Egyptian Journal of Rabbit Science, 20 (1) 1- 14 (2010)

REPLACEMENT OF OKARA FOR SOYBEAN, MEAL PROTEIN WITHOUT OR WITH AVIZYME IN GROWING RABBIT DIETS.

M.R.M. Ibrahim*; H.M.A. EL-Banna*; M. A. F. EL-Manylawi*; Azza. M. M. Badr * and A.A.M. Ahmed**

* *Animal Production Department, Faculty of Agriculture, Cairo University, Giza, Egypt.*

** *Regional Center for Feed and Food, Agricultural Research Center, Giza, Egypt.*

A total number of 72 New Zealand White (NZW) growing rabbits of mixed sex, six weeks old of about 650±8.01 gm average body weight was used to study the effect of different okara meal level without or with supplementation of avizyme on rabbit performance, nutrients digestibility coefficient, carcass characteristics and economic efficiency. Rabbits were divided into 8 treatments; each containing 9 rabbits in 3 replicates (3 rabbits in each). Four substitution levels of okara meal as well as two levels without or with avizyme were used in 4×2 factorial arrangement. Okara meal levels were zero (control), 33.33%, 66.66% and 100% instead of soybean meal protein of the control diet, while the levels of avizyme were 0 or 0.05% of diet. The results obtained can be summarized as follow:

- *Replacing okara for soybean, meal protein at 33.33%, 66.66% and 100% in rabbit diets had no significant effect on DM, OM and CF and NFE digestibilities as compared to the control group. However CP digestibility improved ($P<0.05$) with replacing okara meal at level 33.33% or 100% as compared to the control group. On the other hand, adding avizyme to rabbit diets improved ($P<0.05$) DM, OM, CP and CF digestibilities as well as TDN and DCP values as compared to those groups fed diets without avizyme.*
- *There was a significant ($P<0.05$) increase in average daily BWG and a significant improvement in FCR due to replacing okara meal for soybean meal protein at 33.33%, 66.66% and 100%. The average daily FI values were comparable for the 4 tested experimental groups. Adding avizyme to rabbit diets improved ($P<0.05$) both average daily BWG and FCR compared to the groups fed diets without avizyme.*

- *Replacing okara meal for soybean meal protein at 33.33%, 66.66% and 100% in rabbit diets did not affect significantly dressing percentage, giblets percentage and meat content of CP and moisture in comparison to the control group. Nevertheless, both dressing percentage and edible giblet percentage were improved. (P<0.05) with adding avizyme to rabbit diets.*
- *Replacing okara meal for soybean meal protein at all levels studied in rabbit diets either without or with avizyme decreased* the average total cost/kg body weight and increased the economic efficiency as compared *to the control group.*

These results showed that okara meal can be used instead of soybean meal protein (up to 100%) in growing rabbit diets with avizyme (0.05%) without negative effects on growth performance under Egyptian environmental conditions.

Keywords: Okara meal, avizyme, growth, performance, digestion, carcass characteristics.

The World's growing human population and its demand for more food production have to fall within capacity of the earth's ecological systems. Approximately 40% of world's grain production is consumed by livestock and that percentage increases up to 70% in certain countries (Ministry of Agriculture, 2002). As the green revolution is no longer enough to cope with the population explosion, experts are urged to search for alternative feeding systems since the only grain reserve in case of an emergency is that used in animal production.

In Egypt as in other developing countries there is a serious problem of feeding shortage, so the present study was carried out to examine the possibility of using soybean by-products (okara meal) in feeding rabbits. Okara is a pulp fiber by products of soy milk, has less protein than whole soybean by remaining protein high quality. About 1.1kg of fresh okara is produced from every kilogram of soybean processed for soymilk (Khara *et al.*, 1995). In Japan; about 700000 tons of okara were produced from the tofu production industries in 1986, most of which were burnt as waste (Ohno *et al.*, 1993). Recently, there are some small industries produce soymilk, tofu and okara as waste products in Egypt. The chemical analysis of okara meal as reported by (Farhat *et al.*, 1998) was 23.29% moisture, 12.73% fat, 34.2% CP, 13.70% NDF, 11.73% ADF, 14.38% hemicelluse and 3.8% ash.

Corn is less affected by enzymes than other grains because of lower amounts of nonstarch polysaccharide; however 2 to 3% an improvement in feed conversion has been reported when dietary enzymes were used in corn diets (Cowan, 1993). The same author added that soybean, however, contain nondigestible carbohydrates that can be made available to hens by dietary inclusion

of enzymes (Cowan, 1993). Previous research indicates that avizyme improved nutrient utilization and performance of broilers and laying hens (Francis *et al.*, 1999 and Cook *et al.*, 2000). It was reported that inclusion of avizyme to barley diets improved true metabolizable energy (TME) by 4% (Wyatt and Goodman 1993). In another study, avizyme increased ileal digestible energy of low-digestible- energy soybean meal more than high-digestible-energy soybean meal (Douglas *et al.*, 2000).

Therefore, the main target of this study was to evaluate the effect of the partial and whole replacement of okara for soybean meal protein to rabbit diets supplemented or un-supplemented with avizyme on rabbit performance, nutrients digestibility and economic efficiency, under Egyptian environmental conditions.

MATERIALS AND METHODS

The present experiment was carried out at a Farm in the Pyramids Area, Giza, Egypt. During April and June 2009.

