

## **EFFECT OF DIETARY PROTEIN AND FIBER LEVELS ON GROWTH PERFORMANCE AND DIGESTIBILITIES IN GROWING BOUSCAT RABBITS**

**S. A. Abd El- Latif, S.T. M. Fahmy, and M. H. Ahmed**

*Department of Animal Production, Faculty of Agriculture, Minia University, Minia, Egypt*

### **SUMMARY**

This study was conducted to evaluate the utilization of diets containing different levels of protein and fiber and their effects on the growth performance and digestibility by growing Bouscat rabbits. Thirty six (8- weeks old ) growing Bouscat rabbits (18 males and 18 females) were divided equally into six treatment groups, each containing three male and three female rabbits. Six dietary treatments were formulated to contain 12 or 18% crude protein (CP) and 14, 18, and 22% crude fiber (CF) in a 2 X 3 factorial design. The experiment was terminated when individuals were 19-weeks old (market age). Body weight gain, feed intake, feed conversion, nutrients digestibility coefficients, total digestible nutrients (TDN), starch equivalent (SE)] and the digestible energy (DE) were calculated.

The diet containing 18% CP and 14%CF recorded the greatest daily gain (19.2g/day). Rabbits fed on a diet containing 18% CP and 18 %CF consumed more ( $P<0.05$ ) feed (122.7g/day) compared with other treatments. Increasing protein levels from 12 to 18% improved ( $P<0.05$ ) daily gain and feed conversion (feed/gain); while raising crude fiber levels from 14 or 18 to 22% reduced ( $P<0.05$ ) these values.

The highest value of CP digestibility (75.5%) was recorded by feeding rabbits diet containing 18% CP and 18% CF. The greatest EE digestibility (84.9%) was observed when rabbits fed diet containing 18% CP and 14% CF. No significant differences were observed in dry matter (DM), crude protein (CP), EE, crude fiber (CF), or nitrogen free extract (NFE) digestibilities as the dietary CP or CF levels were increased. The feeding value of the diets (TDN) was reduced significantly in response to increasing dietary fiber level ( $P<0.05$ ).

**Keywords:** Rabbits, protein, fiber, growth

## INTRODUCTION

Protein and fiber are of the major components of feedstuffs which mainly affect rabbit's growth and performance. The wild rabbit, being a herbivore, consumes a high proportion of plant cell walls as an integral part of its diet.

The utilization of protein depends on many factors such as protein level in the diet ( Ibrahim, 1986, Cheeke *et al.*, 1985, and Chaing *et al.*, 1982), amino acids content (Martina and Damian, 1981, Pomytko and Morozova, 1979 and Colin 1974), age and physiological state of rabbits (Auxilia and Masoero, 1978) and the breed ( Mohmed, 1982).

Lui *et al.* (1993) reported that the maintenance requirements of CP for young Angora rabbits, pregnant does, lactating does and adults for wool production were 4.87, 6.71, 4.80, and 6.14g/100g DM of feed, respectively. These values were 2.52, 4.59, 3.15, and 4.11 g/Kg W<sup>0.75</sup> for the maintenance requirements of digestible crude protein (DCP).

Fiber has been considered as an essential component of diets for domestic rabbits. Lai (1983) reported that the daily gains were increased by feeding Angora rabbits fed on diets containing 5 g cellulose, while, fur yield was not affected. Carregal (1980) fed male New Zealand white rabbits from weaning at 45 days on diets containing 20, 25, or 30% ground rice husks. The CF contents were in the order 12, 14, and 16%, respectively. The daily gains and feed conversion values were not affected by increasing fiber level in the diets.

The interaction between protein and fiber levels was examined by Mohamed (1982) who fed rabbits on diets contained 18 or 20% CP and 8, 14, or 20% CF. The best value of feed conversion ( feed / gain ) was observed when rabbits were fed on 20% CP and 20% CF. The digestibility of CP was improved by increasing CP level in the diets, while it was diminished by increasing CF level.

The present study was conducted to evaluate the utilization of CP (12 or 18%) and CF ( 14, 18, 22%) levels and their effects on growth performance and nutrients digestibility coefficients of growing Bouscat rabbits.

## MATERIALS AND METHODS

Thirty six, 8- week old growing Bouscat rabbits (18 males and 18 females) were maintained in boxes (150cm L x 70 cm W x 60cm H) and housed in light (12 hours) and temperature (25°C) controlled rooms. Rabbits were allowed free access to water and food. The rabbits were distributed into 12 groups (6 males and 6 females) of three rabbits each. A (2X3) factorial arrangement of treatments was employed with two levels of dietary CP (12 and 18%) and 3 levels of CF (14, 18, and 22%). Each treatment was offered to one group of each sex.

