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Effects of chromium piclonate and ascorbic acid supplementation on growth performance, carcass traits, blood constituents and picture of growing kids under the summer conditions

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The present work was performed to study the effect of chromium piclonate and/or ascorbic acid supplementation on the performance of growing kids during hot summer season (33.6°C and 74.2% RH). A total number of twenty four weaned commercial kids were randomly distributed into four treatment groups of 6 kids per each Kids in all treatments were equal in number and had nearly similar initial body weight. The first group was fed the basal diet and served as control (0.0 supplementation), while the other three groups were fed diets supplemented with 75 mg/kg diet chromium piclonate, 800 mg/ kg diet ascorbic acid and 75 mg / kg diet chromium piclonate + 800 mg ascorbic acid, respectively. The results obtained for growing Kids showed that the final live body weight and daily body gain were increased significantly (P < 0.05 or 0.01) during 210 and 270 days for Kids fed diets supplemented with chromium piclonate, ascorbic acid and chromium piclonate + ascorbic acid. However, the supplementation of chromium piclonate + ascorbic acid seemed to be the best significant performance. The results obtained for growing Kids showed that the daily feed intake, feed conversion, water/feed intake ratio, water/daily gain ratio were increased significantly (P < 0.05 or 0.01) during the experimental periods for Kids fed diets supplemented with chromium piclonate, ascorbic acid and chromium piclonate + ascorbic acid. The Results showed that water intake, rectum temperature and respiration rate were not significantly affected by previous treatments. The best margin was obtained in group fed on the diet supplemented with chromium piclonate + ascorbic acid. All carcass traits were increased insignificantly due to dietary chromium piclonate and/or ascorbic acid supplementation. Serum total proteins were increased significantly (P < 0.05), in group three only while the cholesterol level and triglycerides decreased significantly (P<0.05) in Kids treated with chromium piclonate as compared with the control group under summer heat stress conditions. Serum albumin, globulin, urea-, creatinine, AST, WBCs, RBCs MCV, MCH and Hb content were insignificantly affected by chromium piclonate and /or ascorbic acid supplementation to the kids' diets. Finally, it could be concluded that supplementation of 75 mg chromium piclonate + 800 mg ascorbic acid / kg diet to the kid diets is necessary to improve the productivity, under the summer conditions.

In tropical and sub- tropical countries, climatic heat is the major constraint on animal productivity. Production and reproduction are impaired as a result to the drastic changes in biological functions caused by heat stress (Kamal *et al.,* 1989 and Marai *et al.,* 2006). Live body weight and gain were decreased by exposure to heat stress. Ascorbic acid, which is present in most animal cells, has numerous biochemical functions. It is essential for growth and counteracting infections caused by pathogenic bacteria and viruses. Verde and Piquer, (1986) noted that the plasma ascorbic acid concentration was significantly reduced in animals exposed to stress. In other species, supplementary ascorbic acid has been shown beneficial in reducing the effects of stress. This means that the metabolic need for ascorbic acid is increased at certain conditions. Therefore, the growth–promoting effect of ascorbic acid may be associated with the alleviation of retardation in the thyroid function, (Coates, 1984).

Abdel-Hamid, (1994) found that body weight, body weight gain, feed intake and feed conversion were improved significantly (P<0.01or 0.05)

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during the summer period for growing rabbits when fed diets supplemented with ascorbic acid, also, Afify and Makled, (1995) found that the growth performance and blood components were affected significantly (P<0.05) with ascorbic acid supplementation at 200 mg / kg diet for bouscat rabbits till 6 months of age. Abdel-Hamid and El-Adawy, (1999) reported that the ascorbic acid supplementation at 300 or 600 mg/kg of rabbit diets improved significantly (P<0.01) growth performance and, economical efficiency when compared with the control. There is no information about the effect of ascorbic acid on the performance of growing kids

Chromium is one of the most important trace elements, its 1evel must be constant in the blood, and it is responsible for maintenance of the blood glucose level (Underwood, 1977). It plays a role in the glucose tolerance, where it facilitates the attachment of insulin to its receptors, so potentiates the action of insulin (Anderson, 1987). Johnson, (1986); Moonsie–Shgeer and Mowat, (1993) reported that chromium may improve the immune response of stressed animals. Later, Kegley *et al.,* (1997) recorded that supplemental organic chromium has markedly improved the growth rate and immune response of stressed feeder calves. Chromium piclonate decreased the total cholesterol, LDL cholesterol (Press *et al.,* 1990). Also reduced body fat while the lean mass was increased (McCarty, 1991).