A total number of 72 New Zealand White(NZW) growing rabbits, six weeks old of about (650 ± 8.01 gm) average body weight was used to study the effect of different okara meal levels without or with supplementation of avizyme on rabbit performance, nutrients digestibility coefficient, carcass characteristics and economic efficiency. Rabbits were randomly divided into 8 equal groups with three replicates (3 rabbit each). The main groups of rabbits were fed on diets containing different levels of okara meal as replacing for soybean meal protein at levels 0, 33.33, 66.66 and 100% (from 6-13 weeks of age) as shown in Table (1a). In each group, diets were fed to the rabbits either un-supplemented or supplemented with avizyme (0 or 0.05% of diets). The diets were formulated to cover the requirement of growing rabbits according to NRC (1977) and (Cheeke, 1987) but with replacing okara meal protein for soybean meal protein at levels 0, 33.33, 66.66 and 100%. Chemical composition of okara meal and soybean meal is shown in Table 1b. Avizyme compound is a multiple enzyme product. Each gram comprises xylanase 1500 units, protease 20000 units and alpha amylase 2000 units. Diets were offered to the rabbits *ad-libitum* and fresh water was available all the time during the experiment. Individual live body weight, feed intake and feed conversion ratio were recorded weekly.

Digestibility trials were carried out using three rabbits from each experimental group at the last week of the experiment. Rabbits for each group were housed in metabolism cages where feces and urine were collected separately four consecutive days. Proximate analysis of the diets and feces were carried out according to the methods of A.O.A.C.(1990). At the end of experimental period (13 weeks of age), three rabbits were randomly taken from each group and fasted for 12 hours before slaughter according to Blasco *et al.*, (1993). Rabbits were housed in separate cages and kept under the same managerial hygienic condition.

Table 1a. Composition and determined analysis of experimental diets

Ingredients %	Levels of okara meal replacement (%)							
	0		33.33		66.66		100	
	(-)	(+)	(-)	(+)	(-)	(+)	(-)	(+)
Barley grain**	32.65	32.60	32.05	32.00	30.05	30.00	30.05	30.00
Clover Hay **	26.00	26.00	25.67	25.67	25.00	25.00	23.00	23.00
Wheat bran**	22.00	22.00	22.00	22.00	23.74	23.74	23.738	23 738
Soybean meal **	15.00	15.00	10.00	10.00	5.00	5.00	0.00	0.00
Okara meal	0.00	0.00	5.83	5.83	11.66	11.66	17.50	17.50
Cotton seed, oil	0.00	0.00	0.00	0.00	0.00	0.00	1.062	1.062
Molasses	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Dicalciume phosphate	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Salt	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
Premix*	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Methionine	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
Lysine	0.00	0.00	0.10	0.10	0.20	0.20	0.30	0.30
Avizyme	0.00	0.05	0.00	0.05	0.00	0.05	0.00	0.05
Total	100	100	100	100	100	100	100	100
Determined analysis								
CP %	16.80	16.80	16.70	16.70	16.68	16.68	16.40	16.14
DE Kcal/kg***	2683.40	2683.40	2611.90	2610.40	2536.40	2534.90	2539.20	2537.7
CF %	11.79	11.789	12.36	12.36	12.94	12.94	13.10	13.10
EE %	2.32	2.32	2.975	2.974	3.67	3.67	4.30	4.30
Ca %	0.46	0.46	0.46	0.46	0.45	0.45	0.42	0.42
P %	0.215	0.215	0.21	0.21	0.207	0.207	0.202	0.201
Methionine,%	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
Lysine%	0.65	0.65	0.65	0.65	0.65	0.655	0.655	0.655

Supplying each kg diet =Vit A 12000 Iu, Vit D3 2000 Iu, Vit E 10mg, Vit k3 2gm, Vit B1 mg, Vit B2 5 mg, Vit B6 1.5 mg, Vit B12 10 mg, Niacin 30 mg, Pantotheni acid 10 mg, Folic acid 1 mg, Choine 250 mg, Biotin 50 mg, Copper 5 mg, Manganese 60 mg, Zinc 50 mg, Iron 30 mg, Iodine 0.3 mg Selenium 0.1 mg and Cobalt 0.1 mg.

(-) Without avizyme, (+) With avizyme at 0.05% diets.

** A according to NRC (1994).

*** A according to General Administration for Agrarian Culture Ministry of Agriculture (2001).

Table 1b. Chemical composition of okara meal and soybean meal (% on DM basis)

Items	DM %	OM %	CP %	EE %	CF %	Ash %	DE* (Kcal/kg)	Lysine** %	Methionine** %
Okara meal	93.30	94.76	37.73	12.4	16.90	5.24	2425.60	1.15	0.45
Soybean meal	89.00	94.10	44.00	1.00	5.80	5.90	3770.00	2.92	0.66

*DE: 4.36-0.049×NFE, NFE=28.294+0.657(%CF) , according to Cheeke (1987)

** According to El-Manylawi (2007).

An input – output analysis and economic efficiency were calculated. The cost of 1 kilogram of growth was determined for each of experimental diets according to the prevailing cost of ingredients in Egypt at the time of the experiment. Economic efficiency of each of the diets was defined as LE returned for 1 LE invested in feed. Economic efficiency was calculated by this equation:
Economic efficiency =(Selling price of one kg live body weight - Feeding cost of one live body weight / Feeding cost of one kg live body weight) × 100

All data were subjected to analysis of variance using the generally linear models GLM Procedure of (SAS, 2002), and differences obtained upon statistical analysis were compared using Duncan Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

