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EFFECT OF CHROMIUM PICOLINATE SUPPLEMENTATION ON GROWTH PERFORMANCE, CARCASS TRAITS, BIOCHEMICAL PARAMETERS AND BLOOD CONSTITUENTS OF GROWING LAMBS UNDER THE SUMMER EGYPTIAN CONDITIONS

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ABSTRACT

This study was carried out on twenty four weaned commercial male lambs of 5 months age and 19.85 Kg body weight. The lambs were allotted at random to four groups each of 6. The first group was served as control, while the second, third and fourth ones were fed the same diet supplemented with chromium picolinate at doses of 50, 75 and 100 mg per kg diets, respectively.

The results obtained for growing lambs showed that the final live body weight and daily body gain increased significantly ($P<0.05$), also the feed efficiency , final margin and the dressing percentage were improved when treated growing lambs with chromium picolinate at doses of 50, 75, and 100 mg per kg diets. The rectal temperature, respiration rate and daily water intake were not affected by using the previous treatments, while the feed intake , fat tail weight and abdominal fat weight decreased significantly ($P<0.05$). The best results obtained for growing lambs were in the group fed on the diet supplemented with 100 mg chromium picolinate per kg diet.

Serum total proteins, albumin, globulin, urea-N, alkaline phosphates, AST, ALT and creatinine were not significantly affected, while the cholesterol level and triglycerides significantly decreased ($P<0.05$) in lambs treated with chromium picolinate comparing with the control group under the summer heat stress. RBCs, Hb, MCV%, MCH%, hematocrite, neutrophils, and Lymphocyte%, were not affected by using the same previous treatments, while WBCs, platelets count, basophil%, and eosinophils were affected by using chromium picolinate as supplementation on diets.

Keywords: lambs, growth performance.

INTRODUCTION

In Egypt, the increase in human population and rise in their standards of living is associated with increasing demand to animal products. The gap between meat production and consumption would be bridged by finding out possible means for increasing and improvement of meat production from agriculture animal species. Egyptian local lambs are efficient in converting energy / protein of high or full

concentrate rations into live body weight gain. Daily gain on these rations reaches 200-250 gm in a growth fattening period of 80 – 85 days. Two stages of growth are considered most efficient in the life – span of ruminant animals. These are during liquid feeding and from weaning to just before the full maturation of the rumen. In the latter stage, high quality dry feeds, mostly concentrates are fed since ruminants utilize concentrates with maximum efficiency. Sheep have the advantage of being small in size compared with other ruminants.

Chromium picolinate is one of the most important trace elements, its level must be constant in the blood, it is responsible for maintenance of the blood glucose level **(Underwood, 1977)**. It plays a role in the glucose tolerance factor, where it facilitates the attachment of insulin to its receptors, so potentiates the action of insulin **(Anderson, 1987). Johnson (1986), Moonsie –Shageer and Mowat (1993)** reported that chromium may improve the immune response of stressed animals. Later, **Kegley *et al.*(1997)** recorded that supplement with organic chromium has markedly improved the growth rate and immune response of nourish stressed calves.

Chromium picolinate decreased the total cholesterol and LDL cholesterol **(Press *et al*, 1990)** and reduced body fat while the lean mass has increased **(McCarty 1991).** The present study was conducted to determine the best level of chromium picolinate supplementation for growing lambs, under summer heat stress.

MATERIALS AND METHODS

This work was conducted in the Department of Animal Production, Faculty of Agriculture, Zagazig University. The experimental work was carried out at private farm in Zagazig city Sharkiaa governorate.

A total number of 24 weaned male lambs were used in the present study. The average body weights in the different groups were nearly similar (overall mean = 19.85 kg). The lambs were allotted at random to four experimental groups, each of 6. The first group (control group) was fed a basal diet, while the second, third and fourth ones were fed the same diet supplemented with 50, 75 or 100 mg chromium picolinate (MEP-ACO-Egypt) per kg diets, respectively, for 5 months.

Animals of all groups were fed *ad libitum* on a concentrate diet contained 16% crude protein. The diet composition is shown in Table (1). The daily consumption values of feed were recorded and water was offered freely to all animals and water consumption was estimated daily.

