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STUDIES ON PERFORMANCE OF MALE LAMBS FED ON RATION CONTAINING AD3E

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ABSTRACT: Eighteen local male lambs (Ossimi x Barki) at age 3.5 months old, were divided randomly into two experimental groups (nine in each), An average body weight for control and treated groups were 28.4 and 27.6 K g, respectively. The basal ration composed of rice straw and concentrate feed mixture was considered as the control diet. The treated group received the basal ration plus 0.1% AD3E of concentrate feed mixture. The period of growth trial was 150 days. The rations were fed to cover the nutritional requirements of growing sheep which according to NRC (1985). Four rams were randomly chosen from each group in average 48.5 Kg were used in digestibility trials to determine the feeding values and nitrogen, calcium and phosphorus balance for the rations. Blood samples were taken twice weekly to analyses total proteins, albumin, GOT, GPT, calcium, phosphorus, T3 and T4 levels. The data is indicating that digestibility (CP) and feeding values expressed as TDN and DCP% were improved ($P>0.05$) by AD3E addition than control ration. DM, OM, CF, EE and NFE digestibility in AD3E ration were higher than control ration but no significance was detected ($P>0.05$) among rations. Nitrogen, calcium and phosphorus balances value were higher ($P<0.05$) with treated group than control group. The values of total protein, GOT, Ca and P were higher ($P<0.05$) for treated group than the values of control group. Blood serum albumin, globulin and T3 were increased non-significantly with treated group than the control group. No significant differences were detected in serum GPT and T4 among experimental groups. Lambs fed on treated ration had better average daily gain (ADG) and feed conversion than lambs fed on control It is suggested that added AD3E to lambs diets as 0.1% to ration can efficiently improve the nutrients digestibility, feeding values.

Key words: male lambs - growth performance - digestibility - feeding conversion - rumen fermentation - blood parameter - AD3E.

INTRODUCTION

In most cases adequate rations can be formulated to promote maximum growth and production, but excesses of some nutrients, especially vitamins may be added to insure that a deficiency will not occur. Several studies have shown that some vitamins such as A, D and E are playing role in the growth of animals.

All animals required a dietary source of vitamin A for growth; vitamin A is concerned in the normal development of bone through a control exercised over the activity of the osteostasts and osteoblasts of the epithelial cartilage (Mellanby, 1947). A ration adequate in vitamin A is necessary to help maintain the normal powers of resistance, but additional intakes will not increase resistance to infections that enter through the epithelium. Animal on good pasture can store extensive reserves to help their need during feeding on poor quality forage or low levels of forage. Whereas, Smith et al.,(1983) showed that the liver can store enough vitamin A to protect t he animal from long periods of dietary scarcity.

Vitamin D plays a critical role in normal bone growth; a primary function of the vitamin is the promotion of calcium absorption. It stimulates the synthesis of calcium binding protein. The binding protein is necessary for efficient calcium absorption. It is also involved in phosphorus absorption. Therefore, vitamin D is needed during body growth, to ensure adequate calcium and phosphorus assimilation. The role of vitamin D in the adult animal appears much less important except during reproduction and lactation. On the other side, supplemental vitamin D is unnecessary when animals receive sun cured forage or are exposed to ultra violet light or sunlight. Green forage and silage have significant vitamin D activity (Thomas and Moore, 1951).

Vitamin E has been demonstrated to be required by large number of animal species but the deficiency signs may differ greatly among species and even within the same species. Vitamin E is a dietary essential for young nursing lambs and calves; it seems to have no further practical importance as a dietary supplement in the nutrition of older animals. Vitamin E deficiency causes muscular dystrophy that is found primarily in the skeletal muscles, and sometimes in the heart. Also, vitamin E requirement may be related to the polyunsaturated fatty acid content of the ration.

Therefore, the objective of this study was to investigate the effect of AD3E supplemented, ration on digestibility coefficients, feeding value, blood parameters, and performance of growing lambs.

MATERIALS AND METHODS

This study was carried out at the farm and laboratory of animals nutrition unit, Biological Application Department, Nuclear Research Center, Atomic Energy Authority. Abou Zaabal.

Experimental animals:

Eighteen local male lambs (Ossimi x Barki) of 3.5 months old, were divided randomly into two experimental groups (nine in each), each group noused separately in shaded pen. An average body weight for control and treated groups were 28.4 and 27.6 K g, respectively.