The present study was conducted to study the effect of chromium piclonate and/or ascorbic acid supplementation on the performance of growing kids, under summer heat stress conditions (33.6^{o}C and 74.2% RH).

Materials and methods

A total number of twenty four weaned commercial kids were randomly distributed into four treatment groups of 6 kids per each. Kids in all treatments were equal in number and had nearly similar initial body weight. The first group was fed the basal diet as control (0.0 supplementation), while the other three groups were fed the basal diets supplemented with 75 mg chromium piclonate / kg diet, 800 mg ascorbic acid / kg diet and 75 mg chromium piclonate + 800 mg ascorbic acid / kg diet, respectively. Animals were individually weighted at two successive days at the beginning of the experiment and then at 15 days intervals up to the end of experiment (3 months). The daily feed and water consumption were recorded and the feed efficiency was estimated.

Kids were housed in semi- open sheds allover the experimental period. All groups were fed ad libitum on a concentrate (as mixture basal diet as shown in Table 1). Rectal temperature and respiration rate were measured three times at 8.00, 12.00 and 16.00 hrs. for one day every week, during the experimental periods. Rectal temperature was measured by inserting YSI Electronic Thermometer Model 46. 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.

Table (1): Ingredients of kids' 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	2.28
Ash	76.10
Moisture	3.55
Feed Value	
TDN	55.50
SV	34.30
DCP	11.94

At the end of experimental period, blood was collected from the marginal ear vein after shaving and cleaning with alcohol in less than 2 minutes into dry clean centrifuge tubes for hematological and biochemical analysis. Serum samples were separated by centrifugation at 3000 rpm for 20 minutes and kept in a deep freezer at -20^{o}C until analysis. Total proteins (Weichselbaum, 1946), albumin (Doumos *et al.,* 1971), urea (Fawcett and Scott, 1960), creatinine (Bord and Sirota, 1948), cholesterol (Richmond, 1973), triglycerides (Eggstein, and Kuhlmann, 1974) concentrations and AST and ALT enzyme activities (Reitman and Frankel, 1957) were estimated. Globulin values

were obtained by subtracting the values of albumin from the corresponding values of total proteins. Five kids in each group were slaughtered for studying carcass traits. Before slaughter the kids were fasted for 12 hrs. The dressing percentage was calculated as (hot carcass weight, liver, heart and kidneys) relatively to slaughter body weight. Data obtained were statistically analyzed by using completely randomize design according to Snedecor and Cochran, (1982) by the following model: Xij = μ +Ti +eij where, μ = general mean, Ti= fixed effect of the treatments (1,…..,4) and eij = random error. The differences between experimental groups were separated by Duncan s multiple range test (Duncan, 1955).

Results and discussion

Growth performance. Data in Table 2 revealed that the growth performance of the growing kids in terms of final live body weight and daily body gain were increased significantly ($P < 0.05$ or 0.01) during 210 and 270 day age groups during all the experimental periods for Kids fed diets supplemented with chromium piclonate, ascorbic acid and chromium piclonate + ascorbic acid. However, the supplementation of chromium piclonate + ascorbic acid seemed to be the best significant performance. The previous results agree with Abdel-Hamid and El-Adawy, (1999) who found that the addition of 600 mg of ascorbic acid increased significantly ($P<0.01$) final body weight and daily weight gain by 3.04 and 9.41 % respectively, than in the control group. Also, other authors obtained the same results such as Abdel-Monem, (2000) in rabbits, Shahin and Kucuk, (2001) in Japanese quails, Sahina *et al.,* (2003)**;** Asli *et al.,* (2007) found the same trend in laying hens. The supplementation of calve diets with chromium piclonate increased significantly ($P<0.05$) final body weight and daily weight gain than in the control group El-Masry *et al.,* (2001); 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 increases in growth performance by using Cr 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 gain.

