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Effect of Different Chromium Picolinate Levels as Feed Additives on Quail Meat Characteristics

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Abstract: This study investigates the effect of different chromium picolinate levels as food supplementation and sex on Japanese quail meat characteristics. Ninety Japanese quail chicks with one day of age were reared in 34^{0}C temperature and continuously feed and water providing at the Faculty of Agriculture-, University of Diyala animals' field, vitamins were provided with water and temperature were monitored continuously. Birds were allocated for three treatments with convergent of weight average when reached the age of 14 days, each treatment contain three replicates and ten birds for each replicate, each replicate birds were rearing in cage with 50×50×50cm for four weeks (until 42 day of age), all treatments birds were provide with free same ration and chromium was added to the treatments ration as follows: control treatment: without chromium, treatment one (T1) adding 250µg (0.25mlg) chromium picolinate/kg ration, treatment two (T2) adding 500µg (0.5mlg) chromium picolinate/kg ration. After the period of the experiment finished, six birds were selected randomly from each treatment (three from each sex) and weighted then slaughtered, many measurements were taken from meat and carcasses, including hot and cold carcass weight, dressing percentage, carcass cuts weight, breast and leg cooking loss, thawing loss and meat chemical composition. Statistical analyses show that no clear effect of supplementation on these measurements and no real benefits from adding it with quail ration in this ratio and this experiment conditions and traits. It might be concluded that the chromium presented normally in ration and water was adequate to normal quail requirement and chromium supplementation may not be essential. Higher chromium ratio should be tested.

Key words: Chromium picolinate,, supplementary food, Japanese quail.

Introduction

In recent years, there was an increase in Japanese quail researches as one of the Animal Production Research because of the economic and nutritional importance that occupied by products of its eggs and meat in various countries around the world (Minvielle, 2004; Rogerio, 2009) and also because of the many positive points that owned by it. Among the most important factors that -encouraged us to conduct this research or focus on quail as an alternative of chicken is the easiness to deal with this bird as a result of its small size and small rearing required area, in addition to the low consumption of food and high growth rate and efficiency conversion of feed (Abdel-Azeem *et al*., 2001), high resistance to diseases and the increasing demand for its products from eggs and meat to meet the nutritional needs as sources of high nutritional value products (Loniţă *et al*., 2010; N.R.C., 1991). Chromium (Cr) is a metallic element that exists naturally in earth crust. It has been used as a marker for the passage of foods and nutrient through the gastrointestinal tract (Lindemann, 2007). There are several forms of Cr according to equivalency degree. The most stable form is trivalent chromium (Cr^{+3}) which also exist in two types: organic such as chromium picolinate and inorganic such as chromium chloride. Chromium picolinate is trivalent chromium which linked with organic material which is picolinic acid (Zafra-stone, 2007). Several researches in last decades were interested in Cr as one of the essential trace elements, which have a beneficial effects when used as a nutritional feed supplement for different avian species (Amata, 2013; Vincent and Stallings, 2007), who indicated that there is a positive relationship of these additives in gaining weight and feed conversion efficiency, increase in relative organ weight, muscle development and relative breast mass (Khan *et al*., 2014), increase in breast and thigh muscle protein levels (Anandhi *et al*., 2006). It also illustrates that the reason of why Cr has been a popular mineral supplement comes from that it increases the retention of other essential elements in blood and decrease their excretion. Also the beneficial of Cr effects have been linked with improve nutrient digestion and enhanced metabolism (Khan *et al.,* 2014), and linked with its important effect in each body protein, carbohydrate and lipid metabolism as it is one of the metabolic modifiers and its positive effect on insulin action (Lindner, 1991; Vincent, 2000). Chromium supplementation also may improve function of various digestive organs such as liver and pancreas with regards to secretion of digestive enzymes (SAS 2004), Since the utilization of chromium in animal feed intake and diets is usually low (Ghanbari *et al*. 2012), and because there is no N.R.C. recommendation for chromium supplementation value for poultry diets (N.R.C., 1994). This study was conducted to investigate the effect of feed additives of different chromium picolinate levels on quail meat characteristics.

