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EFFECT OF DIETARY CRUDE FIBER ON THE PERFORMANCE OF BALADI RABBITS

(With 6 Tables & 2 Figures)

By

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تأثير مستوى الألياف الخام على أداء الأرانب البلدى

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أجريت أربع تجارب نمو على الأرانب البلدى لدراسة تأثير مستوى الألياف الخام على أدائها. استخدم فى هذا البحث أربعون أرنبا، تم تقسيمها الى أربع مجموعات عشرة بكل منها ، غذيت أرانب المجموعات على أربع علائق متساوية فى البروتين ومختلفة فى نسبة الألياف الخام حيث كانت ٢٪ ، ٧٪ ، ١٢٪ ، ١٧٪ فى العلائق الأربع على التوالى. أستمرت فترة التغذية ثمانية أسابيع. وقد أظهرت نتائج البحث ما يلى: أعطت أرانب المجموعة الثالثة التى غذيت على عليقة بها ١٢٪ ألياف خام أعلى المعدلات فى مقاييس النمو والكفاءة التحويلية للغذاء وأيضا أعلى نسبة تصافى للذبيحة، بينما أعطت أرانب المجموعة الأولى التى غذيت على عليقة منخفضة الألياف الخام (٢٪) أقل معدلات نمو وكفاءة تحويلية للغذاء، وبلغت نسبة النفوق فى هذه المجموعة ٥٠٪. ويستخلص من هذا البحث ضرورة الاهتمام بمستوى الالياف الخام فى علائق الارانب ليس فقط للحصول على أعلى معدلات نمو وكفاءة تحويلية للغذاء ونسبة تصافى للذبيحة بل أيضا لحماية الأرانب من الاصابة بالتهاب الأمعاء عند تغذيتها على عليقة منخفضة الألياف، وأن نسبة ١٢ ٪ ألياف خام مع حوالى ٢٨٠٠ كيلوكالورى /كجم عليقة طاقة مهضومة تعتبر عليقة مناسبة لتغذية الأرانب البلدى النامية.

SUMMARY

Four growth trials were conducted to investigate the influence of dietary crude fiber level on the performance of rabbits. A total of forty rabbits of Baladi type were randomly allocated to four groups whereby four different dietary regimens were adopted. The diets isonitrogenic but the percentage of crude fiber were 2, 7, 12, & 17% for diets 1, 2, 3, & 4, respectively. The experiment was durated for 8 weeks. The level of dietary crude fiber had a significant effect on the different parameters of growth, digestive characteristics and dressing percentage of carcass. Rabbits of group 3 which fed diet containing 12% crude fiber gave the highest values for final body weight, weight gain, relative growth rate, feed conversion efficiency and dressing percentage of carcass, while those fed diet contained 2% crude fiber gave the lowest values with high mortality rate (50%). It could be concluded that the level of dietary crude fiber plays an important role in feeding rabbits not only for high productive performance but also for protection against digestive disorders. A diet having 12% crude fiber and about 2800 kcal/kg diet digestible energy seems to be satisfying for growing Baladi rabbits.

Keywords: *Dietary- crude fiber-Balady Rabbits*

INTRODUCTION

The efficiency of rabbits in producing meat compares favourably with most other domesticated species *(WALSINGHAM, 1972 and DICKERSON, 1978)*. The theoretical potential of the rabbit for meat production, however, rests heavily on its capability to attain high growth rate.

In rabbit nutrition, the main interest in fiber is related to its apparent role in protecting against enteritis *(CHEEKE, 1987)* and in affecting its growth *(PROTO et al. 1968; HECKMAN and MEHNER, 1971; LAPLACE and LEBAS, 1977; LAPLACE, 1978; CKEEKE and PATTON, 1980; POTE et al. 1980 and CHAMPE and MAURICE, 1983)*. For this role, fiber seems to be involved in the diets of rabbits.