The results obtained for growing Kids showed that the daily feed intake, feed conversion, water ⁄ feed intake ratio, water ⁄ daily gain ratio were increased significantly ($P < 0.05$ or 0.01) during the experimental periods for Kids fed diets supplemented with chromium piclonate, ascorbic acid and chromium piclonate + ascorbic acid **(**Table 2**)**. The beneficial effects of growth, feed intake and feed conversion due to ascorbic acid supplementation may be due to that ascorbic acid helps to control the increase in body temperature and plasma corticosterone concentration. It also, protects the immune system and it has an important role in bone formation through the growth rate (Pion *et al.,* 2004; Asli *et al.,* 2007).

The Results showed that water intake, rectum temperature and respiration rate were not significantly affected by previous treatments. The best margin was obtained in group fed on the diet supplemented with chromium piclonate + ascorbic acid. All carcass traits were increased insignificantly due to dietary chromium piclonate and ⁄ or ascorbic acid supplementation (Table 2). Similar results were obtained by Gaber and Abdel-Monem, (2003) who found that the rectum temperature and respiration rate were not significantly affected by the presence of chromium piclonate in the rabbit diets.

Carcass traits. All carcass traits studied (Dressing %, Liver weight%, Head weight % and the eye muscle weight%) were increased due to using chromium piclonate and ⁄ or ascorbic acid supplementation on the kid diets Table (3). Similar results were obtained by Pion *et al.,* (2004) who found that feeding growing swine on diets containing ascorbic acid increased the carcass and non carcass weights.

Some blood parameters and constituents. The results obtained for the blood serum of growing Kids showed that the total proteins in vitamin C group increased significantly ($P < 0.05$), while the cholesterol and triglycerides were decreased significantly ($P<0.05$ or 0.01) in Kids treated with chromium piclonate as compared with the control group under summer conditions (Table 4).

Serum albumin, globulin, urea, creatinine, AST, WBCs, RBCs MCV, MCH and Hb content were insignificantly affected by chromium piclonate and ⁄ or ascorbic acid supplementation to the kids diets (Table 4).

The results seem to be like that produced by Campbell *et al.,* (1997) who found that hematocrite, Hb% ,RBCs count, mean corpuscular volume (MCV) and mean corpuscular hemoglobin (MCH) were within the normal clinical ranges, but the blood platelets was increased significantly (P<0.05) by using chromium piclonate supplementation. Chang and Mowat, (1992) who showed that serum globulin in calves were increased with chromium piclonate supplementation; this improves the immune state of the animal. Our result was similar with that produced by Lee and Reasner, (1994); El-Gharably (2000). They recorded that chromium piclonate supplementation is associated with lower serum triglycerides, also we are on the same ground with Boyd *et al.,* (1998) who reported that chromium piclonate supplementation decreased total cholesterol and LDL.

It could be concluded that supplementation of 75 mg chromium piclonate + 800 mg ascorbic acid / kg to the kid diets is necessary to improve the productivity, under the summer conditions.

Table (2): Effect of chromium piclonate and ⁄ or ascorbic acid supplementation on growth performance, some physiological parameters and profit analysis of growing commercial kids, under summer conditions.