Digestibility coefficients and nutritive values:

The nutrients digestibility coefficient and nutritive values as TDN and DCP are presented in Table 2. Data showed an improvement in digestibility coefficient of dry matter (DM), organic matter (OM) and crude fiber (CF) and a decrease ($P<0.05$) in digestibility coefficients of nitrogen free extract (NFE) with replacing okara meal for soybean meal protein at levels 33.33, 66.66 and 100% in rabbit diets in comparison to the control group (0% okara meal). On the other hand, there were increases ($P<0.05$) in CP digestibility with replacing okara meal at level 33.33% or 100% as compared to the control group (69.96, 74.43 and 75.49, respectively). Besides ether extract (EE) digestibility coefficient was increased ($P<0.05$) with replacing okara meal at level of 100% in rabbit diets as compared to the other experimental diet groups. Regarding the effect of experimental diets on nutritive value as total digestible nutrients (TDN) and digestible crude protein (DCP), the results showed that replacing okara meal for soybean meal protein at a level of 100% improved ($P<0.05$) TDN compared to the control group (73.78 vs 76.02).

Table 2. Digestibility coefficient and nutritive values (Means ±SE) as affected by okara meal and avizyme levels and their interaction, during the whole period .

	Digestibility coefficients(%)					Nutritive values		
Items	**DM**	**OM**	**CP**	**EE**	**CF**	**NFE**	**TDN**	**DCP**
Effect of okara meal levels (%)								
0 Control	89.67	76.60	69.96^{b}	80.37^{bc}	39.09	85.34	73.78^{b}	11.75^{b}
33.33	89.06	76.27	74.43^{a}	76.77^{c}	42.19	83.54	74.25^{ab}	12.43^{a}
66.66	87.70	76.23	73.03^{ab}	81.86^{b}	42.49	84.04	74.88^{ab}	12.18^{ab}
100	89.13	76.64	75.49^{a}	86.16^{a}	42.65	83.71	76.02^{a}	12.38^{a}
SE	**±0.79**	**±0.81**	**±1.04**	**±1.33**	**±1.11**	**±1.17**	**±0.67**	**±0.17**
Effect of avizyme levels (%)								
0.00	88.03^{b}	74.91^{b}	69.68^{b}	82.23	37.73^{b}	83.58	73.50^{b}	11. 60^{b}
	±0.70	±0.62	±0.85	±1.58	±0.80	±1.00	±0.62	±0.15
0.05	89.75^{a}	77.96^{a}	76.78^{a}	80.85	45.48^{a}	84.73	75.96^{a}	12.77^{a}
	±0.42	±0.34	±1.31	±1.19	±1.28	±063	±0.47	±0.19
Effect of (Okara meal protein x Avizyme),%								
0 (-)	89.13^{a}	75.64	66.88^{e}	81.94^{abc}	37.41^{de}	84.99	72.98^{b}	11.24^{d}
0 (+)	90.21^{a}	77.56	73.05^{bc}	78.81^{bc}	40.77^{cd}	85.70	74.58^{ab}	12.27^{bc}
33.33 (-)	88.55^{ab}	74.49	72.16^{bcd}	76.59^{c}	40.34^{cde}	81.81	73.31^{b}	12.05^{bc}
33.33 (+)	89.56^{a}	78.06	76.69^{b}	76.95^{bc}	44.03^{bc}	85.26	75.18^{ab}	12.81^{b}
66.66 (-)	85.48^{b}	74.49	71.42^{cde}	82.99^{b}	37.91^{de}	82.73	73.20^{b}	11.91^{cd}
66.66 (+)	89.93^{a}	77.97	74.64^{bc}	80.73^{bc}	47.08^{ab}	85.36	76.57^{a}	12.45^{bc}
100 (-)	88.96$^{a\,b}$	75.04	68.24^{de}	87.39^{a}	35.28^{e}	84.82	74.52^{ab}	11.196^{d}
100 (+)	89.31^{a}	78.24	82.74^{a}	86.92^{a}	50.02^{a}	82.60	77.52^{a}	13.57^{a}
SEM	**±1.11**	**±1.14**	**±1.47**	**±1.89**	**±1.56**	**±1.66**	**±0.95**	**±0.25**

a,b,c.....Means within the same column with common letter(s) are not significantly different (P<0.05).

(-) Without avizyme, (+) With avizyme

With avizyme at level 0.05%.

While the values of TDN were slightly improved with 33.33% and 66.66% replacing level in comparison to the control group. Besides, DCP values improved (P<0.05) with 33.33% and 100% replacing okara meal protein and insignificantly improved 66.66% replacing level compared the control group.

Regardless the effect of okara meal, the results revealed significant increases (P<0.05) in DM, OM, CP and CF digestibility coefficients with supplying avizyme in rabbit diets compared to those groups fed diets without avizyme. This improvement may be due to the beneficial role of avizyme in nutrients absorption, especially CP(%) as reported by Officer and Batterham,(1993), Marsman *et al.*,(1997), Zanella *et al.*, (1999) and EL-Nagmy *et al.*,(2004). Also, Pinheiro *et al.* (2004) concluded that enzyme supplementation in chicken diets improved the activity of digestive enzymes. Generally, the improvement occurring in protein and carbohydrates may be attributed to the role

of avizyme mixtures, which contained effective amounts xylanase, protease and α-amylase. These findings were coincided with those reported by Marquadt *et al.*, (1996) and Fernandez *et al.*, (1996) who found that enzymes addition significantly increased the NDF digestibility, that probably be bound up with cell wall hemicelluloses components. Supplying rabbit diets with avizyme resulted in improvement ($P<0.05$) in both TDN and DCP values compared to those groups fed diets without avizyme. The respective value were 73.5 vs 75.96% for TDN and 11.6 vs 12.77 for DCP (Table 2).

