

EFFECT OF VITAMIN A LEVEL ON THE PERFORMANCE OF GROWING RABBITS

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ABSTRACT: A total number of 192 Hybrid (New Zealand White x California) rabbits, half of females, half of males, 42 days of age were assigned randomly into eight experimental groups (four main groups each divided into two subgroups, females and males) in a factorial design 4 x 2 , each main group contains 48 animals (24 males and 24 females). The first group was kept untreated as control, while the other 3 groups were received vitamin A acetate in drinking water by 1000, 2000 and 3000 IU per head /day, respectively.

The results showed that vitamin A treatments caused an increase in body weight. The increase was significant ($P < 0.05$) only during the period from 5th to 8th week of the experimental period. Rabbits received 2000 IU vitamin A was accompanied by the heavier body weight, significant increase ($P < 0.05$) in body weight, feed intake and highly significant ($P < 0.01$) decrease in feed conversion. However, there were no significant effect of sex or vitamin A x sex interaction on the previous traits. Carcass traits also were not affected by either vitamin A or the interaction due to vitamin A and sex.

Key words: Rabbits, Growing, Performance, Vitamin A and Sex.

INTRODUCTION

Rabbits are bred almost all over the world for many different purposes. However, the main use of rabbits as an agricultural species is meat

production. As a result of its peculiar digestive physiology, which permits it to use farm and industrial by-products, and its small size, short reproductive cycle and meat quality, the rabbit is very

suitable for both small-scale farms and intensive production (Maertens, 1992)

Although, all vitamins are equally important in supporting life, vitamin A may be considered the most important vitamin as a dietary supplement for all animals (McDowell, 1989). It is required for vision, growth, reproduction, cellular differentiation and proliferation, and the immunity system (Sporn, *et al.*, 1984)

The present work aimed to study the effect of vitamin A supplementation to drinking water on body weight, body weight gain, feed intake, feed conversion and some carcass traits of growing rabbits under the Egyptian conditions.

MATERIALS AND METHODS

The experimental work of the present study was carried out in the Rabbit Farm of San EL-Haggar Agricultural Company, San EL-Haggar Aria, Sharkia Governorate, Egypt, during the period from 2nd of April, till 28th of May, 2003.

A total number of 192 Hybrid growing (New Zealand White x California) rabbits half of females, half of males, 42 days of age were randomly divided into eight

experimental groups (four main groups each divided into two subgroups, females and males) in a factorial design 4 x 2, each main group contains 48 animals (24 males and 24 females).

They were allocated in experimental wire cages (4 rabbits / cage). All rabbit groups received vitamin A acetate by 0, 1000, 2000 and 3000 IU/head /day in drinking water. Treatments were added daily in drinking water at 10:00 AM

Rabbits were fed on a basal diet of 18.58% crude protein, 2635Kcal/ Kg diet and 12.25% crude fiber is shown in Table 1.

Feed and water were offered *ad libitum* during the whole experimental period. Individual animal weight and feed consumption were recorded at different intervals (8, 10, 12 and 14 weeks of age), feed conversion was calculated as g feed / g gain. At the end of the experimental period, eight rabbits (4 males and 4 females) from each group were randomly taken, fasten for 12 hours, then slaughtered to estimate the dressing weight percentage as well as other carcass traits relatively to the live body weight.

Statistical analysis was carried out according to Sendecor and Cochran (1967).

The statistical model which used in the analysis was

$$Y_{ijk} = M + V_i + S_j + VS_{ij} + E_{ijk}$$

Where:

Y_{ijk} = An observation.

M = the common mean.

V_i = the fixed effect of vitamin A level (i: 1, 2, 3 and 4).

S_j = the fixed effect of sex (j: 1 and 2).

VS_{ij} = the interaction effect of vitamin A level with sex (ij: 1, 2,, 8).

E_{ijk} = the random error assumed to independently randomly distributed.

Duncan's new multiple range test (Duncan, 1955) was used for comparison among significant means.