Despite numerous research efforts to establish the effect of dietary fiber level on growth performance of rabbits, it is difficult to develop practical recommendations from the work because of differences among experiments in potential growth of animals and type of fiber used, and because of a low number of diets per experiment *(DE BLAS et al., 1986)*.

Therefore, the information concerning the optimal level of dietary fiber for growth and its effect on digestive characteristics and carcass quality in rabbits specialy the Baladi type are still scarce and show some discrepancies. Digestive disorders accompany the feeding of diets containing 5% or less crude fiber. Performance of young rabbits may be satisfactory on such diets but mortality is often higher than normal *(HECKMAN & MEHNER, 1971; DAVIDSON & SPREADBURY, 1975; SPREADBURY & DAVIDSON, 1978)*. Some possibly physical, dietary requirements for function of digestive tract may not be satisfied by low fiber levels. *HECKMAN & MEHNER (1971)* demonstrated that, the best performance in tems of health, growth and food conversion in 6-12 week old rabbits was obtained on a diet containing 8-9% crude fiber; raising the fiber level to 13-14% caused a decrease of 12% in food conversion efficiency and no improvement in health. *BESEDINA (1968)* reported higher growth rates and much reduced mortality on rations containing 15-20% fiber when compared with higher or lower fiber levels, while the level of 12-14% dietary fiber was demonstrated by *COLIN et al. (1976). NRC (1977)* recommended that, the adequate and may not the minimum dietary fiber level for growth of rabbits ranged from 10 to 12%, while the optimum fiber levell of 10% was recommended by *SPREADBURY & DAVIDSON (1978)*.

EL-SERAFY et al. (1980) found that, the best weight gain, relative growth rate and feed efficiency were obtained in rabbits when fed diet containing 15% fiber, while *LEBAS (1980)* recommended that, the dietary fiber level requirement for 4-12 week old growing rabbits was 14%. However, the level of 20% fiber was recommended by *GAMEZ-GUILAMON et al. (1965), DAVIDSON and SPREADBURY (1975) and LEBAS et al. (1982)*.

On the other hand , *DE BLAS et al. (1986)* demonstrated that, diet had a significant influence on the weights of the stomach and its content. Diets with low fiber level lower than minimum to avoid digestive disorders were associated with an increase of cecum contents.

So, in order to put more emphasis on this issue, the present work was done to study the effect of dietary crude fiber level on the growth performance, digestive characteristics and dressing percentages in Baladi rabbits.

MATERIALS and METHODS

Forty healthy (parasites-free) rabbits, of the Baladi type, nearly of the same age (4 weeks) and weight (290-320g), were experimented on. The animals were divided into four groups, each of ten rabbits (5 males and 5 females). The rabbits were housed in units each containing six hutches. Each hutch has a floor area of 60 X 65 cm2 and 45 cm height. The average daily feed consumption during the experiment was determined. The excess food was collected, weighed and carefully mixed with the food of the next day. The food was offered twice daily at 10 a.m. and 3 p.m. Fresh and clean water was available ad libitum.

To study the effect of dietary crude fiber level on growth the percentage of diet ingredients were differed to formulate four diets with variable levels of crude fiber 2, 7, 12, and 17% for diets 1, 2, 3, and 4, respectively (table 2). All the diets were adjusted to be similar in their protein content.

Body weight and feed consumption were recorded for each group during the experimental period (8 weeks). Samples of the feed used were chemically analysed according to the methods of AOAC (1984) for the determination of moisture, crude protien (CP), ether-extract (EE), crude fiber (CF) and ash. The relative growth rate(R.G.R.) was calculated according to *CRAMPTON and ILOYED (1959)*, while the feed conversion index was calculated by dividing the amount of feed consumed by rabbits on their weight gain. The obtained data were statistically analysed according to *SPLEGEL (1972)*.

At the end of the experiment, three male rabbits from each group were slaughtered . The gastro-intestinal tract was removed, the stomach, cecum and their respective contents were weighed separately.