Concerning the effect of interaction between okara meal and avizyme, the obtained results showed numerical increases in DM, OM and NFE digestibility in most instances with adding avizyme to rabbit diets. While, there were slight decreases in EE digestibility with adding avizyme to rabbit diets at most tested levels of replacing okara meal diets. However, feeding rabbits on diets containing okara meal (66.66 and 100% replacement) with avizyme resulted in significant ($P<0.05$) improvement in CF digestibility compared to those groups fed diets without avizyme (37.91 vs 47.08% for 66.66% replacement level and 35.28 vs 50.02% for 100% replacement level respectively). More over, the interaction effect of okara meal and avizyme levels revealed that supplying rabbit diets with avizyme under each tested level of okara meal improved both TDN and DCP. Generally the highest values of both TDN and DCP were recorded with the whole replacement of okara meal protein (100%) in rabbit diets supplemented with avizyme (77.52% and 13.57%) while the lowest values recorded with control group (0%okara meal without avizyme) being 72.98% and 11.23%, respectively.

The improvement in nutrients digestibility and nutritive value resulted from increasing levels of okara meal may be due to the treatment of soybean by boiling and cooking to produce tofu or milk that caused an improvement of okara utilization as reported by Farhat *et al.*,(1998) and El-Manylawi (2007).

Growth performance:

Data in Table (3) revealed that replacing okara meal for soybean meal protein at levels of 33.33, 66.66 and 100% resulted in a significant ($P<0.05$) increase in average daily body weight gain (BWG) and a significant ($P<0.05$) improvement in feed conversion rate (FCR) when compared to the control group (0% okara meal). The recorded values were 21.05, 22.72, 22.94 and 22.19 gm for BWG and 3.75, 3.45, 3.48 and 3.54 for FCR, respectively. While, the values of average daily feed intake (FI) were comparable for the 4 tested experimental groups. The results herein are in good agreement with those reported by Ibrahim (2006) and El-Manylawi (2007) who found an improvement in BWG with replacing okara meal for soybean meal protein in rabbit diets at a level of 50% compared to the control group (0% okara meal).

Table 3. Rabbits growth performance as affected by okara meal and avizyme levels and their interaction during the whole period (6-13) weeks of age.

Items	IBW*(gm)	FBW** (gm)	BWG (gm)	FI (gm)	FCR	Mortality rate, %
Effect of okara meal levels (%)						
0.00	647.50 ^{ab}	1826.3 ^{c}	21.05 ^{b}	78.86	3.75 ^{a}	0
33.33	660.00 ^{a}	1932.1 ^{a}	22.72 ^{a}	78.35	3.45 ^{c}	0
66.66	645.50 ^{ab}	1929.8 ^{a}	22.94 ^{a}	79.76	3.48 ^{bc}	0
100	638.50 ^{b}	1881.0 ^{b}	22.19 ^{a}	78.66	3.54 ^{b}	0
SE	±5.661	±11.99	±0.250	±0.691	±0.039	0
Effect of avizyme levels (%)						
0.00	650.00	1843.73 ^{b}	21.32 ^{b}	82.65 ^{a}	3.8 ^{a}	0
	±5.23	±16.40	±0.273	±0.834	±0.081	
0.05	645.75	1940.90 ^{a}	23.13 ^{a}	75.16 ^{b}	3.25 ^{b}	0
	±3.61	±17.74	±0.338	±0.904	±0.044	
Effect of (Okara meal x Avizyme),%						
0 (-)	645 ^{ab}	1797.5 ^{c}	20.58 ^{cd}	85.41 ^{a}	4.15 ^{a}	0
0 (+)	650 ^{ab}	1855.0 ^{b}	21.52 ^{bc}	72.30 ^{d}	3.36 ^{c}	0
33.33(-)	671 ^{a}	1900.8 ^{b}	21.96 ^{b}	79.21 ^{bc}	3.61 ^{b}	0
33.33(+)	649 ^{ab}	1963.3 ^{a}	23.47 ^{a}	77.49 ^{c}	3.30 ^{c}	0
66.66(-)	642 ^{b}	1891.6	22.31 ^{b}	81.51 ^{b}	3.65 ^{b}	0
66.66(+)	649 ^{ab}	1968.1 ^{a}	23.56 ^{a}	78.02 ^{c}	3.31 ^{c}	0
100(-)	642 ^{b}	1785.0 ^{c}	20.41 ^{d}	84.48 ^{a}	4.14 ^{a}	0
100(+)	635 ^{b}	1977.0 ^{a}	23.97 ^{a}	72.83 ^{d}	3.04 ^{d}	0
SEM	±8.01	±16.96	±0.348	±0.978	±0.055	0

a, b, c.....Means within the same column with common letter(s) are not significantly different ($P<0.05$).

(-) Without avizyme, (+) With avizyme at level 0.05%.