RESULTS AND DISCUSSION

Live Body Weight

Effect of vitamin A:

Average live body weight of rabbits received vitamin A by 2000 IU/head/day was highly significant ($P < 0.01$) increased from the 5th to 8th week of the experimental period for the two sexes as compared with other treatment groups (Table 2). These results may be due to that vitamin

A play an important role on basal metabolism via the thyroid hormone and its effect on the metabolism of lipids and other fat-soluble compounds, whereas vitamin A affects on the metabolism of cholesterol, co-enzyme A, vitamin E, vitamin D and gonadal hormones. Similar results were obtained by Kavamoto *et al.*, (1977) since, they found that growing rabbits fed basal ration plus vitamin A supplement grew significantly ($P < 0.05$) faster. On the otherhand, Ismail *et al.*, (1992) reported that growing rabbits received daily oral allowance (per head) of vitamin A 12000 IU resulted in significant differences in body weight ($P < 0.05$). While, Cheeke (1967) reported that does fed high dietary level of vitamin A resulted in low birth weights.

Effect of sex :

Male rabbits showed slightly increase in body weight as compared with females, however, the differences in body weight between the two sexes were insignificant during the different intervals of the experimental period.

Rabbits received vitamin A by 2000 IU/head/day showed higher body weight in comparison with the other groups of vitamin A levels either males or females.

Effect of vitamin A and sex interaction:

The higher average body weight was recorded with males and females received vitamin A acetate by 2000 IU/head/day from the 5th to 8th week of the experimental period in comparison with the other treatments but the increment was insignificant.

Body Weight Gain:**Effect of vitamin A:**

Average body weight gain of rabbits received vitamin A acetate by 2000 IU/head increased from the 1st to 6th week of experimental period but the increase become significant ($P < 0.05$) during the 5th to 6th week of experimental period for the two sexes as compared with other treatment groups, however, during the period from 7th to 8th week a significant ($P < 0.05$) increase was recorded by the control group (Table 3). El-Husseiny *et al.*, (1997) observed that injection of growing rabbits with 2400 or 4800 IU vitamin A resulted in a decrease in average body weight gain. However, Daader *et al.*, (1999) showed that rabbits fed diet supplemented daily with vitamin A (750 IU per head), daily weight gain was not affected by vitamin A supplementation.

Effect of sex:

Male rabbits showed observable increase in body weight gain as compared with females from the 3rd to 6th week of experimental period, however, the increase in body weight gain between the two sexes were insignificant.

Female rabbits showed slightly increase in body weight gain as compared with males during the last two weeks but the increase was insignificant.

Effect of vitamin A and sex interaction:

Both male and female rabbits did not show any definite trend in average body weight gain.

Feed Intake:**Effect of vitamin A :**

Rabbits received vitamin A acetate by 2000 or 3000 IU/head/day showed significant ($P < 0.05\%$) increase in the average feed intake in the first two weeks of the experimental period. However, during the 3rd and 4th weeks a significant ($P < 0.05$) increase in average feed intake recorded by rabbits received vitamin A by 1000 IU/head. In the last four weeks rabbits received vitamin A by 2000 IU/head

showed slight but insignificant increase in average feed intake (Table 4). Grobner *et al.*, (1985) reported that treating rabbits with 11440 or 19180 IU vitamin A resulted in insignificant differences in mean feed intake or gain. Jarrett *et al.*, (1988), showed that growing rabbits given toxic deits (58000 IU) or defficient (0 IU) of vitamin A had decreased growth and feed intake. El-Husseiny *et al.*, (1997) reported that injection of growing rabbits with 1200, 2400 or 4800 IU vitamin A decreased the weekly feed intake average.

Effect of sex :

Male rabbits showed slightly increase in average feed intake as compared with females, however, the differeces in average feed intake between the two sexes were insignificant during the different intervals of the experimental period.

Effect of vitamin A and sex interaction :

Both male and female rabbits did not show any definite trend in feed intake average.

Feed Conversion :

Effect of vitamin A :

Average of feed conversion of rabbits received vitamin A acetate by 0 or 2000 IU/head was

highly significant ($P < 0.01$) decreased in the 3rd and 4th weeks of the experimental period as compared with the other experimental groups. However, there were significant ($P < 0.05$) decrease in feed conversion average of the control group during the last two weeks of experimental period (Table 5). El-Husseiny *et al.*, (1997) reported that the best feed conversion efficiency values were obtained by rabbits received either 1200 or 2400 IU vitamin A while Daader *et al.*, (1999) showed that feed conversion efficiency estimates were not affected by vitamin A supplementation.

Effect of sex :

Male rabbits showed slightly decrease in average feed conversion from the first week of the experimental period but the decrease become significant ($P < 0.05$) during the 3rd and 4th weeks of experimental period. However, there were no differences between males and females in the last four weeks of the experimental period.