RESULTS

The chemical composition of the experimental feeds their digestible energy are shown in table 1 while table 2 shows the physical and chemical composition of the tested diets and their digestible energy. The results cleared that the level of dietary crude fiber was increased progressively by 5%.

The effect of dietary crude fiber levels on the body weight development and growth rates are shown in tables 3&4 and figures 1&2, while its effect on the food consumption, feed conversion efficiency, dressing percentage and

digestive characteristics are presented in tables 5&6 and figures 3&4. Table 7 shows the mortality in the four groups during the experimental period.

DISCUSSION

The results relating to growth traits were used to determine the acceptable optimal level of fiber in rabbit diets. The obtained data indicated that the level of the dietary fiber affected significantly the growth traits and the incidence of enteritis mortality in rabbits (table 1 to 6 and figures 1 to 2). The corn-soybean meal (diet 1) gave the lowest growth rate and the highest feed conversion index (6.96), beside the high mortality (50%). This means that low fiber level significantly reduced the efficiency of feed utilization and increased the rate of mortality. Similar findings were reported by *HECKMAN and MEHNER (1971), LAPLACE and LEBAS (1977), CHEEKE and PATTON (1978), POTE et al. (1980), CHAMPE and MAURICE (1983), De BLAS et al. (1986) and CHEEKE (1987)* who reported that the low level of dietary fiber (5% or less) diminshed the productive performance of rabbits and incresed the percentages of enteritis mortality.

There are several possible explanations for the low growth rate of rabbits fed low-fiber diets, as mentioned by *LAPLACE and LEBAS (1977)*, finely ground feed increased the retention time of digesta in the cecum, decreasing the dry matter intake and the highly digestible diets are consumed in lower quantities and retained in the digestive tract longer than high- fiber diets. On the other hand, *LAPLACE (1978)* noted that a prolonged retention time of feed in the digestive tract is a precursory sign of diarrhea, which tends to be preceded by cecal-colonic hypomotility.

The final body weight and the growth rate decreased significantly for rabbits fed the diet having 17% crude fiber, while the feed conversion index was significantly increased compared with those fed diets having 7% or 12% crude fiber (table 3, 4 & 5 and figure 1), despite the animals compensated the low dietary energy concentration by increasing the amount of feed intake, so, the acceptable maximam level of dietary fiber in the present work was 12%, in which the greatest values for the growth and efficiency of feed utilization were recorded. This percentage was similar to the maximum a dequate level of fiber recommended by NRC (1977). Other authors have reported values for maximum level of dietary fiber higher than the obtained percentage, 12-14% *(COLIN et al., 1976)*; 14% *(LEBAS, 1980)*; 15% *(EL-SERAFY et al., 1980)* and 15-20% *(GAMEZ-GUILAMON et al., 1965; BESEDINA, 1968; DAVIDSON and SPREADBURY, 1975 and LEBAS et al., 1982)*. In contrast, the 12% fiber was higher than the level reported by *HECKMAN and MEHNER (1971)* (8-9%) and *SPREADBURY and DAVIDSON (1978) (10%)*.

Regarding the feed consumption, the obtained data showed that the average feed consumption increased progressively with increasing the level of crude fiber (table 5 and figure 2). This finding is supported by that found by *LAPLACE and LEBAS (1977), LAPLACE (1978) and DE BLAS et al., (1986)* who mentioned that the low fiber diets were consumed by rabbits in lower quantities owing to its retaining in the digestive tract longer than the high fiber diets.

