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Growth and Carcass Traits of Native Middle-Egypt Rabbits Fed Different Levels of Digestible Energy and Crude Protein Diets

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ABSTRACT

No studies have been published concerning to digestible energy and crude protein requirements for Native Middle-Egypt rabbits. The main objective of the current study was to determine the digestible energy (DE) and crud protein (CP) requirements for Native Middle-Egypt rabbits (NMER) to find out the optimum growth performance and economic efficiency. A total number of 78 Native Middle-Egypt rabbits (NMER) at 5 weeks of age (at weaning) were divided randomly into 6 groups with three different crude protein levels; 13, 14.5 and 16% and two levels of digestible energy; 2500 and 2350 kcal/kg diet in 3 X 2 factorial experiments for eleven weeks. Rabbits were housed in individual cages and kept under the same managerial conditions. Feed and water were offered *ad libitum* throughout the experimental period (5 to 16 weeks of age). Live body weight, feed intake and number of dead rabbits were recorded. Daily weight gain and feed conversion ratio were calculated. At 16 week four rabbits males were taken randomly from each treatment slaughtered to estimate some of carcass traits. Carcass parts were presented as a percent of live body weight. Data were statistically analyzed using the General linear Model Program of SAS. The differences between initial body weights (g) at 5 week of age in feeding groups were not significant. Two levels of digestible energy (DE) did not significant effects on all body weights expect at 8 week of age. Rabbits fed 14.5 protein % had body weight were heaviest in 8, 12 and 16 weeks of age. Daily feed consumption in rabbits fed 14.5 protein % was higher significantly in 5-8 and 8-12 periods. Feed conversion was not significantly influenced by varying crude protein levels. In effects interaction digestible energy and crude protein levels, rabbits fed diets contains 14.5 % CP with 2500 kcal DE /kg diet had body weight were heaviest significantly in 8, 12 and 16 weeks of age. Daily weight gain in rabbits fed 14.5 protein % and 2500 kcal DE /kg, were higher than other groups during 5-8, 8-12 and 5-16 periods. Only during 5-8 period daily feed consumption was significantly influenced by varying digestible energy and crude protein levels .Diets contains 2500 kcal DE /kg diet and 14.5 % CP lead to improve feed conversion ratio during the period from 5 to 12 weeks compared to the other treatment but was not significantly. No significant differences between digestible energy levels were observed in total edible parts (TEP), Fore-quarter, hind-quarter and trunk while the weight of edible giblets (WEG) was significant different. From the economical point of view, the highest economic efficiency was recorded with rabbits fed diet containing 14.5% CP and 2350 kcal DE /kg diet and followed by that fed 13 % CP and 2350 kcal. The mortality % was zero in rabbits group fed on fed 2500 kcal with 14.5 % CP. The highest value of mortality %was observed for those groups were fed 16% CP with 2500 kcal DE/ kg and 13% CP with 2350 kcal DE/ kg. We could recommend with the diet containing fed 2500 kcal with 14.5 % CP for native rabbit during the growing period; from 5 to 16 weeks of age which was the best in economical view, body weight and growth performance in native Middle-Egypt rabbits.

Keywords: energy, protein diets, growing, Native rabbits

INTRODUCTION

Rabbit production could be a good source of meat in Egypt since it is a prolific animal, fast growing and of high fecundity. In Egypt, an early attempt was made to develop selected lines of meat rabbits, beginning with getting of Giza White breed in 1937 (El-Khishin *et al*., 1951). Breeds selected for meat production were produced by crossbreeding between native rabbits and exotic Flemish Giant (Badawy, 1975). Native Egyptian rabbits were used early to get improved breeds but few studies have been published concerning Native rabbits and their nutritional requirements. In 2009, Animal Production Research Institute (APRI) collected Native Middle-Egypt rabbits (NMER) from 3 governorates; Bani Suef, Minya and Fayoum during 2008 and 2009 and reared in Seds farm which located in Bani Suef governorate and belonging to APRI. NMER rabbits described their productive and reproductive traits and phenotype characteristics as a one of native breed in Egypt (Abdel-Kafy *et al*., 2011). As it is known, rabbit lies in the mid way between broiler and ruminant, so that, low levels of protein and digestible energy will meet their requirements. Nutrition and feeding strategies play a key role in rabbit breeding to optimize production itself such as meat, milk and fur (Gidenne *et al.,* 2010). The possibility of widely change the composition of rabbit diets is limited by the need for various nutrients and balance among them (Xiccato and Trocino, 2010). Dietary protein utilization is influenced not only by its digestibility and correct amount of essential amino acids, but also by the ratio between protein and energy digestible energy concentration (DP/DE). The values usually recommended for fattening rabbits range from 10 to 11 g DP/MJ DE. The increase of energy concentration and the reduction of DP/DE provoke a clear modification of tissue development, with a decrease in muscle growth and acceleration in fat deposition (Lawrie and Ledward, 2006). On the country, an increase in protein concentration promotes muscle growth and slows down fattening. Also high levels of protein or energy have been shown to cause many healthy problems which definitely reflect on the growth rate (Maertens 1992). Theses feeding modification either accelerate or delay animal growth finishing and offer a valid mean for the production of ready to market carcasses of different age and weight in rabbit. NMER rabbits have medium body weight and thier requirements from digestible energy (DE) and crud protein (CP) may be different about nutritional requirements of the National Research Council (NRC), 1977. The main objective of the current study was to determine the digestible energy (DE) and crud protein (CP) requirements for Native Middle-Egypt rabbits (NMER) to find out the optimum growth performance and economic efficiency.

