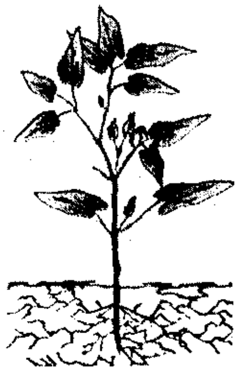

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EFFECT OF COBALAMIN ON GROWTH PERFORMANCE, CARCASS TRAITS AND SOME RELATED PHYSIOLOGICAL PARAMETERS IN GROWING RABBITS

[4]

Tharwat[1], E.E. and Sh.A. EL-Medany[2]

1- Department of Animal Production, Faculty of Agriculture, Ain Shams University, Shoubra EL-Khaima, Cairo, Egypt

2- Regional Center for Food and Feed, Agricultural Research Center, Giza, Egypt

Keywords: Cobalamin, Weaned male rabbits, Body weight, Blood, Plasma metabolites, Rabbit meat and Dressing percentage

ABSTRACT

The experiment was carried out in Intensive Rabbit Production Unit; belonging to the Agriculture Studies and Consultations Center; Faculty of Agriculture, Ain Shams University; on 60 weaned male New Zealand White (NZW) rabbits, four weeks of age, in order to determine the effect of Cobalamin (vitamin B_{12}) on growth performance, carcass characteristics and some related physiological parameters. Rabbits were randomly distributed into two comparable groups of 30 kids. The animals housed in cages provided with continues feeder and automatic waterers facilities during the experimental period, which lasted for 8 weeks. The basal diet (commercial pellets) was fed to the control animals (group I) without Cobalamin supplementation, while the treated animals (group II) was orally supplemented daily with 2 μg Cobalamin / kg body weight. Growth was assessed by measuring body weight gain (BWG). At 12 weeks of age ten animals from each group were slaughtered for carcass evaluation. Results showed that kids in group (II) were significantly ($P < 0.005$) heavier in body weight than those not received Cobalamin. Average daily gains during the study were 21.14 ± 1.16 and 25.40 ± 1.16 gm for groups I and II, respectively. Supplementation with Cobalamin improved ($P<0.05$) the dressing percentage by 3.58%; middle part by 10.09 % as compared with the control group. However, the hind part increased insignificantly by 4.94 %. The percentage of bone less meat increased ($P<0.01$) in front leg and middle part for Cobalamin treated rabbit. Meat protein increased ($P<0.05$) in Cobalamin supplemented rabbit; however ether extract decreased ($P<0.01$). Rabbit received Cobalamin showed higher ($P<0.05$) values of RBCs, Hb, PCV, plasma glucose, globulin and lower ($P<0.05$) plasma cholesterol as compared with control group.

INTRODUCTION

The availability of vitamin B_{12} for animals depends on bacterial synthesis of B_{12} rather than getting it from ration, which is dependent on Cobalt (co) levels in the soil. **House and Fletcher (2003)** reported that the water-soluble vitamin Cobalamin plays a central role as a co-factor in key pathways of energy and protein metabolism. However, **Cheeke (2005)** reported that swine and poultry fed diets deficient in vitamin B_{12} have shown reduced growth, anemia and poor reproduction. ***Kadim et al* (2004)** found that the final live and carcass weights were significantly higher ($P<0.05$) for goat treated with vitamin B_{12} by 13.4 and 8.3% respectively, compared with the control group. Carcass length, leg length, width behind shoulder, maximum shoulder width and longissimus muscle area were significantly higher ($P<0.05$) for goat treated

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with B_{12} than for the control by 6.7, 5.8, 10.1, 10.1 and 28.5%, respectively. This study was designed to investigate the impact of daily oral Cobalamine supplementation on the performance of growing New Zealand White male rabbits.

MATERIALS AND METHODS

This experiment was carried out in the Intensive Rabbit Production Unit belonging to the Agriculture Studies and Consultations Center; Faculty of Agriculture; Ain shams University.