* Initial body weight (gm)

** Final body weight (gm)

Regardless the effect of replacing okara meal, supplying avizyme to rabbit diets improved ($P<0.05$) both average daily BWG and FCR compared to those groups fed diets without avizyme, being 21.32 vs 23.13 gm for BWG and 3.88 vs 3.25 for FCR, respectively. Okara meal had no significant effect on daily feed intake while avizyme lowers ($P<0.05$) daily feed intake. The results herein coincided with Mulkametagoliev *et al.*, (1986), El-Katasha *et al.*,(1988) and Tawfeek (1996) who found that supplying diets with kemezyme improved growth performance of growing rabbits fed diets containing corn or barley grains. However, Zanella *et al.*, (1999) found that supplementation of the diets with an enzyme mixture containing amylase; protease and xylanase improved the broiler performance.

Data concerning the effect of interaction between okara meal and avizyme revealed an improvement ($P<0.05$)in both average daily BWG and FCR with adding avizyme to rabbit diets under each level of replacing okara (except 0%

okara for BWG). However, values of average daily FI were significantly (P<0.05) decreased with adding avizyme to rabbit diets at most levels of replacing okara.

The increase in growth rate of growing rabbits resulted from replacing okara or adding avizyme to rabbit diets may be due to the improvement in both nutrients digestibility and nutritive value of these diets.

Carcass characteristics

Carcass yield expressed as percentage of live body weight and chemical composition of rabbit meat are presented in Table 4. From the results obtained at 13 weeks of age, it could be noticed that replacing okara meal for soybean meal protein at 33.33%, 66.66% and 100% in rabbit diets did not affect significantly dressing percentage, giblets percentages and meat content of CP and moisture in comparison to the control group. The same trend was observed with edible giblet percentage. Nevertheless, both dressing percentage edible giblet percentage and total edible parts percentage were improved (P<0.05) with adding avizyme to rabbit diets. The recorded values were 55.28 vs 56.09% for dressing percentage, 4.15 vs 4.19 for edible giblets percentage and 59.42 vs 60.28 for total edible parts, respectively. These results are in good agreement with those reported by El-Madany and Afifi (2002), Attia *et al.*, (2001 and 2003), Salem *et al.*, (2003), El-Nagmy *et al.*, (2004) and Ibrahim (2006) who found insignificant differences in carcass yield and composition of broiler meat (moisture, protein and fat) when Arbo Acres chicks fed on different levels OF okara meal (6.75 and 13.5%) and microbial phytase at levels (0 and 0.05%).

Economic efficiency (E.F.)

Results in Table 5. Indicated that replacing okara meal for soybean meal protein at levels of 33.33, 66.66 and 100% in rabbit diets either without or with avizyme decreased the average total cost/kg body weight and increased the economic efficiency when compared to the control groups. Therefore, the relative economic efficiency was improved as follows 100, 178.6, 178.6 and 128.6% for diets without avizyme and 164.29, 207.1, 221.4 and 250% for diets with avizyme, respectively. This improvement may be due to the lower price of okara meal protein and better feed conversion for these diets. These results coincided with those reported by Abd-Elsamee *et al.*, (2005) and Ibrahim (2006) who found that the best economic efficiency values were achieved when broiler chicks were fed diets containing 25 or 50% okara meal as replacer for soybean meal. However, El-Manylawi (2007) reported that relative economic efficiency (feed cost per kg live weight gain) was improved when growing NZW rabbit were fed diets contained 25 or 50% okara meal protein replacement.

Table 4. Some carcass characteristics and chemical analysis of rabbit meat (Mean± SE) as affected by by okara meal and avizyme levels and their interaction