MATERIALS AND METHODS

The growth trail was carried out at the Rabbits Farm of Sakha Station, Animal Production Research Institute (APRI), Agricultural Research Center, Ministry of Agriculture, Egypt. A total number of 78 Native Middle-Egypt rabbits (NMER) at 5 weeks of age (at weaning) were divided randomly into 6 groups (13 rabbit each). All rabbits at weaning were nearly equal in live body weight at the beginning of the experiment. Three dietary levels of crude protein, *i.e*. 13%, 14.5% and 16% and two levels of digestible energy, *i.e.* 2500 and 2350 kcal/kg diet were used in 3 X 2 factorial design for eleven weeks. Essential amino acids, lysine and sulfur amino acids, in addition to the minerals and vitamins were adjusted in all diets to cover the requirements according to NRC, 1977. Ingredients and chemical analysis of the experimental diets are presented in Table 1.

Table 1. Ingredients and chemical analysis of the experimental diets.

Ingredients	2500 DE Kcal/Kg			2350 DE Kcal/Kg		
	CP			CP		
	16%	14.5%	13%	16%	14.5%	13%
Wheat bran	27.50	26.19	27.19	27.70	25.19	26.69
Clover hay meal (12%)	24.50	25.00	25.00	22.50	23.00	23.00
Soybean meal (44%)	13.10	9.40	5.00	14.10	10.50	6.00
Barley	21.38	21.38	21.38	18.88	18.38	18.38
Yellow corn	7.00	11.50	14.90	3.00	8.50	11.9
Molasses	3.00	3.00	3.00	3.00	3.00	3.00
DiCalcium Phosphate	1.71	1.71	1.71	1.71	1.71	1.71
Limestone	1.08	1.08	1.08	1.08	1.08	1.08
Salt (NaCl)	0.35	0.35	0.35	0.35	0.35	0.35
*Vit.& Min. Mix.	0.30	0.30	0.30	0.30	0.30	0.30
DL-Methionine	0.08	0.09	0.09	0.08	0.09	0.09
Bean Straw	----	----	----	7.30	7.90	7.50
Total	100	100	100	100	100	100
**Calculated analysis:						
DE Kcal/Kg	2500	2500	2500	2350	2350	2350
Crude Protein %	16.06	14.54	13.05	16.08	14.58	13.06
Crude fiber%	12.54	12.37	12.24	14.73	14.69	14.64
Crude fat%	2.50	2.57	2.67	2.35	2.41	2.53
Calcium %	1.23	1.23	1.21	1.30	1.30	1.29
Total Phosphorus%	0.80	0.78	0.77	0.80	0.76	0.76
Lysine %	0.79	0.69	0.61	0.79	0.68	0.60
Methionine %	0.32	0.31	0.28	0.31	0.29	0.30
Methionine+Cys.%	0.60	0.59	0.56	0.59	0.58	0.56
Sodium %	0.18	0.18	0.18	0.18	0.18	0.18

***Vitamins and Minerals per 3 Kg: Vit. A: 10000000 IU; Vit. E: 50000mg;Vit.B_1:2000mg;Vit.B_2:4000mg;Vit.B_6:2000mg;Vit. B_{12}:10mg;Vit.K_3:2000mg;Vit.D_3:900000IU;Pantothenic acid:10000mg;Niacin:50000mg;Folicacid:3000mg;Biotin:100 mg;Manganese:85000mg;Zinc:50000mg;Iron:50000mg;Copper:5 000mg:Selenium:200mg; Iodine:200mg; Choline:2500000mg and calcium carbonate up to 3kg.**According to NRC, 1977.**