Animals were weighed at two successive days at the beginning of the experiment , then at 15 days intervals. Lams were housed in semi-open sheds all over the experimental period. Physiological parameters measured were rectal temperature, skin temperature, wool middle and surface temperature and respiration rate which measured three times a day at 8:00,12:00 and 16:00 h for one day every week during the experimental period.

Rectal temperature was measured by inserting YSI Electronic Thermometer Model 46. The wool surface temperature was measured by using the upper part of the hind-quarter at the right side of the animal. Respiration rate (RR) was counted by the consistent flank movements per one minute. All measurements were taken within a range of time that did not exceed 2-3 minutes for each animal. At the end of experimental period, blood samples were collected from ear vein of lambs of all groups for hematological and biochemical analysis. All the experimental animals were slaughtered for studying carcass traits . Before slaughtering, the lambs were fasted for 12 hours .

Table (1): Ingredients of lambs diets, chemical composition% and feeding value

Items	%
Ingredients	
Corn	83.00
Soya bean meal	15.00
Calcium carbonate	1.4
Sodium chloride	0.5
Minerals and vitamins	0.1
Chemical composition %	
Dry Matter	90.38
Crude Protein	16.15
Ether Extract	1.92
NFE	76.10
Ash	3.55
Feed Value	
TDN	78.70
SV	34.30
DCP	11.94

After slaughtering, the carcass was chilled , dissected into wholesale cuts (legs , loin , rack , shoulder , neck and brisket) where their weights were recorded .Slaughter weight , hot carcass , four feet , head , digestive tract (full and empty), lungs and trachea, testes, heart, liver, kidneys and internal fat (heart, kidneys and abdominal fat) weights were recorded. The dressing percentage was calculated as :hot carcass weight

+liver + heart + kidneys divided by slaughter body weight. Percentage of liver, heart, kidneys, lung and trachea, head, tail weight, full digestive canal, empty digestive canal, eye muscle weight and abdominal fat weight were also estimated relative to carcass weight. The data of body weight, daily body gain, rectum temperature, respiration rate, blood hematological and biochemical components were analyzed statistically according to **Snedecor and Cochran (1982)** as following: $xij = \mu + T_i + e_{ij}$ where, μ = general mean, T_i= fixed effect of i^{th} treatment (1,…..,4) and e_{ij} = random error. The differences between experimental groups were separated by Duncan's multiple range test **(Duncan, 1955)**

RESULTS AND DISCUSSION

The obtained results indicated that there was no significant difference in the initial live body weight of lambs in all experimental groups. The final live body weight and daily body weight gain significantly ($P<0.05$) increased by using the chromium picolinate at doses of 50, 75, or 100 mg per kg diets as supplementation. The rectal temperature, respiration rate and daily water intake were not affected, while carcass and non carcass components were affected by using chromium picolinate supplementation on diets, also feed efficiency was improved by using the same previous treatments, while the feed intake decreased. The best margin obtained for growing lambs were in the group fed on the diet supplemented with 100 mg chromium picolinate per kg diet comparing with the control group (Tables 2 and 3). The same trend was observed by **El-Masry *et al.* (2001)** in calves , **Gaber and Abdel-Monem (2003)** in rabbits and **Tahan *et al.* (2005)** in lactating cows .

The increase in growth rate and final body weight from supplemented Cr could be resulted from increased nitrogen retention **(Kornegay *et al.*, 1997),** incorporation and utilization of amino acids and nuclear protein synthesis **(Weser and Koolman, 1969)** and RNA synthesis **(Okada *et al.*, 1981).**

On the other hand, **Borel *et al.* (1984)** reported that the positive increase in growth performance by using Cr is likely attributable to the apparent effect of Cr on the distribution of energy between adipose and lean tissues. Moreover, the improve of immunity **(Mowat *et al.*, 1993)** and elevation in growth hormone level **(Page *et al.*, 1993)** may play a role in improvement of growth rate and body weight gain.

In response to blood parameters, Table (4) showed significant ($P<0.05$) decrease in cholesterol and triglyceride concentrations and increase in platelet count in all treated groups compared to control. All changes among other blood parameters had not been significant.