Animals, treatment and management

A total of 60 new-weanling New Zealand White male rabbits, four weeks of age were randomly distributed into two comparable groups of 30 rabbits in each. Animals in group (I) served as control., while group (II) animals were orally administrated with 2 µg of Cobalamin / day/ kg live weight during the experimental period.. All experimental animals were housed in individual cages provided with continues feeders and automatic waterers during the experimental period which lasted for 8 weeks. The basal diet was a commercial feed pellets. Chemical analysis of the ration showed that the basal diet contained 7.93% moisture, 17.6% crude protein, 2.5% ether extract, 11.8% crude fiber, 51.37% nitrogen free extract, 8.8% ash and 0.1mg cobalt /kg diet The animals were fed according to **NRC (1977)**. Animals were weighed individually at weekly intervals.

Blood samples were withdrawn once weekly from the ear vein of each animal in a heparinized syringe and put in a vacutainer tube under cooling to the laboratory. Red blood corpuscle was counted by using heamocytometer, haemotocrit ratio (PCV%) and hemoglobin (Hb) were also measured in fresh whole blood at the same time of collection according to **Frankel and Reitman (1963)**. The plasma was carefully separated after centrifugation and stored at -20°C for biochemical analysis. Total plasma proteins (TP) were estimated as described by **Henary *et al* (1974)**, albumin determine according to **Doumas *et al* (1971)** cholesterol according to **Stein (1986)** and glucose as described by **Bahram and Trinder, (1972)**.

Slaughter and Carcass Traits

At the end of the experimental period (at 12 weeks of age) ten animals from each experimental groups were slaughtered according to the Islamic slaughtering using the procedure described by **Abou-Ashour and Ahmed (1983)**. Rabbits were weighed just before slaughter as well as after complete bleeding. The head, giblets (heart, liver and kidneys) and hot carcasses were weighed. The dressing percentage was calculated. For meat composition traits, all carcasses were divided longitudinally to two similar halves. The right half was physically separated into lean and bone.Lean of each carcass was separated and prepared for chemical analysis. Lean samples from different carcass parts are mixed for chemical analysis. Meat dry matter, crude protein (CP), ether extract (EE) and ash were determined according to the **A.O.A.C. (1990)**. Muscle Calcium (Ca),Phosphorus (P), Zinc (Zn), Iron (Fe), Cupper (Cu) and Selenium (Se) were determined using Inductive Coupled Plasma (ICP) technique, Perkin Elmer- Optima 2000 DV as described in **A.O.A.C (2000)**.

Statistical analysis

Data of the present study were analyzed using procedure of **SAS (1996)** program, Version 6.12. Value in tables were presented as means ± SE.

RESULTS AND DISCUSSION

Growth Performance Traits

Data in **Table (1)** and **Figure (1)** represent the rabbit performance as affected by Cobalamin supplementation. Differences between the body weights of the experimental groups were significant ($P < 0.01$). Rabbits supplemented with B_{12} had heavier weight than the control. The final body weights were 1634±32 and 1858±43 gm for control and treated groups, respectively. Average daily gains followed the same trend of the body weight being higher for rabbits received Cobalamin than control group. Average daily gains were 21.14± 1.16 and 25.40±1.16 gm during the experimental period for control and treated groups, respectively. Similar results were recorded by **Stangl *et al* (1999 and 2000)** who found that vitamin B_{12} deficiency results in reduced feed intake and average daily gain in ruminants. **Kadin *et al* (2004)** found that final live body weight was significantly heavier ($P<0.05$) for goat treated with Cobalamin by 13.4% compared with the control. **Tiffany and Spears (2005)** found significant correlation between average daily gain and plasma vitamin B_{12} in finishing steers. This improvement of body weight and daily gain may be due to the effect of Cobalamin on metabolism of VFA and animal appetite **(Cheeke, 2005 and Smith, 1997)** as Cobalamin increases feed intake and helps the body to absorb calcium to improve chromium picolinate that enhance building lean of mass **(Keizo, 2006)** and save amino acids for muscle growth instead of energy production, because it is considered as a coenzyme in amino acid metabolism.