Composition and proximate analysis of the experimental diets are shown in Table 1. Body weight and feed consumption were measured biweekly and feed conversion values (feed/gain) were calculated. The experiment was terminated when individuals were 19-week old (marketing age)

At the end of experiment (19-week old) a digestibility trial was carried out to evaluate the nutrient digestibilities and the feeding value of the tested diets. Three males from each treatment were individually housed in metabolic cages and fed the experimental diets. The experimental phase continued for 7 days for total fecal collection. Feed intake was recorded. Fecal output was collected daily, oven dried (70°C for 24 hours), ground and representative samples were used for laboratory analysis. The proximate analysis of diets and feces for DM, EE, CP, CF, and ash were done according to A.O.A.C. (1980). The calorific values of experimental diets were determined according to O' shfa and Maguire (1962). The ANOVA and LSR procedures were performed as outlined by Snedecor and Cochran (1967).

Table 1 . Composition of the experimental diets

Ingredients:	Treatments					
	Protein levels %					
	12		18			
	Fiber levels %					
	14	18	22	14	18	22
Yellow corn	30.00	30.00	7.00	15.00	15.00	5.00
Barley grain	28.00	25.00	18.00	17.00	7.00	8.00
Bean straw	15.00	29.00	38.00	17.00	32.00	40.00
Corticated cotton seed meal	3.00	5.00	5.00	15.00	18.00	20.00
Wheat bran	19.00	6.00	18.00	24.00	10.00	9.00
Rice bran	2.00	2.00	11.00	1.00	7.00	5.00
Crushed bean	2.00	2.00	2.00	10.00	10.00	12.00
Yeast	1.00	1.00	1.00	1.00	1.00	1.00
Total	100	100	100	100	100	100
Limestone	2.00	2.00	2.00	2.00	2.00	2.00
Salt (NaCl)	0.50	0.50	0.50	0.50	0.50	0.50
Mineral & Vit. mix*	0.50	5.00	0.50	0.50	0.50	0.50
<b>Proximate analysis (%)</b>						
Crude protein	12.82	11.88	12.66	18.45	19.10	18.56
Crude fiber	13.27	17.97	21.32	13.43	18.44	22.23
Ether extract	2.38	1.90	2.16	3.28	2.77	2.37
Gross energy (Kcal/kg.DM)	3074	3193	3152	3163	3309	3214

\* Each 2.5 kg of vitamins and minerals mixture contain:  
 12000,000 IU vitamin A acetate; 2000,000 IU vitamin D3; 10,000 mg vitamin E acetate; 2000 mg vitamin K3; 100 mg vitamin B; 4000 mg vitamin B2; 1500 mg vitamin B6; 10 mg vitamin B12; 10,000 mg Pantothenic acid; 20,000 mg Nicotenic acid; 1000 mg Folic acid; 50 mg Bioten; 500,000 mg Choline; 10,000 mg Copper; 1000 mg Iodine; 30,00 mg Iron; 55,000 mg Manganese; 55,000 mg Zinc, and 100 mg Selenium.



Table 2a. Effect of dietary treatments on body weight, body gain, feed intake, and feed / gain for males and females growing Bouscat rabbits

Protein level	Fiber level	Treatment					
		12%		18%		22%	
Items	Age(wks)	14%	18%	22%	14%	18%	22%
Body weight (g)	8	784.2	803.4	736.7	801.7	770.9	768.3
±SE		±59.2	±27.2	±79.9	±59.9	±89.4	±4.1
	19	1725.9 <sup>a</sup>	1828.4 <sup>a</sup>	1620.0 <sup>b</sup>	2280.0 <sup>c</sup>	2215.0 <sup>c</sup>	
		±97.3	±27.2	±182.0	±138.0	±164.7	<sup>a</sup>
Body weight gain (g)							±128.6
	8 to 19	941.7 <sup>a</sup>	1025.0 <sup>a</sup>	883.3 <sup>b</sup>	1478.4 <sup>c</sup>	1444.2 <sup>c</sup>	
±SE		±38.1	±24.9	±84.3	±78.9	±78.3	<sup>a</sup>
Daily body weight gain (g/day)		12.2 <sup>a</sup>	13.3 <sup>a</sup>	11.5 <sup>b</sup>	19.2 <sup>c</sup>	18.8 <sup>c</sup>	±125.0
±SE		±0.5	±3.2	±1.1	±1.1	±1.02	14.5 <sup>a</sup>
Feed intake (g/day)		114.4 <sup>a</sup>	113.8 <sup>a</sup>	116.8 <sup>ab</sup>	119.9 <sup>b</sup>	122.7 <sup>c</sup>	±1.6
±SE		±6.4	±4.2	±2.1	±11.1	±1.2	<sup>a</sup>
Feed conversion (g,feed/g,gain )		9.37 <sup>a</sup>	8.55 <sup>a</sup>	10.21 <sup>b</sup>	6.24 <sup>c</sup>	6.52 <sup>c</sup>	7.73 <sup>c</sup>
±SE		±0.15	±1.92	±0.73	±0.32	±0.32	±1.22