Effect of vitamin A and sex interaction :

Male rabbits received vitamin A acetate by 2000 IU/head showed

significant ($P < 0.05$) decrease in average of feed conversion during the 3rd and 4th weeks of experimental period as compared with the other treatments.

Carcass traits :

Carcass and liver percentages were insignificantly ($P \leq 0.05$) affected by vitamin A, sex and their interactions as shown in Table 6.

Effect of vitamin A:

Carcass weight percentage was higher for rabbits received vitamin A acetate by 1000 IU/head/day than other groups. However, the higher liver weight percentage was recorded for rabbits received vitamin A acetate by 2000 IU/head.

Effect of sex:

Carcass and liver weight percentages were slightly increased for males as compared with females.

Effect of vitamin A and Sex:

Results in Table (6) showed that the highest carcass percentage was recorded for males of growing rabbits received vitamin A acetate by 1000 IU/head, while, the highest liver weight percentage was recorded for males received vitamin A acetate by 2000 IU/head/day. The present findings

were closely agree with those obtained by Abdel-Hafeez *et al.* (1975) who found that carcass traits were not largely affected by supplementary vitamin A.

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Table 1: Composition and chemical analysis of pelleted basal ration.

Ingrediens		%
Wheat bran		36.75
Soybean meal 44%		14.60
Hay clover		28.00
Corn yellow		18.10
Molasses		1.00
Limestone		0.90
Salt		0.30
Dicalcium phosphate		0.20
Minerals mixture*		0.10
Methionine		0.05
Total		100.00
Chemical analysis**		
Energy	Kcal/DE/kg	2635
Crude protein	%	18.58
Crude fiber	%	12.25
Calcium	%	0.90
Total phosphorus	%	0.69
Lysine	%	0.90
Meth. + Cystine	%	0.59

* Minerals mixture per Kg contains: 22.3 mg Zn; 10 mg Mn; 25 mg Fe; 1.67 mg Cu; 0.25 mg I; 0.033 mg Se and 133.4 mg Mg.

** Calculated according to NRC (1977)

Table 2: Effect of vitamin A supplementation level, sex and their interaction on body weight ($\bar{x} \pm SE$)g of growing rabbits.

Items	Age in weeks				
	Initial body weight	2	4	6	8
Vitamin A level				**	**
0	701.04±15.07	964.62±24.68	1317.37±33.64	1667.03±43.80 ^c	2005.95±34.92 ^b
1000 IU	726.40±17.98	1012.25±22.06	1359.74±26.55	1741.32±34.29 ^b	1999.47±36.93 ^{bc}
2000 IU	695.83±15.02	994.47±22.66	1368.75±33.19	1798.25±37.09 ^a	2085.25±34.00 ^a
3000 IU	689.58±15.17	981.28±17.54	1286.67±23.38	1648.86±28.23 ^c	1915.45±26.73 ^c
Sex :					
Female	711.98±11.93	998.35±15.81	1334.07±20.49	1708.82±22.89	1997.65±22.41
Male	694.27±10.44	977.10±14.70	1328.67±21.19	1717.30±27.10	2001.22±29.73
Interaction:					
0 x female	708.33±20.33	976.32±35.73	1292.22±51.48	1629.41±53.79	1985.29±54.70
0 x male	693.75±22.58	953.50±34.48	1340.00±44.66	1699.00±51.97	2023.50±45.87
1000 IU x female	737.50±28.59	1030.00±32.14	1361.74±33.35	1754.35±36.92	1986.52±46.84
1000 IU x male	714.58±22.15	985.63±26.52	1356.67±44.95	1721.33±67.38	2019.33±61.63
2000 IU x female	706.25±24.50	1001.67±32.92	1370.45±46.02	1781.82±49.84	2069.55±44.59
2000 IU x male	685.42±17.67	986.96±31.78	1366.76±49.18	1818.33±56.73	2104.44±53.40
3000 IU x female	695.83±21.89	980.83±26.94	1304.35±34.99	1652.17±39.32	1949.13±33.58
3000 IU x male	683.33±21.42	981.74±22.90	1298.18±31.13	1645.24±41.53	1878.57±41.59

** = highly significant ($P < 0.01$).

a-c means within the same column with different superscripts are significantly different ($P < 0.01$).

Table 3: Effect of vitamin A supplementation level, sex and their interaction on body weight gain ($\bar{x} \pm$ SE)g of growing rabbits.