Items	Carcass characteristics										
	Pre slaughter weight (gm)	Carcass weight (gm)	Dressing (%)	Liver (gm)	Kidneys (gm)	Heart (gm)	Edible giblets (%)	Total edible parts (%)	Meat moisture (%)	Meat CP (%)	Meat EE (%)
Effect of okara meal levels (%)											
0.00	1826.67^{c}	1013.9^{b}	55.51	60.58^{c}	11.87^{b}	3.48^{b}	4.17^{a,b}	59.67	66.49	21.98	4.23^{a}
33.33	1930^{a}	1074.20^{a}	55.65	64.23^{a}	12.61^{a}	3.83^{a}	4.18^{a}	59.72	88.68	22.41	4.38^{a}
66.66	1926.67^{a}	1070.2^{a}	55.53	64.23^{a}	12.61^{a}	3.83^{a}	4.19^{a}	59.83	69.17	22.74	3.87^{b}
100	1881.69^{b}	1055^{a}	56.03	61.91^{b}	12.4^{a}	3.74^{a}	4.15^{b}	60.18	68.98	22.91	4.39^{a}
SE	**±10.38**	**±7.90**	**±0.18**	**±0.25**	**±0.111**	**±0.042**	**±0.008**	**±0.182**	**±1.109**	**±0.606**	**±0.108**
Effect of avizyme levels (%)											
0.00	1842.9^{b}	1018.6^{b}	55.28^{b}	60.88^{b}	12.01^{b}	3.53^{b}	4.15^{b}	59.42^{b}	68.12	22.07	4.19
	±15.89	±8.25	±0.134	±0.642	±0.082	±0.044	±0.009	±0.134	±0.63	±0.395	±0.096
0.05	1930.6^{a}	1088.1^{a}	56.09^{a}	64.70^{a}	12.73^{a}	3.91^{a}	4.19^{a}	60.28^{a}	68.54	22.94	4.24
SEM	**±16.75**	**±12.07**	**±0.172**	**±0.497**	**±0.177**	**±0.074**	**±0.007**	**±0.174**	**±0.84**	**±0.427**	**±0.086**
Effect of (Okara meal protein x Avizyme),%											
0 (-)	1798.3	999.8^{c,d}	55.59^{b,c}	59.53^{c}	11.88^{b,c}	3.42^{b}	4.16^{b}	59.75^{b,c,d}	66.13	21.12	4.20^{a,b}
0 (+)	1855	1028^{b,c}	55.42^{b,c}	62.02^{b}	11.85^{b,c}	3.53^{b,c,d}	4.17^{a,b}	59.59^{b,c,d}	66.85	22.83	4.25^{a,b}
33.33 (-)	1900	1049.1^{b}	55.22^{c}	62.93^{b}	12.32^{b}	3.70^{b}	4.16^{b}	59.37^{d}	68.36	21.87	4.37^{a}
33.33 (+)	1960	1099.3^{a}	56.09^{a,b}	65.53^{a}	12.90^{a}	3.95^{a}	4.20^{a}	60.29^{a,b,c}	69.00	22.95	4.39^{a}
66.66 (-)	1886.67	1035.3^{b}	54.87^{c}	62.9^{b}	12.15^{b,c}	3.60^{b,c}	4.17^{a,b}	59.04^{d}	68.94	22.67	3.81^{a,b}
66.66 (+)	1966.67	1105.2^{a}	56. 19^{a,b}	65.57^{a}	13.07^{a}	4.07^{a}	4.21^{a}	60.40^{a,b}	69.40	22.80	3.92^{a,b}
100 (-)	1786.67	990.2^{d}	55.42^{b,c}	58.15^{d}	11.70^{c}	3.38^{d}	4.10^{c}	59.52^{c,d}	69.04	22.62	4.36^{a}
100 (+)	1976.67	1119.22^{a}	56.65^{a}	56.67^{a}	13.1^{a}	4.1^{a}	4.19^{a,b}	60.84^{a}	69.91	23.19	4.41^{a}
SEM	**±14.67**	**±11.170**	**±0.254**	**±0.349**	**±0.157**	**±0.059**	**±0.120**	**±0.258**	**±1.568**	**±0.857**	**±0.153**

a, b,c... ..Means within the same column with common letter(s) are not significantly different (P<0.05)

(-) Without avizyme, (+) With avizyme

Table 5. Economic efficiency of rabbits as affected by okara meal and avizyme levels and their interaction, during the whole period (6-13) weeks of age.

Items	Okara meal levels (%)							
	0(Control)		33.33		66.66		100	
	-	+	-	+	-	+	-	+
Total FI/rabbit kg	4.783	4.049	4.436	4.340	4.565	4.369	4.731	4.079
Price 1kg FI	2.367	2.431	2.271	2.335	2.181	2.245	2.127	2.191
Feed cost/ rabbit	11.321	9.843	10.074	10.134	9.956	9.808	10.063	8.937
Total cost(LE)(a)	34.65	33.17	33.40	33.46	33.286	33.140	33.393	32.267
BW	1.798	1.855	1.901	1.963	1.892	1.968	1.785	1.977
Cost/kg BW (L.E)	19.27	17.88	17.57	17.05	17.59	16.84	18.71	16.32
Total revenue(LE) (b)	39.55	40.81	41.82	43.19	41.62	43.30	39.27	43.49
Net revenue(L.E)	4.90	7.64	8.42	9.73	8.33	10.16	5.880	11.22
EE (c)	0.14	0.23	0.25	0.29	0.25	0.31	0.18	0.35
REE(d)	100	164.29	178.6	207.10	178.60	221.6	128.60	250

(a) Including fixed cost (23.33L.E/rabbit), **(b)** Assuming that the selling price {is (22) L.E}, **(C)** Net revenue per unit total cost, **(d)** Considering the economic efficiency (EE)of the control diet without avizyme = 100%.
(-) Without avizyme, (+) With avizyme at level 0.05%

Conclusively, the previous results showed that okara meal can be used instead of soybean meal protein (up to 100%) in growing rabbit diets with avizyme (0.05%) without negative effects on growth performance under Egyptian environmental conditions.

REFERENCES

Abd-Elsamee, M.O.; Ibrahim, M.R.M. and Abd-Elkrim.F.M. (2005). Use of some plant protein sources in broiler diets. *Journal Agriculture Science*, Mansoura University, **30** (12): 7495-7506.

AOAC (1990). Association of Official Analytical Chemists. *Official Methods of Analysis*, 15th Ed. Published by AOAC, Washington, DC.

Attia, Y.A.; Abd El-Rahman, S.A.; and Qota, E.M.A.(2001). Effects of microbial phytase with or without cell-wall splitting enzymes on the performance of broilers fed marginal levels of dietary protein and metabolizable energy. *Egyptian poultry Science*, **21**:521-547.

Attia, Y.A.; Aggoor, F.A.M., Qota, E.M.A.; and Hayam Abo El-Maaty, M.A. (2003). Effect of dietary crude protein level and source and phytase addition on productive performance, Carcass and plasma constituents of roasters. *Egyptian J. Nut. and Feeds.* **6**(Special issue) 61-75.

Blasco, A.; Quhayoun, J., and Masoscro, G. (1993). Harmonization of criteria and terminology in rabbit meat research. *World Rabbits Science*, 1:3-10

Cheeke, P. (1987). *Rabbit Feeding and Nutrition.* Academic Press, Oriando, Florida, USA.