Rabbits were housed in individual cages and kept under the same managerial conditions. Feed and water were offered *ad libitum* throughout the experimental period (5 to 16 weeks of age). Live body weight, feed intake and number of dead rabbits were recorded weekly. Daily weight gain and feed conversion ratio were calculated. Economic efficiency was calculated according to Raya *et al*. (1991). At 16 week, four male rabbits were taken randomly from each treatment, fasted for 12 hrs, weighed and slaughtered to record some of carcass traits. Carcass parts were presented as a percent of live body weight. The dressing percentage was calculated using the weight of edible giblets (WEG) and the cut-points of the carcass divided by live body weight and multiplied by 100. The variables measured for the carcass traits were WEG (total weights of lung, liver, kidneys and heart) and carcass cuts. The reference carcass cuts according to Blasco *et al*. (1993) used the following points: Fore-quarter, section between the 7th and 8th thoracic vertebra,: Hind-quarter, including hind legs and thighs,: Trunk include two section; section between the last thoracic and the first lumbar vertebra and the end of the 12th rib, in addition to section after the 12th to before hind legs.

Statistical analysis

Data were analyzed using the general linear model of SAS (2002). The following statistical model used in analysis of growth traits is following model: $Y_{ijk}=\mu+P_i+DE_j+(P\_DE)_{ij}+e_{ijk}$. Where μ = general mean; P_i= the fixed effect of ith protein levels; DE_j= the fixed effect of jth digestible energy; $(P\_DE)_{ij}$= the interaction effect between ith protein levels and jth digestible energy; e_{ijk}= random error. Data of carcass traits percentage were subjected to the arcsin transformation before the statistical analysis and then the results obtained were returned back to its original scale.

RESULTS AND DISCUSSION

Body weight and Growth performance

The differences in initial body weights (g) at 5 week of age in feeding groups were not significant as shown in Table 2. Effect of two levels of digestible energy (DE) did not appearance significant effects on body weight all ages expect at 8 week of age (Table 2). In part of effect curd protein only it is noticed that that rabbits fed 14.5% protein had body weight were heaviest in 8, 12 and 16 weeks of age comparing with 13% and 16 % protein (Table 2).

In interaction of levels of crude protein and digestible energy these are significant effects on body weights of the rabbits (Table 2). The body weight in rabbits fed 14.5 % protein and 2500 kcal/kg diet followed by those fed diet containing 14.5 %protein and 2350 kcal/kg diet were heavier than other levels of protein and digestible energy. This is similar to study of Maertens (1992) who recommended lower energy requirements for weanling rabbits to avoid the digestive disorders. Ayyat *et al.* (1992) showed no significant effects due to feeding different dietary energy levels 2707, 2436 and 2276 kcal DE /kg diet on live body weight of male NZW rabbits. Alla *et al*. (2002) found that, live body weight did not significantly affected when mature bucks and does of Bouscat breed were fed different levels of energy 2800, 2650 DE kcal /kg diet with 18 and 15% CP levels.

With two levels of digestible energy (DE) no there are significant effects on daily weight gain (g/d) during 8-12, 12-16 and 5-16 wk periods while 5-8 wk period was significantly different (Table 3). It is noticed that with three levels of crude protein the rabbits were fed 14.5% protein had higher daily weight gain (g/d) in 5-8 , 12-16 and 5-12 periods comparing with 13% and 16 % protein (Table 3). In interaction levels of digestible energy and crude protein the daily weight gain (g/d) during 5-8, 8-12 , 12-16 and 5-16 periods in rabbits fed 14.5 % protein and 2350 kcal/kg diet was higher than other levels of protein and digestible energy (Table 3). Our results support findings of Xiccato (1999) who reported that the feeding modification either accelerate or delay animal growth. On the contrary our findings Bassuny *et al.* (1997) indicated that New Zealand White rabbits fed 16% CP recorded the highest final body weight and daily weight gain compared to rabbits fed 14% CP. In addition to Rohilla *et al.* (2002) found that when Soviet chinchilla rabbits kits were fed diet containing 12, 14, 16 and 18% CP, the final body weight at 91 days and average daily weight gain were significantly higher in treatment fed diet containing 16% CP than the other treatments. Also, the growing Rex rabbit gained rapidly with increasing dietary protein level when rabbits fed diets containing different protein levels of 14.5, 16 and 17.5% (Gu *et al*., 2004). In context Raimondi *et al*., 1973 indicated that, feeding rabbits on diets containing different dietary energy and protein levels, 1600 or 1800 kcal net energy with 20% or 17% crude protein, resulted a significant increase in weight gain with the low crude protein with the energy was low.