The results seem to be like that reported by **Al-Arel and Shamsi (1996),** who proved that prolonged use of chromium with increase of its concentration resulted in a significant depletion of the liver and muscle glycogen. Also the results of this study were in the same line with that produced by **El- Gharably (2000)**

who proved that chromium picolinate lower the serum cholesterol and triglycerides. The obtained result is in agreement with that obtained by **Campbell *et al.* (1997).** The authors studied the effect of chromium picolinate supplementation on hematological indices in moderately over weight man. They found that hematocrite, Hb% ,RBCs

Table (2) : Effect of chromium picolinate supplementation on growth performance, feed intake, feed conversion, rectal temperature, respiration rate and profit analysis of growing commercial lambs under summer Egyptian conditions (mean± SE).

Items	control	Chromium picolinate 50 mg / kg diet	Chromium picolinate 75 mg / kg diet	Chromium picolinate 100 mg/ kg diet	Sig.
Body weight (kg)					
Initial (1)	18.50±1.35	20.76±1.72	21.20±2.11	18.94±1.31	N.S
At 90 days of experiment (2)	28.98±1.87	31.74±2.31	32.62±2.57	32.91±1.95	N.S *
At 150 days of experiment (3)	35.12±2.49^{b}	39.51±2.18^{ab}	40.92±2.56^{a}	43.01±2.29^{a}	
Body weight gain (g/day)					*
From 1 to 2	116.4±7.12^{c}	122.0±11.66^{b}	126.9t12.77^{b}	155.2±9.81^{a}	**
From 2 to 3	102.3±9.48^{c}	129.5±13.02^{b}	138.3±12.90^{b}	168.3±13.34^{a}	**
From 1 to 3	110.8±10.53^{c}	125.0±12.79^{b}	131.5±15.19^{b}	160.5±12.68^{a}	
Some physiological parameters					N.S
Rectal temperature (°C)	39.01±0.37	39.14±0.24	39.09±0.19	39.32±0.32	N.S
Wool temperature (°C)	35.91±0.22	36.07±0.17	35.48±0.14	35.32±0.16	N.S
Respiration rate (R/min.)	81.57±3.27	79.19±4.38	84.26±3.46	78.13±4.19	
Feed intake (g/d)	785.7	657.9	657.5	764.3	N.S
Feed efficiency (kg gain / kg DM intake)	0.14	0.19	0.20	0.21	N.S
Water intake (ml/d)	2790.8	2650.3	2670.1	2752.4	
profit analysis	117.86	98.7	98.63	114.6	
Feed cost (LE / lamb)	166.2	187.5	197.2	240.7	
Return (LE / lamb)	48.34	88.8	98.57	126.1	
Margin (LE / lamb)					

Price : Experimental diet = 1.0 LE per kg diet , lambs live body weight = 10.0LE per kg , Margin per head = Return from body gain – feed cost . Other head costs were assumed constant . N S = not significant, * (P< 0.05) and **(P< 0.01) . Means in the same row bearing different letters differ significantly (P< 0.05).

count, mean corpuscular volume (MCV) and mean corpuscular hemoglobin (MCH) were within the normal clinical ranges, but the blood platelets in this work increased significantly ($P<0.05$) in its percent.

Chang and Mowat (1992) showed that serum immunoglobulin and total immune globulin in calves increased with chromium picolinate supplementation, which improves the immune state of the animal.

The obtained results showed similarity with that produced by **Shiau and Chen (1993)**. They proved that fish supplemented with chromium picolinate has greater weight gain than those have not been fed on the un supplemented diet. **Press *et al.* (1990) and Lee and Reasner (1994)** recorded that chromium picolinate supplementation is associated with lower serum triglycerides. Results were in accordance with that obtained by **Boyd *et al.* (1998)** who reported that chromium picolinat supplementation with exercise decreased total cholesterol. Also the results of this study were in the same line with that produced by **El- Gharably (2000)** who proved that chromium picolinate lowered the serum cholesterol and triglycerides.

It may be concluded that chromium picolinate rises the immunity of lambs under summer hot stress, so increases the growth rate and body gain, at the same time decreases the total cholesterol, tail weight and abdominal fat weight.