Items	Control	Cr 75 mg/kg diet	Vit. C 800 mg/kg diet	Cr 75 mg + Vit.C 800 mg/kg	Sig.
Body weight					
At 120 day of age	8.4	9.1	9.0	8.9	N.S
At ٢١٠ day of age	18.2 [b]	19.5 [ab]	20.6 [a]	21.9 [a]	*
At ٢٧٠ day of age	25.7 [c]	29.9 [b]	31.5 [ab]	33.3 [a]	**
Daily gain					
120 - 210	108.9 [c]	115.6 [cb]	128.9 [b]	144.4 [a]	**
٢١٠ -270	156.7 [b]	173.3 [a]	181.7 [a]	190.0 [a]	**
12٠ - 270	115.3 [b]	138.7 [ab]	150.0 [a]	162.7 [a]	**
Feed intake	492.5 [b]	571.8 [a]	590.8 [a]	610.9 [a]	**
Feed conversion	4.3 [a]	4.1 [ab]	3.9 [b]	3.8 [b]	*
Water intake	1037.3	987.5	1009.5	1005.7	N .S
Water/Feed intake ratio	2.1 [a]	1.7 [b]	1.7 [b]	1.6 [b]	*
Water/daily gain ratio	9.0 [a]	7.1 [b]	6.7 [b]	6.2 [b]	*
Some physiological parameters					
Rectum temp.	39.9	39.6	39.9	39.5	N.S
Respiration rate	91	86	83	94	N.S
Profit analysis					
Feed cost	147.6	171.6	177.2	183.2	
Return	242.2	291.2	315.0	341.6	
Margin	94.6	119.6	137.8	158.4	

Price: Experimental diet = 1.0 LE per kg diet, kids 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 a, b and c in the same row bearing different letters, differ significantly (p< 0.05).

Table (3): Effect of chromium piclonate and / or ascorbic supplementation on carcass traits of growing commercial kids under summer conditions.

Items	Control	Cr 75 mg/kg diet	Vit. C 800 mg/kg diet	Cr 75 mg + Vit.C 800 mg/kg
Carcass traits				
Dressing %	48.3	50.6	51.2	54.1
Liver weight%	1.4	1.5	1.8	1.8
Head weight %	7.4	7.1	6.8	6.7
Eye muscle weight	1.6	1.7	1.8	1.9

Table (4): Effect of chromium piclonate and /or ascorbic supplementation on serum biochemical parameters and blood picture of growing commercial kids, under summer Egyptian conditions.

Items	Control	Cr 75 mg/kg diet	Vit. C 800 mg/kg diet	Cr 75 mg + Vit.C 800 mg/kg	Sig.
Total protein (g/dl)	7.3±0.49 [b]	7.6±0.41[ab]	8.0 ±0.67[a]	7.4 ±0.53[b]	*
Albumin (g/dl)	3.9±0.19	3.7±0.29	4.1±0.31	4.3±0.23	N.S
Globulins(g/dl)	3.4±0.16	3.9±0.20	3.9±0.22	3.1±0.19	N.S
Urea (mg /dl)	24.1±1.32	28.6±1.19	21.9±1.43	26.04±1.27	N.S
Creatinin (mg /dl)	1.3±0.09	1.4±0.04	1.1±0.07	1.5±0.05	N.S
T.Cholesterol (mg /dl)	78.2±5.19 [a]	71.8±7.22 [b]	80.5±6.12 [a]	76.1±7.32 [a]	*
Triglycerides (mg /dl)	103.9±12.1 [a]	88.4±8.7 [b]	98.9±9.2 [a]	94.7±10. 8 [a]	**
AST (U/L)	32.9±2.15	33.5±2.90	31.1±3.27	34.3±2.95	N.S
ALT(U/L)	19.7 ±1.77[a]	20.9±1.81 [a]	18.4±1.47 [b]	20.5 ±1.65[a]	*
Blood picture					
RBcs count	6.7±0.29	5.5±0.21	6.3±0.32	5.8±0.17	N.S
WBcs	7.2±1.43	7.0±1.28	6.8±1.71	7.4±1.25	N.S
HB %	8.9±0.39	9.1±0.27	8.6±0.31	8.4±0.41	N.S
MCV %	55.6±0.15	52.9±0.16	59.2±0.14	50.7±0.19	N.S
MCH %	19.9±1.56	18.5±1.98	18.8±1.84	19.1±1.62	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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تأثير إضافة بيكلونات الكروميوم و/أو حامض الأسكوربيك علي أداء النمو وصفات الذبيحة وبعض قياسات الدم وصورة الدم في الجداء النامية تحت ظروف الصيف