Remarkably the results of this study showed that the interaction between DE and CP levels in the diets had significant effects among treatments. The period from 5 to 16 weeks had the highest body weight and daily weight gain in rabbits fed by using diet containing 14.5 % protein and 2350 or 2500 kcal digestible energy. According to the previous results, body weight and growth performance were increase by using the same treatments (2500 kcal with 14.5% CP and 2500 kcal with 16% CP) in Native Middle-Egypt rabbits (NMER). On contrary that the NZW rabbits fed the crude protein level (16%) achieved significantly better growth performance (final live body weight, daily weight gain, daily feed intake and feed conversion ratio) compared with those of rabbits fed the low crude protein level (14%) under Egyptian condition (Dorra Tork *et al*., 2014). These results could be due to that the NMER is native breed and doesn't need a high level of protein or energy because it is a local breeds that has low or moderate body weight and daily gain and their genetic controlled are lower than the exotic breeds (New Zealand, Californian, Chinchilla, Bouscat etc) as reported by Tag El Din *et al*. (1992), Youssef (1992) and Afifi *et al*. (1993).

Table 2. Effect of digestible energy and crude protein levels and their interaction on body weight of NMER rabbits during growing period

Digestible energy (DE) levels: Kcal/kg diet		**Initial body weight(g)**	**Body Weight(g)** 8wk	12 wk	16 wk
2500		478.4±18.0	782.1^{b} ±23.4	1281.3±31.7	1597.4±37.4
2350		504.7±17.9	859.3^{a} ±23.2	1332.6±31.4	1601.7±37.1
Curd Protein (CP) % levels:		Initial body weight(g)	Body Weight(g) 8 wk	12 wk	16 wk
16		469.8±21.1	790.6^{b} ±27.4	1265.7^{b} ±37.1	1599.3^{ab} ±43.8
14.5		502.3±23.7	877.8^{a} ±30.7	1399.0^{a} ±41.6	1683.4^{a} ±49.2
13		502.7±20.9	793.8^{b} ±27.1	1256.1^{b} ±36.7	1516.0^{b} ±43.4
Interaction DE and CP DE Kcal/kg diet	CP %	Initial body weight(g)	Body Weight(g) 8 wk	12 wk	16 wk
	16	467.6±29.2	735.9^{bc} ±26.2	1233.2^{ab} ±45.9	1600.3^{ab} ±57.2
2500 Kcal/kg diet	14.5	500.5±32.8	837.3^{a} ±29.9	1348.6^{a} ±52.3	1653.9^{a} ±65.1
	13	467.0±30.4	706.4^{c} ±27.3	1204.7^{b} ±47.9	1486.5^{b} ±59.6
	16	471.9±30.5	817.0^{ab} ±27.4	1274.1^{ab} ±48.0	1576.4^{ab} ±59.8
2350 Kcal/kg diet	14.5	504.0±33.7	828.7^{a} ±30.7	1372.5^{a} ±53.8	1643.7^{ab} ±66.9
	13	538.3±27.8	790.9^{a} ±26.5	1230.1^{ab} ±46.4	1475.7^{ab} ±57.8

Table 3. Effect of digestible energy and crude protein levels and their interaction on daily weight gain (g/d) of NMER rabbits during growing period

Digestible energy (DE) levels: Kcal/kg diet		**Daily Weight gain (g/d)** 5-8 wk	8-12 wk	12-16 wk	5-16 wk
2500		13.6^{b} ±0.9	14.6±1.2	15.0±0.9	14.4±0.7
2350		15.7^{a} ±0.9	16.2±1.1	15.2±0.9	15.7±0.7
Curd Protein (CP) % levels:		Daily Weight gain (g/d) 5-8 wk	8-12 wk	12-16 wk	5-16 wk
16		14.4^{ab} ±1.1	14.2±1.4	14.4±1.1	14.3±0.8
14.5		17.1^{a} ±1.2	16.3±1.6	15.6±1.3	16.5±0.9
13		12.5^{b} ±1.0	15.6±1.3	14.5±1.1	14.2±0.8
Interaction DE and CP DE Kcal/kg diet	CP %	Daily Weight gain (g/d) 5-8 wk	8-12 wk	12-16 wk	5-16 wk
	16	13.0^{c} ±1.5	13.1±2.9	15.0^{ab} ±1.6	13.7±2.1
2500	14.5	17.0^{ab} ±1.7	15.0±2.1	14.6^{ab} ±1.7	15.5±3.1
	13	10.8^{c} ±1.6	15.7±2.0	14.5^{ab} ±1.6	13.7±2.5
	16	15.7^{ab} ±1.6	15.3±2.0	15.0^{ab} ±1.6	15.3±2.1
2350	14.5	17.3^{a} ±1.8	17.6±2.3	17.2^{a} ±1.8	17.4±4.1
	13	14.2^{ab} ±1.4	15.6±1.8	14.0^{b} ±1.4	14.6±1.9