Growth experiment:

The basal ration composed of rice straw (RS) as roughage and concentrate feed mixture (CFM) consisted of 19.9% dried beet pulp, 25% yellow corn, 16% cotton seed meal, 12% soybean meal, 20% wheat bran, 5% linseed meal 1% salts, 0.1% mineral mixture, 1% dicalcium phosphate was considered as the control diet. The treated group received the basal ration plus 0.1% AD3E of concentrate feed mixture, which manufactured by Egyptian Co. for chemicals and pharmaceuticals.

Each kilogram AD3E contained: vitamin A 20 million IU, vitamin D3 2 million IU and vitamin E 2 gram. Chemical compositions of the ingredients were carried out according to A.O.A.C (1990), and are shown in Table 1.

The rations were fed to cover the nutritional requirements of growing sheep according to NRC (1985). The weighed daily rations were offered in two equal meals at 8.0 a.m. and 2.0 p.m. The rice straw was offered separately ad libitum at 130% of the previous dayís intake (about 30% refusal rate). Fresh water was a available at all the time and animals were healthy, Lambs body weight were recorded before morning feeding at the beginning of the experimental than at twice weekly intervals till the end of the experiment, which lasted for 150 days to monitor their body weight change.

Digestibility trial

At the end of experimental period, four rams were randomly chosen from each group in average 48.5 Kg were used in digestibility trials to determine the feeding values and nitrogen calcium and phosphorus balance for the rations. Four animals were assigned for each ration using metabolic cages. The 21 days were considered as a preliminary period followed by 6 days as collection period. Feed residues were removed at the next morning and individually weighed to determine the actual daily feed intake and recorded individually. Total feces were collected daily and weighed. Feces samples (10%) were sprayed with 10% sulphuric acid and dried at 60oc for 24 hrs then finely grounded and kept for chemical analyses. Total urine was individually collected in a glass bottle containing 20 ml of diluted sulphoric acid (10%). Urine volume was recorded and a sample of 5% was taken. At the end of the collection period, composite samples of feed offered and feces were mixed separately, finely ground and kept for chemical analysis.

Feeds, feces and urine were analyzed by the conventional methods of A.O.A.C. (1990). Digestible energy (DE) and metabolizable energy (ME) MJ/Kg DM of the experimental rations were calculated according to MAAF, (1975) equations: DE MJ/Kg DM = Digestible organic matter X 19

ME MJ/Kg DM = DE X 0.82

Table 1: The chemical analysis of ingredients used in the experimental diets (on DM Basis).

Ingredient	%DM	%CP	%CF	%EE	%NFE	%Ash
Yellow corn	90.12	10.35	3.51	2.89	81.31	1.94
Dried sugar beet pulp	90.52	9.01	18.59	2.20	66.1	4.1
Soya been meal	90.70	46.11	6.69	1.34	38.65	7.21
Cotton seed meal	90.07	24.05	22.65	4.77	42.44	6.09
Lin seed meal	91.52	29.68	7.98	7.64	44.00	10.70
Wheat bran	90.52	16.50	8.61	3.99	64.31	6.59
Rice straw	91.91	3.21	38.15	2.78	37.53	18.33

Blood parameters

Blood samples were taken twice weekly from the jugular vein of each animal. Blood serum was separated through one hour and stored at -200C until analyses for total proteins (Weichselbaum, 1946), albumin was determined according to Doumas et al, (1971), globulin was calculated by difference between total proteins and albumin. Glutamic- oxaloacetic transaminases (GOT) and glutamic- pyruvic transaminases (GPT) were determined as described by Reitman and Frankel (1957). Calcium (Ca) was determined by using atomic absorption (Buck scientific 210 VGP). Phosphorus (P) was determined by using spectrophotometer (carry - 3E- UV-visible). Triiodothyronine (T3) and tetraiodothyronine (T4) levels were estimated by RIA technique using solid phase coated tubes and the tracer was labeled with 125I (Diagnostic Products Corporation, 5700 West 96th street, Los Angeles, CA 90045-5597, USA).

Statistical analysis of data was carried out as one-way classification and the difference among means were tested by using Duncanís multiple test (Duncun. 1955).