Cook, M.E.; Drake, B.M. and Pierson, E.E.M. (2000). A blend of xylanase, amylase and protease (Avizyme) improves laying hen egg production, feed efficiency, and livability when supplemented in corn –soy based diets. *Poultry Science*, **79**: (Suppl. 1):21. (Abstr.)

Cowan, W.D. (1993). Understanding the manufacturing, distribution, application, overall quality of enzymes in poultry feeds. *J. Appl. Poult. Res.*, 2: 93 -99.

Douglas, M.W.; Parsons, C.M. and Bedford, M.R. (2000). Effect of various soybean meal sources and avizyme on chick growth performance and ileal digestible energy. *J. Appl. Poult. Res.*, **9**: 74-80.

Duncan, D.B. (1955). Multiple range and multiple F-tests. *Biometrics.*, **11**: 1-42.

El-Katasha, M.L.; Ismail, E.Y. and Mohamed, O.E. (1988). Performance of growing rabbits fed diets containing corn or barley grain with or without addition of kemzyme. *Alexandria Journal Veterinary Science,* 185-197.

El-Manylawi, M.A.F. (2007). Effect of replacing soybean meal protein by okara meal protein (soybean by-product) on performance of growing rabbits. *Egyptian Journal of Rabbit Science*, **17** (1): 43-56.

El-Medany, N.M.; and Afifi, Sh.F. (2002). The effect of microbial phytase on utilization of protein and phosphorus in broiler rations. *Egyptian Poultry Science,* **22**: 427-443.

El-Nagmy, K.Y., Abd-Elsamee, M.O.; and Ibrahim, M.R.M. (2004). Effect of dietary plant protein and microbial phytase levels on performance of broiler chicks. *Egyptian Poultry Science*, **24**: 101-121.

Farhat, A.; Normand, L.; Chavez, E.R. and Touchburn, S.P. (1998). Nutrient digestibility in food waste ingredients for pekin and Muscovy ducks. *Poultry Science*, 77: 1371-1376.

Fernandez, C.; Merino, J.M. and Carabano, R. (1996). Effect of enzyme complex supplementation on diets digestibility and growth performance in growing rabbits. *Proc. 6th World Rabbit Congress, Toulouse,* Vol.**1**: 163-166.

Francis, P.A., Robbins, K.R. Mathew, A.G. Droughton, F.A. and Golden, D.A. (1999). The effect of avizyme in rye or corn based diets on broiler performance, microbiological and fermentation changes in the gastrointestinal tract. *Poultry Science.* **78** (suppl. 1): **102** (Abstr.).

General Administration for Agrarian Culture Ministry of Agriculture (2001). Food composition tables for animal and poultry feedstuffs used in Egypt. *Technical Bulletin Nutrition*, **1** (2001).

Ibrahim, M.R.(2006). Effect of different dietary levels of okara meal and microbial phytase on broiler performance. *Egyptian Poultry Science*, **26** (1): 235-246.

Khara, S.K.; Jha, K. and Sinha, L.K. (1995). Preparation and nutritional evaluation of okara fortified biscuits. *Journal of Dairying, Foods Home Science.* **14**, 91-94; (Biological Abstract, 103:20755).

Marquadt, R.R.; Brenes, A.; Zhong, Z and Boros, D. (1996). Use of enzyme to improve nutrient availability in poultry feedstuffs. *Animal Feed Science,* Technol., **60**: 321-330.

Marsman, G.J.P.; Gruppen. H.; Vanderpoel, A.F.B.; Kwakkel. R.P.; Verstegen M.W.A. and Verstegen, A.G.J. (1997). The effect of thermal processing and enzyme treatments of soybean meal on growth performance, lleal nutrients digestibility and chyme characteristics in broiler chicks. *Poultry Science.,* **76**: 864-872.

Ministry of Agriculture (2002). *J. Agr. Econ.* ,Ministry of Agriculture.

Mukhametagoliev, N.N.; Korshum, V.P. and Yapparov, A.K. (1986). Growth and development of young rabbits periodically given enzyme preparations. Nutrition Abstract and Review, **56**: 6934.

NRC (1977). National Research Council, Nutrient Requirements of Domestic Animals. *Nutrient Requirements of Rabbits.* Second revised edition. National Academy of Sciences, Washington. D.C., USA.

NRC (1994). National Research Council, *Nutrient Requirements of Poultry*, **8** Rev. ed. National Academy Press, Washington, DC., USA.

Officer, D.I.; and Batteram. E.S. (1993). Enzyme supplementation of linola meal for grower Pigs. *Proc. Aust. Soc. Animal. Prod.*, **19**: 288. (Abstract).

Ohno, A.; Ano, T. and Shoda, M. (1993). Production of the antifungal peptide antibiotic, iturin by Bacillus subtitles NB22 in solid state fermentation. *Journal of Fermentation Bioeng.*, **75**, 23 -27.

Pinheiro, D.F.; Cruz. V.C.; Sartori, J.R. and Vicentini Paulino, M.L.M. (2004). Effect of early feed restriction and enzyme supplementation on digestive enzyme activities in broilers. *Poultry Science.,* **83**: 1544-1550.

Salem, M.Fayze; El-Alaily, H.A.; El-Medany, N.M. and El-Galil, V. (2003). Improving phosphorus utilization in broiler chick diets to minimize phosphorus pollution. *Egyptian Poultry Science.*, 23: 201-218.