Feed consumption and Feed conversion

Daily feed consumption was not significantly influenced by two levels of dietary digestible energy (DE) only (Table 4). Levels of crud protein (CP) had significantly affects on feed consumption during 5-8 and 8-12 periods (Table 4). In interaction levels DE and CP in the NMER, there is significant effect on feed consumption during the period in 5-8 week, only (Table 4). In APRI rabbits, the daily feed consumption was the highest fed on diet containing 2600 kcal DE /kg diet and 16% CP (Nehad Ramadan *et al*., 2012).

No significant differences in interaction levels of dietary digestible energy and crud protein (CP) levels or their interaction were observed in feed conversion ratio (Table 5). Diet contained 14.5 % CP and 2500 or 2350 kcal DE /kg diet lead to improve feed conversion ratio during the period from 5 to 12 weeks compared to the other treatment as shown in Table 5.

The highest feed consumption was observed by feeding rabbits on diet containing 14.5 and 16% CP. Also, feeding rabbits on diets contains 2500 kcal DE /kg diet with 14.5 % CP lead to improve feed conversion ratio compared to the other treatment in present study. The control of appetite is very efficient and any increase or decrease of dietary energy concentration determines an inverse modification in feed ingestion. Appetite regulation in rabbits is mostly controlled by a chmiostatic mechanism; therefore the total quantity of energy ingested daily tends to be constant. Voluntary intake is proportional to metabolic live weight. The chemiostatic regulation occurs only with a digestible energy concentration of the diet higher than 9 to 9.5 MJ/Kg (Cheeke, 1987), below which level a physical-type regulation linked to the filling of the gut by the dietary material takes place. The National Research Council, (1977) recommends that domestic rabbits be fed a diet with CP content (6.25 N) of 13–18% for maintenance and a dietary level of 16% CP is considered adequate for growth and reproduction. (Lisa et al 2006).

Table 4. Effect of digestible energy and crude protein levels and their interaction on daily feed consumption (g/d) of NMER rabbits during growing period

Digestible energy (DE) levels:		**Daily feed consumption (g/d)**			
Kcal/kg diet		**5-8 wk**	**8-12 wk**	**12-16 wk**	**5-16 wk**
2500		46.3±2.6	60.0±4.5	72.5±2.2	59.3±2.9
2350		50.3±2.5	68.8±4.4	75.2±2.2	59.8±2.9
Curd Protein (CP) % levels:		Daily feed consumption (g/d)			
		5-8 wk	8-12 wk	12-16 wk	5-16 wk
16		48.8^{ab} ±3.0	61.1^{b} ±5.3	72.4±2.6	60.9±3.4
14.5		54.9^{a} ±3.5	66.1^{a} ±6.0	77.6±2.9	62.4±3.9
13		41.3^{b} ±2.9	65.9^{a} ±5.1	71.5±2.5	55.3±3.3
Interaction DE and CP		Daily feed consumption (g/d)			
DE Kcal/kg diet	CP %	5-8 wk	8-12 wk	12-16 wk	5-16 wk
	16	44.8^{bc}±4.2	57.4±7.4	73.8±3.6	60.3±4.8
2500	14.5	53.9^{ab}±4.8	57.5±8.3	72.2±4.0	61.8±5.4
	13	40.3^{c}±4.4	65.1±7.7	71.5±3.7	55.6±5.0
	16	52.7^{ab}±4.4	64.9±7.6	71.1±3.7	61.5±5.0
2350	14.5	55.9^{a}±5.0	74.7±8.7	83.0±4.1	62.9±5.7
	13	42.3^{bc}±4.0	66.7±6.9	71.5±3.4	55.0±4.5

Table 5. Effect of digestible energy and crude protein levels and their interaction on Feed conversion ratio of NMER rabbits during growing period