Findings of the present study revealed that, fiber content of the diet had apparent effect on several digestive characteristics. The increase of stomach contents with increasing the level of fiber (table 6) may be related to the higher feed intake observed in the high fiber diet (diet 4). The relative increase in the weight of empty stomach could be explained by adaptation to a greater feed intake, in addition to the physical effect of fiber in stimulating an increased thickness of stomach wall which may be needed to support the great amount of feed consumed. Similar finding has been reported by *CHAMPE and MAURICE, 1983; PEKAS et al., 1983 and DE BLAS et al., 1986.*

On other hand, the weight of cecum contents did not vary with the level of fiber in the diet that were not associated with digestive disorders (diets 3&4), while in low fiber diets (diets 1&2) the weight of cecum contents increased about 40&37%,respectively over the mean value obtained from the diets 3&4. This demonstrated the importance of the cecum in fermentation of soluble carbohydrates, thus in contrast to what might be expected, a low fiber diet results in a greater cecal size than does a high fiber diet. A similar finding was reported by *CHAMPE and MAURICE (1983) and DE BLAS et al. (1986)* who observed similar trends with cecal enlargement for rabbits fed low fiber diets. The cecal enlargement may probably be due to the results of hypomotility of the hindgut with low fiber diets and while it may facilitate fermentation, it also predisposes the animal to diarrhea. This finding suggests that a minimal level of fiber is required to regulate adequate flow of cecal digestion which coincides with that mentioned by *DE BLAS et al. (1986)* and *CHEEKE (1987).* The data in table 6 illustrated that diets containing large quantity of fiber (diets 3&4) gave the highest relative weight for empty cecum. This is supported by what was found by *HOOVER and HICTMANN (1972) and EL-SERAFY et al. (1980)* who reported that, the relative weight of empty cecum was high in rabbits fed high fiber diets in comparison with those fed low fiber diets.

Concerning the effect of diet composition on the dressing percentage of carcass (table 6). The obtained results cleared that rabbits fed diet had 12% fiber produced carcass with the

best dressing percentage, while those fed diet containing 2% fiber gave the lowest one.

Collectively, from the previous findings, it is cleared that the fiber level of diet explains the main variations observed in the growth traits, digestive parameters and dressing percentages. So, the suitable level of dietary crude fiber for growing Baladi rabbits is 12% with 2831 kcal/kg diet digestible energy.

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Table 1 : Chemical composition of the experimental feeds.

Feeds	DM %	CP %	EE %	CF %	NFE %	Ash %	Ca* %	P* %	Lysine* %	Sulphur amino acids* %	DE* Kcal/kg
White corn	89.50	8.46	4.03	1.78	73.51	1.72	0.04	0.28	0.30	0.29	3500
Soybean meal	91.50	42.57	1.58	4.87	37.48	5.00	0.32	0.61	2.80	1.26	3160
Wheat bran	88.90	11.73	2.54	11.22	58.11	5.30	0.14	1.01	0.56	0.44	3200
Wheat straw	89.88	2.83	1.30	36.10	43.55	6.10					1500**

DM = dry matter EE = ether-extract NFE = nitrogen-free extract
CP = crude protien CF = crude fiber DE = digestible energy
* From Cheeke, 1987.
** From Cullison, 1979.

Table 2 : composition of the tested diets.

Items	Diets			
	1	2	3	4
Ingredients :				
White corn	74.99	44.16	26.67	4.36
Soybean meal	22.68	22.00	24.55	27.77
Wheat bran	0.00	25.00	25.00	25.00
Wheat straw, chopped	0.00	6.51	21.45	36.54
Limestone, ground	1.58	1.58	1.58	1.58
Common salt	0.5	0.50	0.50	0.50
Rabbit premix*	0.25	0.25	0.25	0.25
Calculated :				
DM	90.20	90.06	87.84	84.38
CP	16.00	16.22	16.25	16.16
EE	3.38	2.85	2.38	1.72
CF	2.44	7.01	12.22	17.43
NFE	65.96	60.40	53.74	44.05
Ash	2.42	3.38	3.25	5.02
Ca	0.70	0.69	0.72	0.73
P	0.35	0.51	0.48	0.43
Lysine	0.86	0.89	0.91	0.93
Sulphur amino acids	0.50	0.52	0.50	0.47
DE(kcal/ kg)	3341	3164	2831	2378

* Produced by Pfizer Co., Cairo, Egypt.

Table 3 : Average body weight development of rabbits in the four groups.