RESULTS AND DISCUSSION

Digestibility trials:

The results of nutrients digestibility and feeding values of the experimental rations are shown in Table 2. Average daily DM intake (g/h/d) was not significantly by AD3E supplementation, values were 868 and 922 g/h/d for treated and control group, respectively. Supplemented ration with AD3E increased ($P<0.05$) CP digestibility, this improvement in CP digestibility could be due to increase microbial protein synthesis in the rumen or/and increase passage rate of undegradable dietary protein and consequently more organic matter was digested postruminally (Safaa .1999). DM, OM, CF, EE and NFE digestibility in AD3E ration were higher than control ration but no significance was detected ($P>0.05$) among rations. Whereas a higher dilution rate increases the efficiency of microbial production in the rumen (Kennedy and Milligan, 1978; Prigge et al.,1978).

Feeding values expressed as total digestible nutrient (TDN) and digestible crude protein (DCP)% were higher ($P>0.05$) for supplemented ration than control ration, they were 72.88, 9.73 and 69.39, 9.28%, respectively. It could be attributed to higher nutrients digestibility with treated ration than control ration.

There were no pronounced differences in digestible energy (DE, Mj/Kg DM) and metabolizable energy (ME, Mj/Kg DM) values among experimental rations. The data indicated that digestibility and feeding values were improved by AD3E addition than control ration.

Nitrogen balance

Nitrogen balance values for lambs fed on control ration and treated ration, which supplemented with 0.1% of AD3E were presented in Table 3. Nitrogen balance value was higher ($P<0.05$) with treated group than control group; values were 11.02 and 8.78 g/h/d, respectively. Whereas, nitrogen excreted (feaces and urine) was higher for control group than treated group.

The values of nitrogen balance expressed as percentages of nitrogen intake, were higher (P<0.05) with treated group than control group. This result may be attributed to nitrogen made more available with AD3E in the ration and to the improvement of crude protein digestibility (table 2).

Table 2: Dry matter intake, nutrients digestibility % and feeding values% of lambs fed the experimental rations.

Item	Control	Treatment
No. of animals	4	4
Average body weight, Kg	48.8	48.2
DM intake g/h/d		
CFM	706	750
RS	162	172
Total	868	922
Nutrients digestibility %		
DM	75.46	77.20
OM	77.56	79.75
CP	72.48[b]	76.89[a]
CF	54.39	60.73
EE	69.95	78.17
NFE	83.92	84.19
Feeding values%		
TDN	69.57	72.88
DE (MJ/Kg DM)*	14.74	15.15
ME (MJ/Kg DM)**	12.08	12.42
DCP	9.28	9.73

* and ** DE, calculated according to MAAF (1975) using equations being DE (Mj/Kg DM) = Digestible organic matter (DOM X 19) and ME (Mj/Kg DM) = DE X 0.82.

a, b Mean in the same row with different superscripts differ significantly (P<0.05).

Table 3: Nitrogen balance of lambs fed the experimental ration.

Item	Control	Treatment
N intake, g/h/d	19.12	20.48
Faecal N, g/h/d	5.26	4.89
% Of N intake	27.51	23.88
Digested N, g/h/d	13.86	15.39
Urinary N, g/h/d	5.08	4.57
% Of N intake	26.56	22.31
N balance, g/h/d	8.78[b]	11.02[a]
% Of N intake	45.92[b]	53.81[a]

a, b Mean in the same row with different superscripts differ significantly (P<0.05).

Calcium and phosphorus balances

Calcium and phosphorus balances are shown in Table 4.The same calcium and phosphorus %are presented in two rations, while there were a few different between the experimental groups in calcium and phosphorus intake. The treated group recorded higher values of calcium and phosphorus balances than control group. Results of this study suggested that calcium and phosphorus might be more available with added AD3E to the ration. Deluce,(1984) and Horst (1993) found that vitamin D stimulates calcium absorption also a secondary increase in phosphorus absorption.

Blood serum parameters:

Blood serum parameters are presented in Table 5. The values of total protein (g/dl) of treated group were higher ($P<0.05$) than the values of control group (7.21 vs 6.22 g/dl), which may reflect the improvement of protein digestibility in the gut. High total protein content in treated group serum was connected to the greatest body weight gain. These results agree with Baranowski, et al, (2000) who found that the correlation coefficient for body weight and serum total protein content was ($r = 0.67$) higher for lambs group born by the ewes that had received vitazol AD3E than control group($r = 0.51$). Blood serum albumin and globulin were increased non-significantly with treated group than the control group. Values of total protein, albumin and globulin were within the normal ranges reported by El- Reweny (1999).