Digestible energy (DE)		**Feed conversion ratio**			
levels: Kcal/kg diet		**5-8 wk**	**8-12 wk**	**12-16 wk**	**5-16 wk**
2500		4.1±0.2	3.5±0.2	4.8±0.13	4.1±0.2
2350		3.9±0.2	3.9±0.2	4.9±0.13	3.8±0.2
Curd Protein (CP) %		Feed conversion ratio			
levels:		5-8 wk	8-12 wk	12-16 wk	5-16 wk
16		4.1±0.3	3.7±0.3	4.7±0.15	4.3±0.2
14.5		3.7±0.3	3.4±0.3	4.8±0.17	3.8±0.2
13		4.2±0.3	3.9±0.2	4.9±0.15	3.9±0.2
Interaction DE and CP		Feed conversion ratio			
DE Kcal/kg diet	CP %	5-8 wk	8-12 wk	12-16 wk	5-16 wk
	16	4.4±0.4	3.5±0.4	4.8±0.21	4.4±0.3
2500	14.5	3.2±0.5	3.0±0.4	4.8±0.24	4.0±0.3
	13	4.6±0.4	3.9±0.4	4.9±0.22	4.1±0.3
	16	3.8±0.4	4.0±0.4	4.7±0.22	4.0±0.3
2350	14.5	4.2±0.5	3.8±0.4	4.8±0.24	3.8±0.3
	13	3.8±0.4	3.9±0.3	5.1±0.20	4.1±0.3

Carcass traits

No significant differences between digestible energy levels were observed in total edible parts (TEP), fore-quarter, hind-quarter and trunk while the weight of edible giblets (WEG) was significant different (Table 6). All carcass traits were not affected by different levels of protein in diets (Table 6). The interaction between DE and CP levels in the NMER, the trunk was significantly increase by increasing level of digestible energy. In contrast WEG was significantly increase by decreasing level of digestible energy and decreasing dietary CP levels (Table 6). The trunk part has abdominal fat. Our results are close those of Nehad Ramadan *et al.*, 2012 who reported that the highest abdominal fat % was recorded with increasing level of digestible energy (2700 kcal DE/kg); the proportional increment was 47.8% comparable to those fed diet containing 2500 kcal DE/kg diet. On the country, Obinn and Mmereole (2010) reported that when the cross between New Zealand White and Californian breeds fed on diets containing 14, 16 and 18% CP with 6.7, 8.7 and 10.8 MJ kg (DE), there were no significant effects on carcass yield, weight of heart and abdominal fat.

Table 6. Effect of digestible energy and crude protein levels and their interaction on carcass traits of NMER rabbits in 16 weeks of age

Digestible energy (DE) levels:				**Carcass Traits**		
Kcal/kg diet		**TEP**	**Fore-quarter**	**Hind-quarter**	**Trunk**	**WEG**
2500		52.8±0.05	14.5±0.05	20.1±0.01	7.8±0.01	1.9±0.01^{b}
2350		54.9±0.05	15.5±0.04	18.5±0.01	6.8±0.01	5.1±0.01^{a}
Curd Protein (CP) % levels:				Carcass Traits		
		TEP	Fore-quarter	Hind-quarter	Trunk	WEG
16		51.7±0.07	14.6±0.06	18.9±0.01	6.4±0.02	3.1±0.01
14.5		56.6±0.08	16.9±0.07	19.5±0.01	7.3±0.02	3.6±0.01
13		53.3±0.09	13.4±0.08	19.5±0.01	8.2±0.02	3.3±0.01
Interaction DE and CP				Carcass Traits		
DE Kcal/kg diet	CP %	TEP	Fore-quarter	Hind-quarter	Trunk	WEG
	16	50.0±0.13	13.7±0.11	19.6±0.02	6.6±0.03^{ab}	1.7±0.01^{cb}
2500	14.5	53.8±0.18	15.0±0.15	20.2±0.02	7.2±0.04^{ab}	2.6±0.02^{b}
	13	54.7±0.18	14.6±0.15	20.3±0.01	9.7±0.04^{a}	1.4±0.02^{c}
	16	53.7±0.13	15.7±0.11	18.1±0.01	6.1±0.03^{b}	4.9±0.010^{a}
2350	14.5	59.2±0.13	18.8±0.11	18.8±0.01	7.5±0.03^{ab}	4.6±0.01^{a}
	13	52.1±0.18	12.2±0.15	20.1±0.02	6.8±0.04^{ab}	5.8±0.02^{a}

The increase of energy concentration and the reduction of DP/DE provoke a clear modification of tissue development, with a decrease in muscle growth and acceleration in fat deposition (Wilson, 1981; Lawrie and Ledward, 2006). On the country, an increase in protein concentration promotes muscle growth and slows down fattening. In rabbits Xiccato (1999) reported that the different levels of protein and energy may cause the modification of relative tissue growth and consequent carcass and meat quality.