a, b, and c Means in the same row followed by unlike letters differ significantly at the (P< 0.05).

Table 2b. The main effect of dietary protein and fiber levels on body weight gain, feed intake, and feed / gain for males and females growing Bouscat rabbits

Item	Treatment				
	Protein level		fiber level		
	12%	18%	14%	18%	22%
Daily body weight gain (g/day)	12.34 <sup>a</sup>	17.87 <sup>b</sup>	15.71 <sup>a</sup>	16.04 <sup>b</sup>	13.00 <sup>a</sup>
±SE	±2.03	±1.26	±1.75	±1.56	±2.43
Daily feed intake (g/day)	115.01 <sup>a</sup>	118.23 <sup>a</sup>	117.15 <sup>a</sup>	118.25 <sup>a</sup>	114.44 <sup>b</sup>
±SE	±4.37	±5.36	±8.53	±7.35	±6.36
Feed conversion (feed,g/gain,g)	9.36 <sup>a</sup>	6.83 <sup>b</sup>	7.80 <sup>a</sup>	7.50 <sup>a</sup>	9.00 <sup>b</sup>
±SE	±3.25	±5.23	±1.63	±1.56	±1.03

a, and b means in the same row of each treatment level followed by unlike letters differ significantly at the (P< 0.05).

Table 3a. Effect of dietary treatments on the digestibility coefficients and feeding value of growing male Bouscat rabbits

Protein level	Treatment					
	12%		18%		22%	
Fiber level	14%	18%	22%	14%	18%	22%
Dry matter	74.0 ±3.70	72.79 ±2.31	68.49 ±3.88	72.2 ±1.28	69.93 ±2.67	69.45 ±0.84
Organic matter	73.59 ±1.71	74.28 ±2.13	69.47 ±1.63	72.94 ±1.63	71.36 ±1.63	72.33 ±1.63
Crude protein	69.25 <sup>a</sup> ±1.63	72.72 <sup>a</sup> ±1.63	56.67 <sup>b</sup> ±3.52	75.45 <sup>a</sup> ±0.96	75.53 <sup>a</sup> ±2.45	72.87 <sup>a</sup> ±2.46
Ether extract	78.12 <sup>a</sup> ±6.50	75.52 <sup>a</sup> ±3.32	73.80 <sup>a</sup> ±5.47	84.88 <sup>b</sup> ±0.96	79.84 <sup>a</sup> ±2.57	80.92 <sup>a</sup> ±2.39
Crude fiber	57.60 <sup>a</sup> ±6.89	56.18 <sup>a</sup> ±5.00	57.96 <sup>a</sup> ±5.45	47.77 <sup>b</sup> ±6.82	51.97 <sup>ab</sup> ±4.12	59.09 <sup>a</sup> ±0.23
Nitrogen free extract	81.55 ±6.89	81.53 ±1.02	78.80 ±2.49	80.61 ±0.43	77.57 ±2.48	78.69 ±3.28
Total digestible nutrients (TDN)	71.66 ±3.27	68.28 ±0.92	63.56 ±3.02	72.31 ±0.70	67.15 ±2.21	62.87 ±1.80
Starch Value (SE)	62.56 ±3.12	55.01 ±1.40	48.70 ±2.90	60.72 ±1.05	53.01 ±1.78	47.14 ±1.86
Digestible energy (DE)* (K.cal / Kg)	2298 ±76.3	2369 ±73.4	2190 ±85.2	2307 ±32.8	2362 ±81.1	2324 ±78.9

a,b, c Means in the same row followed by unlike letters differ significantly at the (P<0.05).