Carcass characteristics and meat quality

Data concerning the carcass characteristics of the growing rabbits (NZW) supplemented with Cobalamin and control group are shown in **Table (2)**. Body weight at slaughter was heavier in rabbit supplemented by Cobalamin than control group. This may be due to the differences in body weight gain and/or growth rate **(Table 1 and Figure 1)** as treated rabbits were growing faster than control. Carcass weight followed the same trend being heavier for rabbit received Cobalamin than control group. The carcass weight improvement may be due to the effect of Cobalamin on metabolism of VFA and animal appetite **(Cheeke, 2005 and Smith, 1997)**, which increased growth rate and daily gain **(Table 1 and Figure 1)**. The Cobalamin supplementation for rabbits increased dressing percentage being 63.6±0.22 and 61.4±0.22 % for Cobalamin and control groups, respectively. Similar results were obtained by **Kadim *et al* (2004)** who found that the final live and carcass weights were significantly heavier ($P<0.05$) for goat treated with vitamin B_{12} by 13.4% and 8.3% compared with the control group.

Cobalamin enhanced ($P<0.01$) the percentage of boneless meat in the front leg and middle part by 18.01% and 18.76 %, respectively. The increasing boneless meat in the Cobalamin treated group may be due to the role of Cobalamin in methionine synthesis and activation of metabolic enzymes, which increase lean mass **(Matthews, 1999 and Holm *et al* 2005)**. The percentage of rabbit head, liver, kidney, lung and heart did not differ significantly between Cobalamin and control groups. The chemical analysis of rabbit meat showed that Cobalamin increased ($P<0.05$) CP and deceased ($P<0.05$) EE % in rabbit meat (Figure 2). This may be due to the effect of Cobalamin on energy and protein metabolism **(House and Fletcher 2003)**. Moreover, **Smith (1997)** found that New Zealand White male rabbits given additional vitamin B_{12} had significantly decreased surface area of fat deposition. Cobalamin causes a shift from body fat to body protein **(Holm *et al* 2005)** and the absorption of chromium picolinate to enhance lean mass building **(Keizo, 2006)**. The muscle ash and moisture had not been affected by Cobalamin supplementation.

Data concerning the minerals concentration in meat of growing rabbit supplemented with Cobalamin and control groups are shown in **Table (3)**. Cobalamin increased Ca, Cu , Na and P concentration. **Keizo, (2006)** found that Cobalamin helps the body to absorb calcium to improve skeletal strength and chromium picolinate to enhance lean mass building. The meat Fe, Se and Zn concentration were decreased in Cobalamin supplemented group. The lower concentration of pervious minerals in rabbit meat may be due to that certain minerals have to interact, either positively or negatively, with absorption of other minerals. Excessive amounts of calcium can influence phosphorus and selenium absorption **(Bell, 2003)**. **Wang *et al* (2006)** found that there is a negative correlation between lean or plasma zinc and vitamin B_{12} in lambs.

Hematological parameters

Hematological parameters of New Zealand White male rabbits are presented in **Table (4)**. Rabbit received Cobalamin showed higher ($P<0.05$) values of RBCs, Hb and PCV compared with control group. Treated weaned male rabbits with vitamin B_{12} increased ($P<0.05$) RBC's, Hb and PCV by 23.25, 13.82 and 19.23, respectively **(Table, 4)**. These results were in agreement with those of **Cheeke (2005) and Girard & Matte (2006)** who reported that vitamin B_{12} is required for formation of hemoglobin and has a dual role in the formation of erythrocytes which stimulates erythropoiesis and increases packed cell volume and blood hemoglobin. Blood plasma biochemical constituents of rabbits as affected by Cobalamin are shown in **Table (4)**. Plasma globulin concentration was higher ($P<0.05$) in male rabbits received Cobalamin as compared with control. The decrease in Alb/Glb ratio (-28.12%) in treated animals seems to be due to the increase in globulin **(Table, 4)**, which increased by 31.6%. This may reflect the positive increase in animal immunity through increasing the gama-globulin **(More *et al* 1980)**. However there were no differences between male rabbits received Cobalamin and control in plasma total protein and albumin concentration, however TP increased by 7.84% and albumin decreased by 5.17% as compared with control rabbit. Furthermore plasma