Materials and Methods

The study was conducted at the Faculty of Agriculture, University of Diyala animals field for the period from 24/2/2015 until 06/04/2015 where 90 Japanese quail chicks with one day of age were reared in 34°C of heat and continuously feed and water providing, vitamins were provided with water, temperature were monitored continuously according to rearing temperature table. Birds when reach the age of 14 days were allocated for three treatments with convergent of weight average, each treatment contain three replicates and ten birds for each replicate, each replicate birds were rearing in cage with 50×50×50cm, treatment cages were built in good ventilated and lighted room, birds were reared for four weeks (until 42 day of age), all treatments birds were provide with free same ration (table 1) and chromium was added to the treatments ration as follows: control treatment: without chromium, treatment one (T1) adding 250µg (0.25mlg) chromium picolinate/kg ration, treatment two (T2) adding 500µg (0.5mlg) chromium picolinate/kg ration. After finishing the period of the experiment, six birds were selected randomly from each treatment (three from each sex), each bird was weighted then slaughtered and hot carcasses weight recorded, then carcasses were chilled in 4°C overnight then cold carcass weight was recorded and dressing percentage was calculated. Carcasses were cut and also recorded, then samples of breast and legs meat were taken from the same point of each carcasses cuts then samples were weighted and frozen (-18ºC) for one week then thawed on refrigerator (4 ºC for 12 hours) and dried with blotting paper and weighted again, thaw loss was calculated as follow: thaw loss (%)= [(frozen sample weight- thawed weight)/frozen weight] ×100. Thawed samples then cooked (dried cooking under 200 º for 15 min) then dried with blotting paper and weighted again, cooking loss was calculated as follow: cooking loss (%)= [(thawed sample weight- cooked weight)/thawed weight] ×100. Another meat samples were taken from the same cuts point to estimate the chemical composition of breast and leg meat. Statistical analysis was conducted to investigate treatments and sex effect and their interactions on different measurements by statistical analysis program (15) with completely randomized design (CRD), then differences between the averages were compared by Duncan polynomial test (Duncan 1955).

Table (1): Composition of basal diet used in study.

ingredient	%
Crushed yellow corn	57
Soybean meal	29
protein	10
Vegetable oil	3
calcium carbonate	0.7
salt	0.3
Crude protein	22.6
Metabolizable energy (kcal/kg)	3064.8

Results and Discussion

Table (2) shows the effect of different chromium levels and sex on slaughtering weight, hot weight, cold weight and dressing percentage. It can be noticed that there were no significant effects for different treatments on studied traits, as well no significant effects for sex on that traits except on dressing percentage where there was a superiority ($P \leq 0.01$) of males when compared with females, that effects were deflected on the results of interaction between treatments and sex it can be can noticed no significant effects on studied traits except there was a superiority ($P \leq 0.01$) of interaction between males and treatments when compared with the interaction between females and treatments in dressing percentage traits. Those results were agree with Al-Hajo *et al*. (2012), who conclude that there is a superiority of quail male dressing percentage comparing with female, and agree with Ghanbari *et al*. (2012), who conclude that there are no significant effects of adding organic chromium with broiler diets on carcass traits. Table (3) shows the effect of

Table (2):Effect of different chromium levels and sex on slaughtering weight, hot weight, cold weight and dressing percentage (mean± SD error) (Different letters refer to significant differences (P≤0.01) between means).