\* The DE were calculated as gross energy×organic matter digestibility coefficient

Carregal (1979) fed rabbits on diets containing 7, 10, and 13% C F. The digestibility coefficients of OM, CP, and NFE were increased with increasing fiber level in the diet. While, The digestibility coefficients of CF were reduced. These trends were in contrast to the results reported herein. It is well known that rabbits are rodent animals and a minimum dietary fiber level is required to slow down the flow rate of digesta through the alimentary tract, giving better chance for enzymatic digestion and absorption across the intestinal wall. Moreover, rabbits with its enlarged secum and the microorganisms that inhabit secum and large intestine are able to and encouraged by the presence of certain level of dietary fiber that is responsible for the fragile texture of the chymous that may help digestibility and absorption. In this study the 14% dietary fiber level seems appropriate in the condition of this experiment.

Table 3b. The main effect of dietary protein and fiber levels on the digestibility coefficients and feeding value of growing male Bouscat rabbits

Treatment	Item							TDN	SE	DE
	Dry matter	Organic matter	Crude protein	Ether extract	Crude fiber	Nitrogen free extract				
<b>Protein level</b>										
12%	71.77 ±1.68	72.45 ±1.84	66.21 ±4.87	75.81 ±1.26	57.27 ±0.60	80.62 ±0.91	67.86 ±1.80	55.41 ±4.17	2286 ±52.4	
18%	70.53 ±0.85	72.21 ±0.46	74.62 ±0.87	81.88 ±1.50	52.94 ±3.30	78.96 ±0.89	67.44 ±2.10	53.62 ±2.52	2331 ±19.6	
<b>fiber level</b>										
14%	73.12 ±0.75	73.27 ±0.27	72.35 ±3.10	81.56 ±3.40	52.72 ±4.901	81.08 ±1.47	71.99 <sup>a</sup> ±0.32	61.61 <sup>a</sup> ±2.161	2302 ±3.5	
18%	71.36 ±1.43	72.82 ±1.50	74.13 ±2.03	77.68 ±2.16	54.08 ±2.11	79.55 ±1.90	67.72 <sup>ab</sup> ±0.60	54.00 <sup>b</sup> ±1.57	2365 ±3.56	
22%	68.97 ±0.48	70.96 ±1.43	64.77 ±8.12	77.36 ±3.57	58.53 ±3.57	78.75 ±0.06	63.21 <sup>b</sup> ±0.34	47.93 <sup>c</sup> ±2.37	2257 ±56.7	

a, b, c Means in the same column followed by unlike letters differ significantly at the (P < 0.05).

## REFERENCES

- Abdel-Rahman, 1975. The effect of roughage level on growing and carcass composition of rabbits. M. Sc. Thesis, Fac. Agric., Zagazig Univ., Egypt.
- A. O. A. C. 1980 . Association of Official Analytical Chemists Official Methods of Analysis. 13<sup>th</sup> ed. Association of official Analytical Chemists, Washington,DC.
- Auxilia, M. T. and G. Masoero, 1978. Effect of different amount of protein during productive cycle of rabbits does. I. Growth trail Annali dell. Instituto Sperimentale per la Zootecnia, 13 (1) 53-62.
- Carregal, R. D., 1979. Effect of different fiber contents on digestibility of nutrients of rations by rabbits. Cientific, 7(1) 137-142.
- Carregal, R. D., 1980 Use of rice husks as source fiber in diets for growing rabbits. In Resumos, S. Encontro de Pescu, Vetennarias, Jaboticabal, November 1980. Riberrao Pr Brazil, Sociedate Paulista de Medicina Veterinaria (undat 87-88).
- Chaing, S. Ch., C.T. Haug, M. S. Lee, and C. M Hong, 1982. The study of protein requirements of growing rabbits. Journal of Taiwan Livestock Research, 15 (2), 25-30.
- Cheeke, P. R., W. K. Sanchez, and N. M. Patton, 1985. Protein requirements for optimal growth and reproduction of rabbits. Journal of Applied rabbits research 8 (3) 139-140.
- Colin, M. 1974. Supplementaion with lysine of diet based on sesame meal for rabbits. Effect on growth and nitrogen balance estimated by two methods. Annales Zootechnie., 23 (2),119-132.
- Ibrahim, M.R.M; 1986. Effect of dietary protein , zinc and calcium levels and their interactions on growing rabbits performance. M. Sc. Thesis, Fac. of Agric., Cairo Univ., Egypt.
- Lai, Y. Y., 1983 Feed Angora rabbits with cellulose. Fur animal farming No 3,7-5 (ch) Local products Co. Tongxiang Country. Zhejiang, China.
- Lui, S. M., L. Zhang, C. M. Wei, C. Chang, Y. X. Lu and D. H. Pen, 1993. The maintenance requirements of protein for Angora rabbits and the utilization efficiency of digested protein by the rabbits. Acta-Veterinaria - et - Zootechnica - Scienta., 22(4) : 323 - 326.
- Martina, C. and C. Damian, 1981. Supplementation of diets low in protein with lysine and methionine for fattening young rabbits. Lucrarile Stiintifice ale institutului de cercetari Pentru Nutritie Animala 9,10.,227-236. (Nut. Abst. and Rev. 53: 4391,1983).
- Mohamed, S. M., 1982. Nutritional studies on rabbits. M. SC. Fac. of Agric. Cairo Univ., Egypt.
- O'shfa, J. and M. F. Maguire 1962. Determination of calorific value of feedstuff by chromic acid oxidation. J. Sci. Food and Agric., 13, 530.