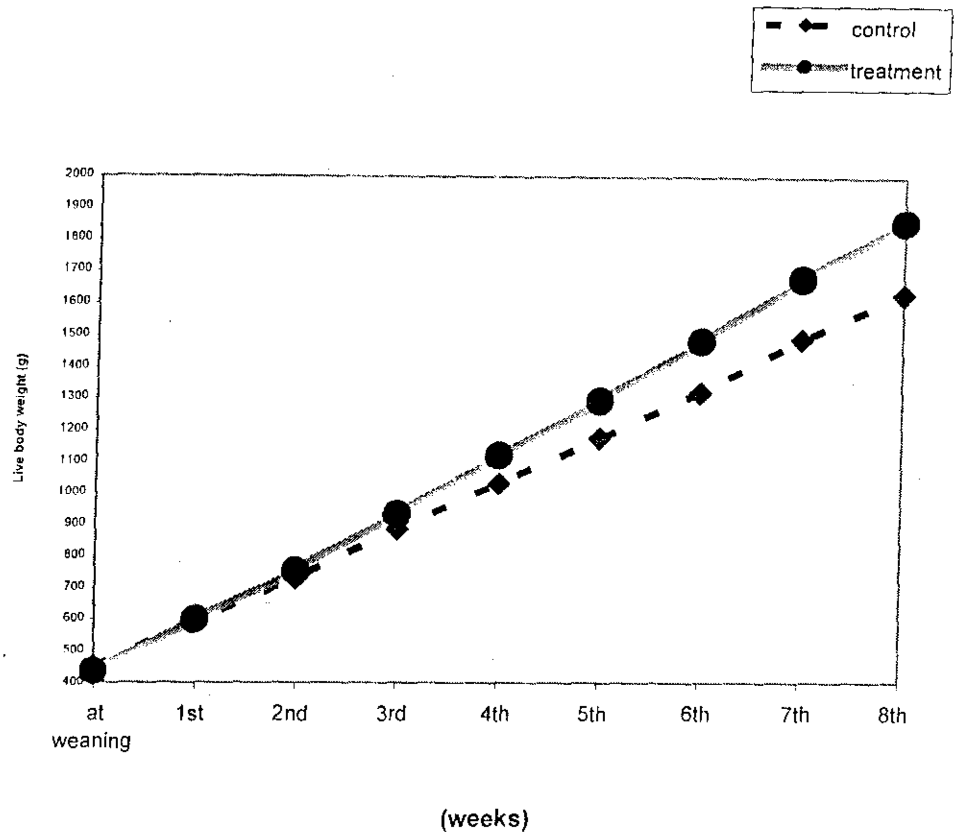

Figure 1. Effect of Cobalamin supplementation on body weight of post weaning rabbit

Table 1. Effect of Cobalamin supplementation on growth performance of growing rabbits

Items	Control	Cobalamin	Changes%	MSE	Probablity
Animal number	30	30			
Initial Body weight (g) (4th weeks of age)	450± 6.68	435±6.68	-3.33	1339.21	NS
Final body weight(g) (12th weeks of age)	1634±22.6	1858±22.6	+13.71	15674.38	(P<0.05)
Total body gain (g) (4th to 12th week of age)	1184±11.14	1423±11.14	+20.19	3728.89	(P<0.01)
Daily body gain(g)	21.14±1.16	25.4±1.16	+20.15	40.82	(P<0.01)

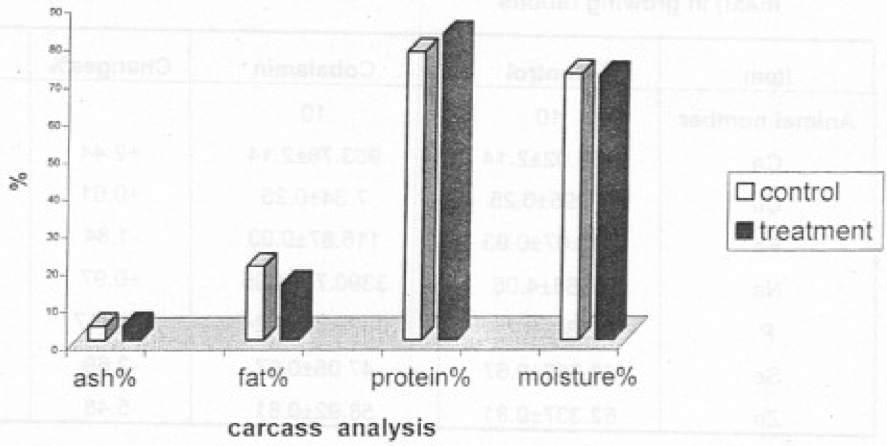

Figure 2. Show the percentage of meat component for control and Cobalamin supplemented growing rabbit