Economic efficiency

From the economical point of view, the highest economic efficiency for a head was recorded with rabbits fed diet containing 14.5% CP and 2350 kcal DE /kg diet with followed by that fed 13 % CP and 2350 kcal. This increment may be due to the improvement of weight gain or due to decreasing the price of the kilogram diet, while the worst value was observed for those fed 13% CP and 2500 kcal DE/ kg diet (Table 7). Also, the mortality % was zero in rabbits group fed on fed 2500 kcal with 14.5 % CP (Table 7). The highest value of mortality %was observed for those groups were fed 16% CP with 2500 kcal DE/ kg and 13% CP with 2350 kcal DE/ kg. This may support findings of Fraga *et al* 1983 who reported that any major deviation from the correct protein to energy ration may cause digestive disorders and increase mortality. At the same time exceeding 15% in waning diets and 25% in fattening diets can induce a negative modification of gut micro flora and provoke diarrhea and even death (Xiccato , 1999).

Table 7. Input-output analysis and economic efficiency of different treatments.

Energy Level (Kcal/ kg diet)	Protein Level (%)	Total Feed Intake (kg/head)	Price/kg Diet (L.E.)	Total Feed Cost (L.E.)	Average Weight Gain (kg/head)	Selling Price (L.E.) (1)	Net Revenue (L.E.) (2)	% Economic Efficiency(3)	Mortality %
2500 DE Kcal/Kg	16	4.14	3.94	16.32	1.02	25.49	9.17	36.0	23.1 (3/13)
	14.5	4.60	3.82	17.54	1.15	28.83	11.28	39.1	0.0 (0/13)
	13	4.99	3.64	18.14	1.13	28.32	10.18	35.9	15.4 (2/13)
2350 DE Kcal/Kg	16	3.53	3.76	13.27	0.94	23.44	10.16	43.4	7.7 (1/13)
	14.5	4.12	3.63	14.95	1.14	28.49	13.54	47.5	7.7 (1/13)
	13	4.44	3.45	15.32	1.10	27.61	12.29	44.5	23.1 (3/13)

Other conditions like management are fixed.

- Ingredients prices (L.E. per ton) at 2016 were: 3400 barley; 4050 yellow corn; 2950 berseem hay(12%) ; 3000 wheat bran ; 7850 soybean meal (44%) ; 250 limestone ; 25000 premix ; 550000 DL-methionine ; 21000 DL-lysine; 10500 dicalcuim phosphate ; 500 Bean Straw; 500 salt; 1800 cane molasses. - Adding 100 L.E. /ton for pelliting. (1) Price of kg live body weight was 25 L.E.

(2) Net revenue for a head = Selling price – total feed cost. (3) % Economic efficiency for a head = Net revenue/ total feed cost*100

In conclusion, although native rabbits have a relatively high energy requirement (2500 Kcal/kg diet as digestible energy), they seem to have a lower a moderately low level of protein (14.5 as % protein level) comparing with recommends of NRC, 1977 (16%) for European rabbits (*Oryctolagus cuniculus*). The higher energy requirement relative in native rabbit may be attributed to their behavior and habitat demand that they acquire additional energy from their food. Additional activity increases the energy expenditure of cottontails by 30–60% (Rose, 1973). In addition to the bodies native rabbits are smaller and their fermentation capacity (i.e., size of ceca) is low that due to they have a faster throughput of ingesta and less efficient digestion of plant fiber (Kuijper *et al*., 2004). We could recommend with the diet containing 2500 Kcal/kg diet digestible energy and 14.5 % CP for Native Middle-Egypt rabbits (NMER) during the growing period; from 5 to 16 weeks of age. The economical point of view and the results of body weight and growth performance conformed that. Future studies examining behavioral and physiological responses to these digestible energy and protein% levels will enhance our understanding of the requirements of native rabbit.

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صفات النمو والذبيحه في أرانب مصر الوسطى غذيت مستويات مختلفة من الطاقة القابلة للهضم و البروتين الخام في العلف