Items	Periods in weeks			
	1- 2	3 - 4	5 - 6	7 - 8
Vitamin A levels			*	*
0	278.61±22.85	374.31±25.10	347.64±19.79 ^c	340.97±27.57 ^a
1000 IU	276.04±17.52	344.58±23.89	386.81±24.27 ^b	263.00±19.37 ^c
2000 IU	322.36±17.31	365.07±16.67	430.83±16.88 ^a	281.33±09.85 ^b
3000 IU	285.10±24.03	309.18±17.49	359.38±19.89 ^{bc}	267.71±16.44 ^{bc}
Sex :				
female	292.53±14.54	335.66±10.75	366.15±11.68	296.94±17.57
male	288.51±15.10	360.90±18.80	396.18±18.00	279.80±11.33
Interaction :				
0 x female	282.64±37.58	344.00±32.36	326.53±20.55	371.53±52.83
0 x male	274.58±29.65	404.58±36.86	368.75±33.52	310.42±27.57
1000 IU x femae	309.17±26.18	309.17±14.30	391.53±22.72	231.53±21.35
1000 IU x male	242.92±14.80	380.00±42.49	382.08±45.36	295.42±28.07
2000 IU x female	291.25±12.86	352.36±15.29	400.70±22.14	288.06±08.44
2000 IU x male	353.47±27.67	377.78±30.40	460.97±19.99	274.61±18.39
3000 IU x female	287.10±39.29	337.10±20.08	345.83±20.83	296.67±19.39
3000 IU x male	383.10±31.56	281.25±25.13	372.92±35.12	238.75±21.85

* = significant (P<0.05).

a-c means within the same column with different superscripts are significantly different (P<0.05).

Table 4: Effect of vitamin A supplementation level, sex and their interaction on feed intake ($\bar{x}\pm SE$)g of growing rabbits.

Items	Periods in weeks			
	1-2	3-4	5-6	7-8
Vitamin A levels	*	*		
0	768.17±19.25 ^c	1041.58±78.70 ^b	1213.58±42.90	1108.67±47.03
1000 IU	803.17±21.28 ^b	1159.92±66.45 ^a	1224.50±41.22	1200.00±39.15
2000 IU	824.08±11.65 ^a	925.00±36.57 ^c	1254.67±28.94	1215.17±37.28
3000 IU	840.92±11.65 ^a	1037.92±31.68 ^b	1201.33±33.31	1119.25±33.59
Sex :				
Female	802.46±15.08	1026.47±22.28	1224.50±23.57	1125.38±26.80
Male	816.00±11.25	1055.75±56.41	1222.45±28.11	1196.17±29.41
Interaction :				
0 x female	739.33±26.43	1002.17±066.69	1193.17±80.46	1146.17±59.57
0 x male	798.17±24.22	1081.00±148.93	1234.00±38.16	1071.17±53.26
1000 IU x femae	803.83±33.38	1056.50±031.79	1226.33±25.59	1119.33±36.58
1000 IU x male	802.50±29.65	1263.33±118.92	1222.67±82.58	1280.67±52.74
2000 IU x female	810.33±13.79	0959.00±031.97	1267.50±28.09	1159.67±43.79
2000 IU x male	837.83±18.21	0891.00±066.33	1241.83±53.20	1270.67±54.46
3000 IU x female	856.33±28.10	1088.17±026.15	1211.00±41.23	1067.33±52.88
3000 IU x male	825.50±17.80	0987.67±052.17	1191.67±56.07	1162.17±37.48

* = significant (P<0.05).

a-c means within the same column with different superscripts are significantly different (P<0.05).

Table 5: Effect of vitamin A supplementation level, sex and their interaction on feed conversion ($\bar{x}\pm SE$)g of growing rabbits.