Table 2. Effect of Cobalamin supplementation on carcass characteristics of growing rabbits

Carcass traits	Control	Cobalamin	Changes%	MSE	Probability
Animal number	10	10			
Slaughters body weight (g)	1634 ± 4.73	1858.0 ± 4.73	+13.71	223.72	(P<0.01)
Hot carcass weight (g)	997.13 ± 10.59	1181.69±10.59	+18.44	1121.48	(P<0.01)
Dressing (%)	61.4 ± 0.22	63.6±0.22	+3.58	0.484	(P<0.05)
Front leg + chest (%)	18.23± 0.14	18.02±0.14	-1.15	0.198	NS
Front leg (%)	6.76 ± 0.143	7.4±0.143	+9.47	0.205	(P<05)
Front leg bone less meat (%)	4.83± 0.07	5.70±0.07	+18.01	0.049	(P<0.01)
Front leg bone (%)	1.93± 0.04	1.70±0.04	-11.92	0.016	NS
Middle part (%)	11.10±0.2	12.22±0. 2	+10.09	0.43	(P<0.05)
Middle part bone less meat (%)	8.42 ± 0.109	10.00±0.109	+18.76	0.12	(P<0.01)
Middle part bone (%)	2.68 ± 0.05	2.25±0.05	-16.05	0.025	NS
Hind part (%)	15.6 ± 0.117	16.37±0.117	+4.94	0.137	NS
Hind part bone less meat (%)	11.96± 0.173	13.0±0.173	+8.69	0.3	NS
Hind part bone (%)	±0.051 3.37	3.63±0.051	+7.72	0.026	NS
Head (%)	11.0 ± 0.137	11.3±0.137	+2.73	0.188	NS
Liver (%)	3.23±0.122	3.79±0.122	+17.34	0.1486	NS
Kidney (%)	0.71±0.0091	0.71±0.0091	0.0	0.0008	NS
Heart (%)	0.26±0.00316	0.285±0.00316	+9.6	0.0001	NS
Lung (%)	0.79±0.0055	0.802±0.0055	+1.5	0.0003	NS

Table 3. Effect of Cobalamin supplementation on meat mineral concentration (mg/kg meat) in growing rabbits

Item	Control	Cobalamin	Changes%	MSE
Animal number	10	10		
Ca	931.02±2.14	953.78±2.14	+2.44	45.8
Cu	7.295±0.25	7.34±0.25	+0.61	0.67
Fe	119.07±0.93	116.87±0.93	-1.84	8.7
Na	3358±4.05	3390.72±4.05	+0.97	164.5
P	8530±6.24	8889.75±6.24	+4.217	390.4
Se	48.355±0.67	47.05±0.67	-2.69	4.62
Zn	62.337±0.81	58.92±0.81	-5.48	6.54

Table 4. Mean ± SE of some hematological and plasma parameters of growing male rabbit as affected by Cobalamin

Item	Control	Cobalamin	Changes%	MSE	Probability
Number of samples	240	240			
Blood parameters					
RBCsx10^6	4.714±0.068	5.81±0.068	+23.25	1.12	P<0.05
Hb (g/dl)	12.01±0.075	13.67±0.075	+13.82	1.35	P<0.05
PCV (%)	38.37±0.18	45.75±0.18	+19.23	7.82	P<0.05
Plasma parameters					
Total Protein(g/dl)	7.14±0.058	7.7±0.058	+7.84	0.82	NS
Albumin(g/dl)	4.64±0.047	4.4±0.047	-5.17	0.55	NS
Globulin(g/dl)	2.5±0.037	3.29±0.037	+31.6	0.34	P<0.05
A / G ratio	1.85±0.006	1.33±0.006	-28.12	0.01	P<0.05
Glucose(mg/dl)	105.98±0.71	120.3±0.71	+13.51	122.4	P<0.05
Cholestrol(mg/dl)	110.3±0.65	87.48±0.65	-20.68	101.3	P<0.05

