enzyme supplementation highly significantly (p≤0.01) affected triglyceride and significantly (p≤0.05) affected on cholesterol and pH. The finding results were agreed with Wu *et al.* (2005) whom observed that enzyme supplementation can improve availability of phosphorus in feed

CONCLUSION AND RECOMMENDATIONS

Conclusion

Heat-Processing reduced the anti- nutritional factors of guar seeds which made the nutritional components of guar be more bioavailable.

Recommendations

Based on the present results, it can be stated that high levels of boiled guar in egg-type pullet diets may cause significant adverse effects on the performance.

Table 10. Effect of dietary inclusion of Heat- treated guar seeds and enzyme supplementation on pullet's performance during starter period (0-18 week)

Treatment	Items		
	Feed consumption(g)	Weight gain(g)	F.C. R(g:g)
Guar 0% enzyme	328.3	76.3	4.3
Guar 0% no enzyme	327.3	73.9	4.4
Guar 5% enzyme	326.6	71.6	4.5
Guar 5% no enzyme	326.8	69.4	4.6
Guar 10% enzyme	326.4	66.1	4.9
Guar 10% no enzyme	326.3	66.2	4.8
Guar 15% enzyme	325.8	63.3	5.03
Guar 15% no enzyme	326.6	62.3	5.24
S E M	5.28	0.834	0.065
Guar effect			
0% guar	327.8	75.1 ^a	4.38 ^d
5% guar	326.7	70.5 ^b	4.58 ^c
10% guar	326.4	66.2 ^c	4.84 ^b
15% guar	326.2	62.8 ^d	5.13 ^a
S E M	3.74	0.589	0.046
Sig	N S	**	**
Enzyme effect			
Supplemented	326.8	69.3 ^a	4.68 ^b
Enzyme free	326.7	67.9 ^b	4.78 ^a
S E M	2.64	0.417	0.032
Sig	NS	*	*
Guar × enzyme	NS	NS	NS

interaction

^{a b} Means values within a column with no common superscript differ significant

*: Significant with (p<0.05), **: Significant with (p<0.01), NS: No significant

Table 11. Effect of dietary inclusion of Heat-Treated guar seeds and enzyme supplementation on serum characteristics of pullets (12 week of age)

Treatment	Items				
	Total protein gm/dl	Cholesterol gm/dl	Triglyceride gm/dl	Ca gm/dl	pH gm/dl
Guar 0% enzyme	5.87	70.66	128	8.33	3.4
Guar 0% no enzyme	5.87	57.66	118.3	8.23	3.03
Guar 5% enzyme	5.96	68.00	131	7.93	3.3
Guar 5% no enzyme	5.80	68.33	127	7.83	3.2
Guar 10% enzyme	5.83	75.00	122	7.90	3.2
Guar 10% no enzyme	6.23	70.00	122.67	8.27	3.0
Guar 15% enzyme	5.73	64.67	130.33	8.07	3.4
Guar 15% no enzyme	6.00	70.66	114.67	7.90	3.4
S E M	0.200	2.29	2.19	0.153	0.113
Guar effect					
0% guar	5.86	64.17 ^b	123.16 ^b	8.28 ^a	3.21
5% guar	5.88	68.17 ^{ab}	129 ^a	7.88 ^b	3.25
10% guar	6.03	72.5 ^a	122.33 ^b	8.08 ^{ab}	3.11
15% guar	5.87	67.67 ^{ab}	122.5 ^b	7.98 ^{ab}	3.40
S E M	0.141	1.62	1.55	0.108	0.080
Sig	NS	*	*	*	NS
Enzyme effect					
Supplemented	5.85	69.58 ^a	127.83 ^a	8.05	3.33 ^a
Enzyme free	5.98	66.67 ^b	120.66 ^b	8.05	3.15 ^b
S E M	0.100	1.14	1.09	0.076	0.057
Sig	NS	*	**	NS	*

Guar × enzyme	NS	**	*	NS	NS
Interaction					

^{a b} Means values within a column with no common superscript differ significant

*: Significant with (p<0.05), **: Significant with (p<0.01), NS: Not significant

REFERENCES

- Annison, G., Hughes, R. J. and Choct, M. (1995). Effects of enzyme supplementation on the ****nutritive value of de hulled lupins. *Br. Poult. Sci.* 37:157–172.
- AOAC (2005). Official methods of analysis of the Association of Official Analytical Chemists international 15th edition association of official Analytical chemists, Arlington VA, USA.
- Couch, J. R., Bakshi, Y. K., Ferguson, T. M., Smith, E. B. and Creger, C. R. (1967). The effect of processing on the nutritional value of guar meal for broiler chicks. *Br. Poult, Sci.*8: 243-250.
- Friesen, O. D., Guenter, W., Marquardt, R. R. and Rotter., B. A. (1992). The effect of enzyme supplementation on the apparent metabolizable energy and nutrient digestibility of wheat, barley, oats, and rye for the young broiler chick. *Poult. Sci.* 71:1710.
- Gutierrez, O., Zhang, C., Cartwright, A. L., Carey, j. b. and Bailey, C. A. (2007). Use of guar by- products in high – production laying hen diets Department of poultry science, texas A&M University College station 77843.
- Lee, J. T. Connor-Appleton, S., Baily, C. A. and Cartwright, A. L. (2004). quantitative measurement of negligible trypsin inhibitors activity and

nutrient analysis of guar meal fraction *J. Agricu food chem* 20: 6492-56495.