The GOT and GPT enzymes are most important indicator for liver cells activity. Significant increases ($P<0.05$) were found with GOT in blood serum of lambs fed treated ration. That may be due to high body weight recorded for this group, Metwally and Mohsen (1997) found that there is positively correlated between body weight and GOT. The same trend was observed with Baranowski, et al, (2000) who reported that ewes received vitazol AD3E during pregnancy recorded higher ($P<0.05$) serum GOT enzyme activity and had higher body weight.

Table 4: Calcium and phosphorus balances of lambs fed the experimental ration.

Item	Control	Treatment
DM intake, g/h/d	868	922
Ca balance		
Ca in ration %	0.87	0.87
Ca intake, g/h/d	7.55	8.02
Ca balance, g/h/d	4.02^{b}	5.33^{a}
P balance		
P in ration %	0.49	0.49
P intake, g/h/d	4.25	4.51
P balance, g/h/d	2.33^{b}	2.87^{a}

a, b Mean in the same row with different superscripts differ significantly ($P<0.05$).

Table 5: Some blood constituents of lambs fed the experimental rations.

Item	Control	Treatment
Total protein g/dl	6.22±0.06[b]	7.21±0.03[a]
Albumin g/dl	3.13±0.05	3.65±0.06
Globulin g/dl	3.09±0.02	3.56±0.01
Albumin /globulin ratio	1.01±0.01	1.02±0.01
GOT IU /L	50.2±5.00[b]	57.2±1.40[a]
GPT IU /L	25.3±1.40	24.8±2.70
Inorganic phosphorus mg/dl	5.10±0.18[b]	6.30±0.29[a]
Calcium mg/dl	9.02±0.21[b]	10.1±0.35[a]
T3 ng/dl	188 ±31	222 ±32
T4 µg/dl	6.63±0.98	5.70±0.55

a, b Mean in the same row with different superscripts differ significantly (P<0.05).

Table 6: Performance of growing lambs fed the experimental rations.

Item	Control	Treatment
No. of animals	8	8
Duration of trial, day	150	150
Initial body weight, Kg	28.4	27.6
Final body weight, Kg	48.46	53.84
Weight gain, Kg	20.06[b]	26.24[a]
Average daily gain, g	134[b]	175[a]
Daily feed intake, g/h/d on DM basis		
DM, g	995	1018
TDN, g	692	742
DCP, g	92.33	99.05
Feed conversion:		
DM/ gain, Kg/ Kg	7.42[a]	5.82[b]
TDN / gain, Kg/KG	5.16	4.24
DCP/ gain, Kg/Kg	0.689[a]	0.566[b]

a, b Mean in the same row with different superscripts differ significantly (P<005).

The present data are within the normal ranges reported in lambs by Awad (1966) and El-Ayek et al (2001). On the other side, there are no significant differences detect in GPT IU/L among experimental groups. Values GPT in experimental groups ranged from 24.8-25.3 IU/L. The GOT and GPT concentrations were about the normal ranges detected by Reitman and Frankel, (1957).

The results of serum mineral content showed significantly (P<0.05) increased of calcium and inorganic phosphorus levels with AD3E group than control group. It attributed to vitamin D in treated ration stimulates absorption of Ca and P across intestinal epithelial cells by active transport mechanisms, it leads to increase serum Ca and P (Pond, et. al, 1995). Serum concentration of calcium and phosphorus were within the physiological range for sheep (Baranoski, et. al, 1998).

Levels of T3 were increased (P>0.05) with treated group, which recorded the highest body weight because T3 enhances general protein synthesis and causes positive nitrogen balance, increases metabolism of carbohydrates and fats (DeGroot and Nietonniszcze, 1977). This explain that treated group showed positive N balance which, reflected a generalized increase in protein synthesis by increased the transport of amino acids into muscle cells. Over that T3 enhances transcription of the growth hormone (GH) gene, it leads to more GH produces and promotes a positive calcium, magnesium and phosphorus balance (Larsen, 1982).

There are no significant difference detect in T4 levels among experimental groups, whereas levels of T4 were slightly decreased when vitamins AD3E supplemented in the ration. This data agreement with Naziroglu et al (1998) who reported that vitamin E supplementation had no effects on plasma thyroid hormones in lambs but it increased the levels of serum selenium whereas, the metabolic role of selenium is linked to that of vitamin E.