Table (3) : Effect of chromium picolinate supplementation on carcass and non carcass components of growing commercial lambs under summer Egyptian conditions.

Items	control		Chromium picolinate 50 mg / kg diet		Chromium picolinate 75 mg / kg diet		Chromium picolinate 100 mg/ kg diet	
	Weight (kg)	%	Weight (kg)	%	Weight (kg)	%	Weight (kg)	%
Slaughter weight	35.12	100	39.51	100	40.92	100	43.01	100
Hot carcass	15.95	45.42	19.35	48.97	21.14	51.7	23.7	55.1
Abdominal fat	0.23	0.65	0.24	0.61	0.25	0.61	0.25	0.58
Liver	0.52	1.48	0.59	1.49	0.57	1.39	0.62	1.44
Kidney	0.13	0.37	0.14	0.35	0.15	0.37	0.16	0.37
Tail	1.83	5.21	1.92	4.86	2.00	4.89	2.1	4.88
Head	2.47	7.03	2.84	7.19	2.94	7.18	3.09	7.18
Heart	0.21	0.60	0.25	0.63	0.28	0.68	0.33	0.77
Lung	0.49	1.39	0.52	1.32	0.55	1.34	0.62	1.44
Eye muscle	0.57	1.62	0.68	1.72	0.73	1.78	0.85	1.98

Table (4) : Effect of chromium picolinate supplementation on blood chemicals and blood picture of growing commercial lambs, under summer Egyptian conditions (mean± SE).

Items	control	Chromium picolinate 50 mg / kg diet	Chromium picolinate 75 mg / kg diet	Chromium picolinate 100 mg/ kg diet	Sig.
AST (U/L)	30.90±2.15	32.16±3.71	31.29±2.95	33.14±2.91	N.S
ALT (U/L)	22.18±1.67	21.75±2.01	22.92±2.36	23.31±1.99	N.S
Alkaline phosphates(mg/dl)	109.88±4.08	130.17±6.49	100.97±8.07	125.87±5.84	N.S
Total protein (g/dl)	6.19±0.47	6.21±0.52	6.73±0.27	6.45±0.29	N.S
Albumin (g/dl)	3.51±0.19	3.78±0.21	3.58±0.26	4.01±0.17	N.S
Globulin (g/dl)	2.68±0.12	2.43±0.14	3.15±0.19	2.44±0.15	N.S
Cholesterol (mg/dl)	89.8±7.12^{b}	65.0±5.66^{a}	62.9±4.57^{a}	59.2±6.81^{a}	*
Triglycerides	112.3±8.18^{c}	95.5±9.02^{b}	88.3±10.90^{b}	70.3±13.34^{a}	*
Urea (mg/dl)	25.46±1.54	25.0±1.76	31.5±1.13	30.5±1.62	N.S
Creatinine (mg/dl)	1.32±0.07	1.24±0.04	1.59±0.09	1.62±0.06	N.S
RBCs	5.2±0.21	4.9±0.25	5.6±0.31	5.3±0.19	N.S
WBCs	4.7±1.23	7.9±1.90	7.3±1.25	8.3±1.48	N.S
HB %	10.5±0.37	11.8±0.39	10.2±0.42	10.8±0.28	N.S
MCV%	63.24±1.88	63.11±2.01	62.52±2.17	64.73±1.95	N.S
MCH%	21.07±0.12	21.77±0.14	21.58±0.16	21.06±0.13	N.S
Platelets count	129.1±35.04	180.38±42.58	240.62±59.23	250.71±36.41	*
Hematocrite	40.0	35.67	39.77	41.02	N.S
Staff	1.1	0.93	0.82	0.79	N.S
Segmented cells	0.72	0.85	0.90	0.99	N.S
Lymphocyte%	45.0	44.09	52.86	40.25	N.S
Monocyte%	4.0	5.2	3.11	4.9	N.S
Basophils%	0.5	0.7	0.01	0.3	N.S
Eosinophils%	43.65	39.55	36.12	40.02	N.S

N S = not significant, * ($p< 0.05$) and ** ($p< 0.01$) . Means in the same row bearing different letters , differ significantly ($p< 0.05$).

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