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لم تنشر أية دراسات تتعلق بالاحتياجات الغذائية للأرانب المحلى في منطقة مصر الوسطى. الهدف الرئيسي من الدراسة الحالية هو تحديد الاحتياجات الغذائية في الطاقة القابلة للهضم ولبروتين الخام للأرانب المحلى في مصر الوسطى (نمر) لمعرفة أداء النمو الأمثل والكفاءة الاقتصادية. تم تقسيم مجموع ٧٨ من الأرانب في مصر الوسطى في ٥ أسابيع من العمر (عند الفطام) عشوائيا إلى ٦ مجموعات هي ثلاثة مستويات مختلفة من البروتين الخام؛ ١٣، ١٤.٥ و ١٦٪ ومستويين من الطاقة القابلة للهضم. ٢٥٠٠ و ٢٣٥٠ سعر حراري / كجم علف في تجربة مصممة كعوامل ٢X٣ لمدة ١١ أسبوعا. وكانت الأرانب تسكن في أقفاص فردية وتظل تحت نفس الظروف البيئية. التغذية والماء عرضت حرة طوال الفترة التجريبية (٥-١٦ أسابيع من العمر). تم تسجيل وزن الجسم الحي و كمية العلف وعدد الأرانب الميتة. تم حساب الزيادة اليومية في الوزن ونسبة التحويل الغذائي. وفي عمر ١٦ أسبوعا أخذت أربع ذكور من الأرانب عشوائيا من كل معاملة و ذبحت لتقدير بعض صفات الذبيحة. تم حساب أجزاء الذبيحة كنسبة مئوية من وزن الجسم الحي. تم تحليل البيانات إحصائيا باستخدام برنامج النموذج الخطي العام باستخدام الـ SAS. كانت الفروق بين وزن الجسم عند عمر ٥ أسابيع في المجموعات ليست معنوية. مستويي الطاقة القابلة للهضم اثنين من لم تؤثر معنويا على جميع الأوزان الجسم فيما عدا ٨ أسبوع من العمر. الأرانب التى غذيت على ١٤.٥ ٪ بروتين كانت اوزان الجسم أثقل عند ٨ و ١٢ و ١٦ أسبوعا من العمر. وكان استهلاك العلف اليومي في الأرانب التى غذيت على ١٤.٥٪ بروتين كانت أعلى في فترات ٥-٨ و ٨-١٢ اسبوع. ولم يتأثر التحويل الغذائي معنويا" بمستويات البروتين الخام. في تفاعل الطاقة القابلة للهضم ومستويات البروتين الخام الأرانب التى غذيت بعلف يحتوي على ١٤.٥٪ بروتين مع ٢٥٠٠ سعر حراري طاقة قابلة للهضم / كجم علف كان وزن الجسم أثقل معنويا في اعمار ٨ و ١٢ و ١٦ أسبوع. الأرانب التى غذيت بعلف ١٤.٥ بروتين٪ و ٢٥٠٠ سعر حراري لكل كجم علف كانت أعلى في زيادة الوزن اليومي من غيرها من المجموعات خلال فترات ٥-٨، ٨-١٢ و ٥-١٦ اسبوع. فقط خلال فترة ٥-٨ اسبوع تأثر استهلاك الأعلاف معنويا بتغير الطاقة القابلة للهضم ومستويات البروتين الخام. العلف الذي يحتوي على ٢٥٠٠ كيلو كالوري / كجم علف كطاقة قابلة للهضم مع ١٤.٥٪ بروتين يؤدي إلى تحسين نسبة التحويل الغذائي خلال الفترة من ٥ إلى ١٢ أسبوعا مقارنة بالمجموعات الآخرى ولكن لم يكن معنويا . لم يلاحظ وجود فروق معنوية بين مستويات الطاقة القابلة للهضم في مجموع الأجزاء الصالحة للأكل في الذبيحة و الربع الامامي و الخلفي والجذع في حين أن وزن الاحشاء الصالحة للأكل كانت مختلفه معنويا . من الناحية الاقتصادية سجلت أعلى كفاءة اقتصادية في الأرانب التي غذت علف يحتوي على ١٤.٥٪ بروتين خام و ٢٣٥٠ سعرة حرارية طاقة قابلة للهضم / كجم علف و تليها علف المحتوي على ١٤.٥٪ بروتين و ٢٥٠٠ كيلو كالوري. وكانت نسبة الوفيات صفر في مجموعة الأرانب التي تغذت على ٢٥٠٠ سعر حراري و ١٤.٥٪ بروتين. وقد لوحظت ان أعلى قيمة للوفيات كانت في المجموعه التى غذيت على ١٦٪ بروتين و ٢٥٠٠ سعر حراريطاقة قابلة للهضم / كجم و ١٣٪ بروتين و ٢٣٥٠ سعر حراري . يمكن أن نوصي باتباع نظام غذائي يحتوي على ٢٥٠٠ سعر حراري مع ١٤.٥٪ بروتين للأرانب المحلية بمصر الوسطى (نمر) خلال فترة النمو من ٥ إلى ١٦ أسبوعا من العمر و الذي كان الأفضل من وجهة النظر الاقتصادية و وزن الجسم والنمو في الأرانب نمر .