Weeks	Groups			
	1*	2**	3	4
0	320.00 ± 2.64	321.60±2.14	300.00±2.18	318.90±2.40
1	329.88±2.81^{a}	369.92±2.43^{b}	385.32±2.55^{c}	364.52±2.80
2	341.54±3.11^{a}	434.33±2.65^{b}	477.73+-2.90^{c}	419.86±3.14^{d}
3	355.35±3.33^{a}	504.82±3.14^{b}	577.22±3.60^{c}	479.74±3.66^{d}
4	369.55±3.64^{a}	589.42±3.84^{b}	687.82+-3.84^{c}	554.40±3.89^{d}
5	384.09±2.88^{a}	675.12±3.66^{b}	799.86±4.44^{c}	634.51±4.22^{d}
6	399.12±6.11^{a}	765.88±4.11^{b}	913.57±4.84^{c}	718.95±4.66^{d}
7	415.08±6.64^{a}	857.68±4.16^{b}	1032.33±5.11^{c}	805.28±4.90^{d}
8	430.80±6.44^{a}	953.20±5.53^{b}	1152.74±5.80^{c}	893.50±6.14^{d}

± SD. * Five rabbits died. ** Two rabbits died.

a-dMeans within the same raw with the different superscripts are significantly different ($P < 0.01$).

Table 4 : Average weight gain (g) and relative growth rate in the four groups.

Weeks	Group1		Group2		Group3		Group4	
	Weight gain	R.G.R. %	Weight gain	R.G.R. %	Weight gain	R.G.R. %	Weight gain	R.G.R. %
0-1	9.88 ±1.01	3.04 ±0.91^{a}	57.32 ±1.22	16.80 ± 0.87^{b}	85.32 ±1.21	24.90 ±0.88^{c}	45.62 ±1.22	13.35±1.11^{d}
1-2	11.66 ±1.02	3.47 ±0.93^{a}	64.41 ±1.23	16.02±0.85^{b}	92.41 ±1.31	21.41 ±0.86^{c}	55.34 ±1.41	14.11 ±1.09^{d}
2-3	13.81±1.11	3.96 ±0.88^{a}	70.49 ±1.23	15.01 ±0.98^{b}	99.49 ±1.11	18.86 ±0.97^{c}	59.88 ±1.33	13.31 ±1.21^{d}
3-4	14.20±1.14	3.92 ±.96^{a}	84.60 ±1.33	15.46 ±0.94^{b}	110.60 ±1.32	17.49 ±0.89^{c}	74.66 ±1.33	14.44 ±1.22^{b}
4-5	14.54 +1.21	3.86 ±.97^{a}	85.70 ±1.31	13.55 +0.96^{b}	112.04 ± 134	15.06 ±1.11^{c}	80.11 ±1.42	13.48 ±1.32^{b}
5-6	15.03 ±1.35	3.84 ±.98^{a}	90.70± 2.11	12.60 ±0.87^{b}	113.71 ±2.10	14.10 ±1.23^{c}	84.44 ±2.31	12.48 ±1.33^{b}
6-7	15.96 ±2.41	3.92 ±.1.11^{a}	91.80 ±2.43	11.31 ±1.12^{b}	118.76 ±2.44	12.21 ±0.99^{b}	86.33 ±2.35	11.33 ±2.33^{bc}
7-8	15.72 + 1.65	3.72 ±1.14^{a}	95.52± 2.14	10.55 ±1.32^{b}	120.41 ±2.36	11.02 ±1.12^{b}	88.22 ±2.14	10.39 ±1.98^{bc}
Total	110.80 ± 1.44	29.52 ±1.00	640.60 ± 1.24	101.22 ±0.99	852.74 ±2.41	117.40±1.01	574.60 ±1.95	94.79 ±1.34

± SD.

R.G.R. = relative growth rate.

R.G.R. = 100 (Wt2 - Wt1) -- 1/2 (Wt2 + Wt1). Crampton and lloyd (1959).

Wt 1 = the body weight at the beginning of week or period.