cholesterol was lower ($P<0.05$) in male rabbit received Cobalamin as compared with control animals. Plasma glucose concentration was increased ($P< 0.05$) by 13.51% in rabbit received vitamin B_{12} as compared with control group. These results were similar to those reported by **Girard and Matte, (2006)** who found that plasma glucose increased in cows received vitamin B_{12}. This increase in glucose level may be due to effect of Cobalamin on propionate that transferred to glucose as reported by **Chen and Wolin, (1981)**; **Tanner and Wolfe, (1988)** and **Strobel, (1992)**.

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حوليـــات العلـــوم الزراعية
جامعة عين شمس ، القاهرة
مجلد(٥٥)، عدد (١)، ٥٧-٦٤، ٢٠١٠

تأثير فيتامين B_{12} على النمو وصفات الذبيحة وبعض المقاييس الفسيولوجية في الأرانب النامية

[٤]

عصام الدين ثروت[١] - شوقي احمد الميداني[٢]
١- قسم الإنتاج الحيواني- كلية الزراعة- جامعة عين شمس شبرا الخيمة- القاهرة - مصر
٢- المركـز الإقليمى للأغذيــة والأعــلاف - مركز البحــوث الزراعيــة - الجيــزة - مصر

الموجــــز

تم أجراء الدراسة بوحدة الإنتاج المكثف للأرانب التابعة لمركز الدراسات والاستشارات الزراعية بكلية الزراعة، جامعة عين شمس بإستخدام ٦٠ ذكر أرنب نيوزيلاندى ابيض مفطوم عمرهـا أربعــة أسـابيع لدراسة تأثير فيتامين B12 على النمو وصفات الذبيحة وبعض المقاييس الفـسيولوجية . قـسمت الأرانـب عشوائيا إلى مجموعتين بكل منهــا ٣٠ أرنــب .تـم أسكان الأرانب بالبوسكات مع توافر الماء اتوماتيكيـا والغذاء خلال فترة التجربة التي استمرت لمدة ثمانية أسابيع. كانت العليقة الأساسية عبارة عن المكعبـات التجارية تم تغذيتها للمجموعة الضابطة بدون إضـافة فيتامين B12 بينما المجموعة التجريبية تم تجريعها يوميا عن طريق الفم بـ٢ ميكروجرام فيتـامين B12 / يوميا / كجم من وزن الجسم . عند عمر ١٢ أسبوع تم ذبح ١٠ أرانب من كل مجموعة تجريبيـة لتقـيم الذبائح .

أوضحت النتائج أن الأرانـب فـى المجموعـة التجريبية كانت أعلى معنويـا ($P<0.05$) فـى وزن الحسم من المجموعة الضابطة. وكان متوسط معـدل النمو اليومي ٢١,١٤ ± ١,١٦ و ٢٥,٤٠ ±١,١٦ جم / يوم للمجموعة الضابطة والمعاملة على الترتيـب . المعاملة بفيتامين B12 أدت إلى زيادة نسبة التصافي بنسبة ٣,٥٨% ونـسبة الجـذع ١٠,٠٩ % مقارنـة بالمجموعة التجريبية بينما ذادت الأرباع الخلفية بنسبة ٤,٩٤% ونسبة اللحم ذادت ($P< 0.05$) في الأربـاع الأماميـة والجـذع بالمجموعـة المعاملـة مقارنـة بالمجموعة الضابطة ، ذادت نسبة بروتين اللحم ($P<0.05$) فى المجموعة المعاملـة وانخفـضت نـسبة المـستخلص الاثيـرى ($P< 0.01$) عـن الجموعـة الضابطة. المعاملـة بفيتامين B12 أدت إلـى زيـادة ($P<0.05$) عدد كرات الدم الحمراء ونسبة كرات الدم الحمراء المنضغطة والهيموجلوبيـولين وجلوكـوز بلازما الدم و الجلوبيولين وقللت ($P< 0.05$) مستوى الكولسترول ببلازما الدم مقارنة بالمجموعة الضابطة.

تحكيـم: أ.د فاروق عبد الله
أ.د ثويب أبو ستيت