Lee, J. T., Bailey, C. A. and Cartwright, A. L. (2009). *in vitro* viscosity as a function of guar meal and beta-mannanase content of feeds. *International Journal of poult, sci* 8 (8): 715-719.

Lodhi, G. N., Danalat, S. and Lchhoponani, J. S. (1976). Variation in nutrient content of feeding stuff rich in protein and reassessment of chemical method for ME stimulation for *poultry*. *J. Agricultural Science* ,86: Pp. 293.

McNaughton, J. L., Hsiao, H., Anderson, D. and Fodge, D. W. (1998). Corn/soy/fat diets for broilers, β -mannanase and improved feed conversion. *Poult. Sci.* 77(Suppl. 1):153. (Abstr).

Nadeem, M. A., Gilani, A. H., Khan, A. G. and MAHR-UN-NI. (2005). true metabolizable Energy values of poultry feedstuffs in Pakistan *Inter. Jo. of agric. Bio.*7(6): 990-994.

NRC. (1994). National research Council. Nutrient Requirement of poultry 8th ed National Academy press Washongton, DC. USA.

Odetallah, H. N., Ferket, P. R., Grimes, J. L. and Mc Naugh-ton, J. L. (2002). Effect of mannan-endo-1, 4- β -mannosidase on the growth performance of turkeys fed diets containing 44 and 48% crude protein soybean meal. *Poult. Sci.* 81:1322–1331.

Panda and Mahapatra. (1989). poultry production ICAR new Delhi, PP190.

- Petrie, A. and Watson, P. (1999). *Statistics for Veterinary and Animal Science*. Blackwell Sci., Malden, MA.
- Rainbird, A. L., Low, A. G. and Zebrowska, T. (1984). Effect of guar gum on glucose and water absorption from isolated loops of jejunum in conscious growing pigs. *Br. J. Nutr.* 52:489–498.
- Robinson, D., Singh, D. N. (2001). *Alternative protein sources for laying hens*. RIRDC publication 00/144. Rural Industries Research and Development Corporation, Kingston a CT, Australia. 85pp. for *sci 4*: 283-292.
- SPSS. (2010). 21.0. SPSS for Windows. SPSS, Chicago, IL.
- verma, S. V. S. and McNab, J. M. (1984). Performance of hens fed guar meal containing diets with or without supplemental cholesterol. *Ind. J. Poult. Sci.* 19:245–250
- Whistler, R. L. and Hymowitz, T. (1979). *guar: Agronomy, Production. Industrial use and Nutrition*. Purdue Univ., Press, West Lafayette, IN.
- Wu. G. M. M., Bryant, R. A., Voitle, D. A. and Roland, S. R. (2005). effect of B-Mannanase in corn –soy Diets on commercial leg horns in second cycle hens. Department of poultry science, Auburn University, Auburn, Alabama 36849.

الملخص

استجابة فراخ البيض للإدخال الغذائي لبذور القوار المعاملة حرارياً كمصدر بروتين مدعم بالإنزيم

أجريت الدراسة لبحث استجابة دجاج البيض لإدخال بذور القوار المعالجة بالحرارة كمصدر بروتيني مدعم بالإنزيم. تم معالجة بذور القوار بالحرارة (الغلي) في الماء لمدة 20 دقيقة ثم تجفيفها باستخدام الإشعاع الشمسي بعد تصريف الماء، وطحنها وإخضاعها للتحليل الكيميائي. تم استخدام تجربة عاملية (2 × 4) بتصميم عشوائي كامل (CRD) لدراسة تأثير أربعة مستويات مختلفة من بذور القوار المعالج بالحرارة (0، 5، 10، و15%) ومستويين من الإنزيم (0 و500 ملغ/كغ) على أداء الدجاج البياض. احتوت العليقة الحاكمة (الضابطة) على 0% من القوار المعالج بالحرارة و0% إنزيم. تم توزيع 240 كتكوت من سلالة هاي لين W-98 على 8 معاملات، وكل معاملة تم تكرارها ثلاث مرات مع 10 طيور لكل تكرار. أظهرت النتائج أن محتوى الفيتات والتانين في القوار انخفض بسبب المعالجة بالغلي. خلال فترة النمو الكلية، تدهورت معدلات الزيادة في الوزن (WG) ومعامل تحويل العلف (FCR) مع زيادة مستوى القوار في النظام الغذائي ($p \leq 0.01$). تحسنت WG وFCR عند إضافة إنزيم Natuzyme إلى النظام الغذائي ($p \leq 0.05$). لم يتأثر استهلاك العلف بالمعاملات التجريبية. في نهاية فترة النمو لم يتأثر البروتين والكوليسترول والكالسيوم والفوسفور بإضافة الإنزيم. ومع ذلك تأثر الكوليسترول والكالسيوم بإضافة القوار. لم تتأثر معايير الدم عند عمر 18 أسبوعاً بالمعاملات التجريبية، باستثناء عدد خلايا الدم البيضاء التي تأثرت بإضافة القوار. تأخر عمر بداية وضع البيض مع زيادة مستوى القوار. كان للدجاج الذي تم تغذيته على نظام غذائي مدعم بالإنزيم المتعدد بداية مبكرة لإنتاج البيض.