Wt 2 = the body weight at the end of week or period.

a-d Means within the same raw with the different superscripts are significantly different ($P < 0.05$).

Table 5 : Average feed intake (g) and feed conversion index in the four groups

Weeks	Group1		Group2		Group3		Group4	
	feed intake	F.C.I.	feed intake	F.C.I.	feed intake	F.C.I.	feed intake	F.C.I
0-1	43.57	4.41	138.14	2.41	221.83	2.60	150.24	3.29
1-2	59.58	5.11	171.33	2.66	262.44	2.84	249.18	4.50
2-3	78.72	5.70	203.72	2.89	309.41	3.11	310.34	5.18
3-4	90.60	6.38	299.48	3.54	387.10	3.50	439.91	5.89
4-5	110.50	7.60	322.23	3.76	459.36	4.10	565.60	7.06
5-6	130.91	8.71	373.02	4.11	513.97	4.52	635.25	7.52
6-7	129.44	8.11	424.12	4.62	583.11	4.91	710.35	8.23
7-8	127.65	8.12	459.45	4.81	650.21	5.40	752.34	8.53
Total	770.97	6.96	2391.49	3.73	3387.43	3.97	3813.21	6.64

F.C.I. = feed conversion index.

Regarding the feed intake, the statistical analysis showed a significant ($P < 0.01$) differences between groups 3 and 1 , 2 & 4 ; between groups 2 and 1 & 4 and between groups 1 & 4 .

Regarding the feed coversion index, the statistical analysis showed a significant ($P < 0.01$) differences only between groups 3 and 1 & 4 and between groups 2 and 1 & 4 .

Table 6 : Dressing percentage and weight of the stomach and cecum in the four groups.

Items	Groups			
	1	2	3	4
Sloughter weight (g)*	420± 0.23	940± 0.25	1100± 0.26	890± 0.28
Dressing % **	29.44±1.19	38.43±1.14	44.15±1.51	34.92±1.14
Stomach :				
Organ (%)***	0.84± 0.20	0.85± 0.19	0.85±0.18	1.00± 0.18
Content (%)	1.89± 0.21	2.20± 0.18	2.50± 0.21	3.66± 0.18
Cecum :				
Organ (%)***	1.46± 0.16	1.51± 0.17	1.72± 0.19	1.73± 0.18
Content (%)	7.80± 0.21	7.60± 0.19	5.61± 0.19	5.52± 0.21
Stomach content (as % of cecal content)	24.23	28.95	37.23	70.11

± SE * Live body weight. ** = % of meat, bones and visible fat *** As % of body weight.

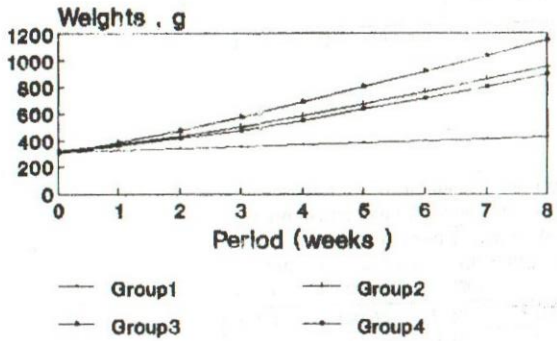

Fig.1: Average weight devolopments

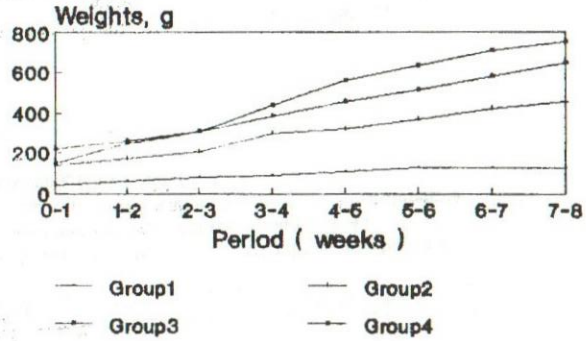

Fig.2: Average feed intake