SAS, the S A S Institute (2002). Statistical user's Guide. Statistical Analysis System. INT., Cary, Nc. USA.

Tawfeek, M.I., (1996). Effect of feeding system and supplemented diet with kemzyme on growth, blood constituents, carcass traits and reproductive performance in rabbits under intensive production conditions. *Egyptian Journal of Rabbit Science*, **6:** 21-37.

Wyatt, C.L., and Goodman, T. (1993). Utilization of feed enzymes in laying hen ration. *J. Appl. Poult. Res.*, **2**: 68-74.

Zanella, I., Sakomura, N.K. Silversides, F. G. Fiqueirdo, A. and Pack, M. (1999). Effect of enzyme supplementation of broiler diets based on corn and soybean. *Poultry Science*, **78**: 561-568.

إحلال مسحوق الاوكارا محل بروتين كسب الصويا بدون أو مع الإفزيم فى علائق الأرانب النامية.

محمد رضا محمد ابراهيم* – هشام محمد عبدالجواد البنا* – محمد احمد فؤاد المنيلاوى* - عزه محمد محمد بدر*– احمد عبدالله محمد احمد**

*قسم الإنتاج الحيوانى – كلية الزراعة – جامعة القاهرة – جيزة- ج.م.ع.

** المركز الإقليمى للأغذية والأعلاف- جيزة - ج.م.ع.

استخدم 72 أرنب نيوزيلاندى أبيض نامى مختلط الجنس عمر 6 أسابيع ومتوسط وزن (650 جم±8.01) لدراسة تأثير مستويات الاوكارا المختلفة بدون أو مع إضافة الأفزيم على أداء الأرانب والمركبات الغذائيه المهضومة وصفات الذبيحة والكفاءة الإقتصادية. استخدم 4 مستويات إستبدال من مسحوق الاوكارا مع مستويين أفزيم بنظام العاملى 4×2 . مستويات مسحوق الاوكارا كانت صفر% (وهى مجموعة الكنترول) ، 33.33% ،66.66 % ، 100% بدلا من بروتين كسب الصويا بعليقه الكنترول. بينما مستويات الأفزيم كانت صفر% ، 0.05% من العليقة. وقسمت الأرانب الى 8 معاملات كل معاملة تحتوى على 9 أرانب مقسمه إلى 3 مكررات (3 أرانب لكل مكرر). والنتائج المتحصل عليها يمكن تلخيصها كما يلى :

- إستبدال مسحوق الاوكارا ببروتين كسب الصويا للمستويات 33.33 % ، 66.66 % ، 100% فى علائق الأرانب لم يكن له تأثيرمعنويا على معاملات هضم المادة الجافة والمادة العضوية والألياف الخام المستخلص خالى الأزوت مقارنه بالمجموعة الكنترول . بجانب ذلك حسن معنويا معامل هضم البروتين الخام مع إحلال بروتين مسحوق الاوكارا عند مستوى 33.33% أو 100% مقارنة بالمجموعه الكنترول. ومن جهه اخرى إضافه الأفزيم الى علائق الأرانب حسنت معنويا من معاملات هضم الماده الجافه والمادة العضوية والبروتين الخام والألياف الخام مقارنه بتلك المجموعات المغذاة على علائق بدون الأفزيم.
- إضافة الأفزيم الى علائق الأرانب نتج عنه تحسن معنوى فى قيم كلا من المركبات الغذائية المهضومة الكلية والبروتين الخام المهضوم مقارنة بالمجموعات المغذاة على علائق بدون أفزيم. هناك زيادة معنوية فى المتوسط اليومى للزيادة المكتسبة لوزن الجسم وتحسن معنوى فى معدل التحويل الغذائى نتيجه لاحلال مسحوق الاوكارا محل بروتين كسب الصويا عند المستويات 33.33% ، 66.66% ، 100% . بينما متوسط المأكول اليومى كان متقارب للمجاميع الأربعة المختبرة. من جهه اخرى إحلال مسحوق الاوكارا مع إضافة الأفزيم لعلائق الأرانب حسن معنويا كلا من المتوسط اليومى للزياده فى وزن الجسم ومعدل التحويل الغذائى مقارنه بتلك المجموعات المغذاه على علائق بدون الأفزيم .
- إحلال مسحوق الاوكارا محل بروتين كسب الصويا عند 33.33% ،66.66% ،100% فى علائق الأرانب لم يؤثر معنويا على النسبه المئوية للتصافى والنسبه المئوية للأعضاء الداخلية المأكوله وكذلك محتوى اللحم من البروتين الخام والرطوبة مقارنه بالمجموعه الكنترول .وبالعكس تماما تحسنت النسبه المئوية للتصافى والنسبه المئوية لوزن الأعضاء الداخلية المأكولة مع إضافة الأفزيم لعلائق الأرانب .
- إحلال مسحوق الاوكارا محل بروتين كسب الصويا عند المستويات 33.33 ، 66.66 ، 100% فى علائق الأرانب سواء بدون او مع إضافة الأفزيم قللت من التكلفة الكليه لكل كجم من وزن جسم ، وزادت من الكفاءة الاقتصادية مقارنه بمجاميع الكنترول .

التوصية: النتائج السابقة توضح ان مسحوق الاوكارا يمكن استخدامه بدلا من بروتين كسب الصويا حتى 100% فى علائق الارانب الناميه باستخدام الافزيم بدون اى تأثيرات عكسية على النمو .