Lambs performance

The performance of lambs, feed consumption and feed conversion are given in Table 6. Data showed that total daily feed intake as dry matter intake (DMI) were nearly similar in the two groups However, average daily gain (ADG) for lambs fed treated ration was higher (P<0.05) than lambs fed control ration (175 and 134 g/d, respectively). It may be due to good effect of AD3E on organic matter digestibility that related to microbial protein production in the rumen (Tommingo, 1981& Santos et al, 1984). Vitamin A is essential for growth, whereas vitamin A deficiency is characterized by stratified karatinization of epithelial tissue, diarrhea, loss of appetite, and emaciation are commonly observed at this stage of deficiency. Also, vitamin E plays an important role in membrane metabolism or maintenance. Imik, et. al (1998) who reported that vitamin E and mineral mixture supplementation improved live weight gain.

Data in Table 6 indicated that lambs fed on treated ration had better feed conversion (5.82 Kg DM/Kg gain and 0.565 Kg DCP/Kg gain) than lambs fed on control ration which, had worse feed conversion (7.42 Kg DM/Kg gain and 0.689 Kg DCP/Kg gain) The results on the growing lambs are partly confirmed the results obtained from the digestibility trials and indicated the AD3E supplementation can enhance growth rate of lambs. That is agreement with Abdelhhamid et al, (1992) who reported that a high level of vitamin A in the ration of lambs during fattening from 16 Kg to 35-40 Kg, at a regular feeding level, resulted in the highest live weight gain.

It could be concluded that, adding 0.1% of AD3E to lambs ration resulted in improve feeding values, feed conversion and better daily gain of lambs.

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دراسات على أداء ذكور الحملان المغذاة على علائق تحتوى على أد ٣ هـ

صفاء عبد المنعم صالح – هشام منير صالح

قسم التطبيقات البيولوجية – مركز البحوث النووية – هيئة الطاقة الذرية

فى هذه التجربة تم دراسة مدى تأثير إضافة فيتامينات أد ٣ هـ على اداء ذكور الحملان. استخدم فى هذا البحث ١٦ حمل خليط (اوسيمى × رحمانى) قسمت إلى مجموعتين ٨ حيوانات فى كل مجموعة بمتوط وزن ٢٨ كجم وعند عمر حوالى ثلاث أشهر ونصف. غذيت المجموعة الاولى على العليقة الكنترول التى تغطى احتياجات الحملان حسب مقررات (1985) NRC وغذيت المجموعة الثانية على نفس العليقة الكنترول مع إضافة ١و. ٪ من فيتامينات أد ٣ هـ إلى العلف المركز . استمرت التجربة لمدة ١٥٠ يوم تم خلالها وزن الحيوانات وسحب عينات دم كل اسبوعين، وفى نهاية تجربة النمو تم إجراء تجربة هضم على ثمان حيوانات بواقع أربع حيوانات لكل مجموعة.

كانت أهم النتائج المتحصل عليها هى:

١ – تحسن معنوى فى هضم البروتين فى المجموعة المعاملة ب أد ٣ هـ بالمقارنة بالمجموعة الكنترول.

٢ – تحسن غير معنوى فى هضم المادة الجافة والمادة العضوية والألياف ومستخلص الدهون فى المجموعة المعاملة بالمقارنة بالكنترول.

٣ – زيادة الاستفادة من الغذاء نتيجة لزيادة معدل الهضم للغذاء للمجموعة المعاملة بالمقارنة بالمجموعة الكنترول.

٤ – ارتفاع ميزان النيتروجين والكالسيوم والفوسفور معنويا للمجموعة المعاملة بالمقارنة بالمجموعة الكنترول.

٥ – زيادة مستوى البروتين الكلى وإنزيم GOT والفوسفور غير العضوى والكالسيوم فى سيرم دم المجموعة المغذاة على عليقة تحتوى على أد ٣ هـ بالمقارنة بالمجموعة الكنترول.

٦ – لم يكن هناك اختلاف معنوى بين المجموعة المعاملة والمجموعة الكنترول فى محتوى سيرم الدم من الألبومين والجلوبيولين وإنزيم GPT.

٧ – تحسن معنوى فى معدل الزيادة اليومية ومعدل التحويل الغذائى لحملان المجموعة المعاملة بالمقارنة بالمجموعة الكنترول.

من هذه الدراسة يمكن النصح باستخدام مركب الفيتامينات أد ٣ هـ فى علائق الحملان النامية لما لذلك من تأثير إيجابى على أداء الحملان فى المواسم التى لا تتوفر بها العلائق الخضراء.