- Pomytko, V. K. and K. N., Morozova, K.N. and E. A. Razzorenova, 1979. Crystalline amino acids in diets for rabbits. Nouchnye Trudy Nauchno-Issledovateksskogo Instituta Pushnego Zverovodstva i Kvolikovodsiva Rererativnyi Zhurnal, 58,9., 58:559. (Nut. Abst. and Rev. 438,1979).
- Snedecor, G. W., and W. C. Cochran., 1967. Statistical Methods. 6th Ed. Iowa State Univ. Press. Ames, Iowa, U. S. A.



تأثير العلائق المحتوية على نسب مختلفة من البروتين والألياف على إستجابة النمو  
ومعدلات الهضم فى الأرناب البوسكات النامية

شاكى عبد التواب عبد اللطيف، سمير توفيق محمد فهمى، محمد حافظ أحمد

كلية الزراعة - جامعة المنيا - قسم الإنتاج الحيوانى

تم إجراء هذه الدراسة لتقييم تمثيل العلائق المحتوية على نسب مختلفة من البروتين والألياف ودراسة تأثيرها على إستجابات النمو ومعدلات الهضم فى الأرناب البوسكات النامية. واستخدم فى هذه الدراسة ٣٦ أرناب (عمر ٨ أسابيع) نصفهم ذكورا والنصف الآخر إناثا. وقسمت هذه الأعداد إلى ٦ مجموعات حيث احتوت كل مجموعة على ٣ ارناب ذكور و ٣ ارناب إناث. غذيت مجاميع الذكور أو الإناث على ٦ علائق مختلفة كونت لتشتمل على ١٢ أو ١٨٪ بروتين خام و ١٤، ١٨، ٢٢ ٪ اليف خام تحت كل مستوى من مستويات البروتين بتصميم احصائى متداخل ٢ × ٣. وفى نهاية التجربة (١٩ أسبوع) تم أخذ ثلاث ذكور من كل معاملة وعمل تجربة هضم عليها. وتم دراسة معدلات النمو والمأكول من الغذاء ومعاملات الهضم.

وكان من نتائج التجربة:-

- سجلت العليقة التى احتوت على ١٨٪ بروتين خام، ١٤٪ اليف خام أفضل نمو يومى (٩,٢جم/يوم). وكان أعلى استهلاك فى الغذاء فى العليقة المحتوية على ١٨٪ بروتين خام، ١٨٪ اليف خام (١٢٢,٧جم/يوم) وذلك مقارنة بباقى العلائق.
- لوحظ تحسن معنوى فى معدلات النمو والكفاءة التحويلية للغذاء بزيادة مستوى البروتين فى العليقة.
- أوضحت الدراسة أن معاملات الهضم للبروتين الخام سجلت أعلى معدلاتها فى العلائق المحتوية على ١٨٪ بروتين خام، ١٨٪ اليف خام. كما لوحظ أن معدلات الهضم للمادة الجافة والبروتين الخام والألياف الخام والكربوهيدرات الذائبة لم تتأثر معنويا بزيادة البروتين أو الألياف الخام بالعلائق.
- بزيادة الألياف الخام فى العليقة حدث انخفاض فى القيمة الغذائية (مجموع المركبات الغذائية المهضومة ومعادل النشا) لها.