Items	Periods in weeks			
	1-2	3-4	5-6	7-8
Vitamin A levels		**		*
0	3.05±0.54	2.84±0.16 ^a	3.60±0.22	3.39±0.22 ^a
1000 IU	3.02±0.18	3.54±0.34 ^b	3.64±0.31	4.81±0.35 ^c
2000 IU	2.63±0.13	2.57±0.12 ^a	2.88±0.16	4.43±0.33 ^{bc}
3000 IU	3.31±0.41	3.47±0.19 ^b	3.43±0.17	4.44±0.43 ^{bc}
Sex :		*		
female	2.98±0.23	3.18±0.12	3.42±0.13	4.21±0.28
male	3.02±0.17	3.08±0.21	3.35±0.20	4.48±0.28
Interaction :		*		
0 x female	2.97±0.54	2.99±0.20 ^c	3.75±0.38	3.31±0.40
0 x male	3.13±0.42	2.69±0.26 ^{abc}	3.45±0.24	3.48±0.22
1000 IU x female	2.66±0.14	3.44±0.14 ^{def}	3.17±0.14	5.09±0.28
1000 IU x male	3.38±0.27	3.64±0.69 ^f	4.10±0.56	4.52±0.42
2000 IU x female	2.81±0.12	2.75±0.15 ^{bc}	3.22±0.21	4.06±0.28
2000 IU x male	2.45±0.20	2.39±0.16 ^a	2.55±0.14	4.79±0.58
3000 IU x female	3.49±0.77	3.53±0.33 ^{def}	3.55±0.20	3.70±0.28
3000 IU x male	3.13±0.39	3.58±0.19 ^{ef}	3.31±0.28	5.18±0.71

* = Significant ($P < 0.05$) and ** = Highly significant ($P < 0.01$).

a-c means within the same column with different superscripts are significantly different ($P < 0.01$).

Table 6: Effect of vitamin A level supplementation, sex and their interaction on some carcass traits ($x \pm SE$) of growing rabbits.

Items	Traits		
	Live body weight	Carcass weight (%)	Liver weight (%)
Vitamin A levels:			
0	2033.75± 56.65	58.04±0.59	3.24±0.16
1000 IU	2017.50±71.43	59.53±1.67	3.39±0.21
2000 IU	2111.88±29.20	58.12±0.70	3.58±0.18
3000 IU	1962.50±30.40	57.37±0.76	3.52±0.19
Sex:			
female	2039.69±21.83	58.08±0.43	3.37±0.13
male	2023.13±47.43	58.45±0.93	3.49±0.13
Interaction:			
0 x female	2030.00±65.54	57.70±0.68	3.46±0.25
0 x male	2037.50±73.05	58.38±1.05	3.02±0.14
1000 IU x femae	2045.00±41.13	59.42±0.37	3.42±0.43
1000 IU x male	1990.00±147.03	59.65±3.59	3.35±0.12
2000 IU x female	2096.25±36.36	57.62±1.25	3.35±0.27
2000 IU x male	2127.50±49.94	58.63±0.75	3.82±0.21
3000 IU x female	1987.50±14.36	57.60±.091	3.27±0.08
3000 IU x male	1937.50±60.74	57.14±1.34	3.77±0.35

تأثير مستوى فيتامين A على أداء الأرناب النامية

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أجريت هذه الدراسة على ١٩٢ أرناب تسمين خليط (نيوزيلندي x كاليفورنيا) نصفهم إناث والنصف الآخر ذكور عمر ٤٢ يوماً وقسمت عشوائياً إلى ٨ مجاميع تجريبية في تصميم احصائي ٤ × ٢ (أربع مجاميع رئيسيه كل واحده تحتوى على مجموعتين فرعيتين واحده ذكور والأخرى إناث) بكل مجموعة رئيسيه ٤٨ أرناب (٢٤ ذكر ، ٢٤ أنثى) المجموعة الأولى بقيت بدون معاملة للمقارنة والمجاميع الثلاثة الأخرى أعطيت فيتامين A في مياه الشرب بمستوى ١٠٠٠ ، ٢٠٠٠ و ٣٠٠٠ وحدة دولية لكل حيوان على التوالي.

وتشير النتائج إلى أن المعاملة بالفيتامين أدت إلى حدوث زيادة في الوزن الحى وأن هذه الزيادة كانت معنوية ($P < 0.05$) خلال الفترة من الأسبوع الخامس وحتى الأسبوع الثامن من التجربة.

وجد أن الأرناب التى عوملت بـ ٢٠٠٠ وحدة دولية من فيتامين A كان وزن الجسم فيها أعلى من المجاميع الأخرى. كما أنها سجلت زيادة معنوية ($P < 0.05$) فى كل من الوزن الحى ومتوسط استهلاك الغذاء وسجلت إنخفاضاً معنوياً جداً ($P < 0.01$) فى معامل التحويل الغذائى بينما لم يكن هناك تأثيراً معنوياً ($P < 0.05$) للجنس والتداخل بين الفيتامين والجنس على الصفات السابقة.

كذلك لم تتأثر صفات الذبيحة بأى من فيتامين A أو الجنس أو التداخل بين الفيتامين والجنس.