صممت هذه التجربة لدراسة تأثير إضافة بيكلونات الكروميوم و/ أو حامض الأسكوربيك علي أداء الجداء النامية تحت ظروف موسم الصيف الحار (حيث كانت درجة الحرارة = ٣٣,٦ و معدل الرطوبة النسبية ٧٤,٢) . أجريت هذه الدراسة علي عدد ٢٤ جدي محلي مفطوم عند عمر أربع شهور حيث وزعت الجداء عشوائياً علي أربع مجاميع تجريبية (٦ حملان في كل مجموعة). المجموعة الأولي اعتبرت مجموعة ضابطة بينما المجموعة الثانية والثالثة والرابعة قد تم تغذيتها علي عليقة ضابطة مضافاً لها بيكلونات الكروميوم ٧٥ مجم / كجم عليقة وحامض الأسكوربيك ٨٠٠ مجم / كجم عليقة و بيكلونات الكروميوم ٧٥ مجم / كجم عليقة + حامض الأسكوربيك ٨٠٠ مجم / كجم عليقة علي التوالي لدراسة أداء النمو وبعض قياسات الدم وصورته إضافة إلى صفات الذبيحة. وقد أظهرت النتائج أن وزن الجسم النهائي ومعدل الزيادة اليومية في وزن الجسم وكذلك الغذاء المأكول وكفاءة تحويل الغذاء قد زادوا معنوياً (علي مستوي ٠,٠١ و ٠,٠٥) طوال فترات التجربة علي الجداء التي تغذت علي عليقة بها حامض الأسكوربيك. بينما وجد أن إضافة بيكلونات الكروميوم بمستوي ٧٥ مجم / كجم عليقة + حامض الأسكوربيك بمستويات ٨٠٠ مجم / كجم عليقة يبدوا المعاملة الأمثل تبعاً لأفضلية الأداء المعنوي . أظهرت النتائج أن درجة حرارة الجسم ومعدل التنفس لم يتأثروا معنوياً بوجود بيكلونات الكروميوم و/ او حامض الأسكوربيك في غذاء الجداء. وجد أن أفضل عائد نهائي كان في المجموعة التي تم تغذيتها علي عليقة مضافا اليها حامض الاسكوربيك بمعدل ١٠٠٠ مجم. كما أن صفات الذبيحة لم تتأثر أيضاً بإضافة حامض الأسكوربيك . كما وجد أن جميع صفات الذبيحة تحسنت بدرجة غير معنوية في المجاميع التي تغذت علي عليقة بها بيكلونات الكروميوم بمستوي ٧٥ مجم / كجم عليقة أو حامض الأسكوربيك بمستويات ٨٠٠ مجم / كجم عليقة أو بيكلونات الكروميوم بمستوي ٧٥ مجم / كجم عليقة + حامض الاسكوربيك بمستويات ٨٠٠ مجم / كجم عليقة عند مقارنتها بمجموعة الكنترول تحت ظروف الصيف. بروتين الدم الكلي ,ALT ارتفعوا معنوياً بينما وجد أن الكوليسترول والدهون الثلاثية قد انخفضوا معنوياً علي مستوي (٠,٠٥) . في حين أن الألبيومين والجلوبيولين واليوريا و ,AST والكرياتيينين لم يتأثروا معنوياً في الجداء التي تغذت علي عليقة بها بيكلونات الكروميوم و / أو حامض الأسكوربيك عند مقارنتها بمجموعة الكنترول تحت ظروف الصيف. كما أن العدد الكلي لكل من كرات الدم البيضاء وكرات الدم الحمراء والهيموجلوبين ونسبة حجم الكرات و وحجم الخلايا المقسمة والهيماتوكريت لم يتأثروا معنوياً بإضافة بيكلونات الكروميوم و/أو حامض الأسكوربيك في غذاء الجداء. التوصية : من الواضح أن إضافة بيكلونات الكروميوم ٧٥ مجم / كجم عليقة + حامض الأسكوربيك ٨٠٠ مجم / كجم عليقة ضروري لتحسين انتاجية الجداء تحت ظروف الصيف الحار.