Traits	Slaughter weight (gm)		Hot weight (gm)		Cold weight (gm)		Dressing percentage	
Treatments								
Control	160.33± 6.67		110.66 ± 4.89		107.66 ± 4.52		67.19 ±1.40	
T1	157.16± 6.07		106.50 ± 4.66		102.50 ± 4.88		65.21± 1.68	
T2	176.66 ± 6.28		119.33 ± 4.71		144.66 ± 5.32		65.00 ± 2.36	
Sex								
Male	159.55 ± 5.83		114.00 ± 4.61		110.77 ± 4.66		69.32 ± 0.59 a	
Female	169.88 ± 5.29		110.33± 3.65		105.77 ± 3.62		62.28± 1.06 b	
Interaction								
	Male	Female	Male	Female	Male	Female	Male	Female
Control	153.6±2.72	167.0±13.1	109.3±2.4	112.0±10.6	106.6±2.18	108.6±9.83	69.4±0.21 a	65.0±2.23 bc
T1	152.0±9.6	162.3±8.11	107.6±9.17	105.3±4.84	104.3±9.33	100.6±5.36	68.4±1.87 ab	62.0±0.57 dc
T2	173.0±13.1	180.3±3.48	125.0±8.62	113.6±2.18	121.3±9.2	108.0±3.51	70.1±0.19 a	59.9±1.28 d

different chromium levels and sex on carcass cuts weight. It can be noticed that there were no significant effects for treatments or sex or interaction on main quail cuts weight. Table (4) shows the effect of different chromium levels and sex on breast and leg cooking and thawing loss. There was no significant effect of each treatments and sex and their interaction on breast and leg cooking loss, however there was a non-significant decrease in breast and leg cooking loss for chromium treatments comparing with control treatment, It also was non-significant decrease in breast and leg cooking loss for the interaction between chromium treatments and sex comparing with control and sex interaction treatments. Where there was a decrease in breast and leg thaw loss for chromium treatments comparing with control treatment, and for interaction treatments and sex for chromium treatments when comparing with control treatment also, that decrease was unclear trend between significant (P≤0.01) and non-significant decrease. That decrease may be due to the metabolic modifier effect of chromium (Lindner, 1991; Vincent, 2000) which may affect the energy in breast and leg muscles and after slaughtering affect the final muscles pH which helps muscles to maintain more moisture thereby decrease losing water when cooking or thawing.

Tables (5) and (6) show the effect of different chromium levels and sex on chemical composition of breast and leg respectively. It can be noticed no significant effects of treatments and sex and their interaction on chemical composition of each breast and leg.

From results above It can be concluded that there are no real benefits from adding organic chromium with quail ration in this

Table (3): Effect of different chromium levels and sex (♀: Female, ♂: Male) on carcass cuts weight (mean± SD error).

Traits	Cooking loss (%)				Thawing loss (%)			
	Breast		Leg		Breast		Leg	
Treatments								
Control	43.40±1.67		46.75±7.45		18.32±1.31 a		5.26±0.51 a	
T1	37.29±3.89		33.26±1.88		14.40±2.31 ab		5.23±0.34 a	
T2	34.06±1.92		34.86±1.62		9.55±1.13 b		3.19±0.32 b	
Sex								
Male	37.75±1.93		34.11±1.74		13.54±1.42		4.80±0.44	
Female	38.75±2.99		42.47±5.23		14.64±2.14		4.32±0.48	
Interaction								
	♂	♀	♂	♀	♂	♀	♂	♀
Control	41.7±3.32	45.1±0.43	30.8±4.43	32.8±1.66	17.9±2.41 a	18.8±1.59 a	5.3±0.91 a	5.2±0.70 a
T1	36.1±3.33	38.5±7.94	34.2±1.16	32.4±3.94	11.7±0.64 ab	17.1±4.37 a	5.5±0.40 a	5.0±0.60 a
T2	35.5±3.28	32.7±2.42	37.4±2.09	32.3±1.53	11.0±2.00 ab	8.1±0.45 b	3.6±0.40 ab	2.8±0.45 b

Table (4): Effect of different chromium levels and sex on breast and leg cooking and thawing loss (mean± SD error).

Traits	Breast (gm)		Leg (gm)		Dram stick (gm)	
Treatments						
Control	59.16±3.49		38.16±1.60		11.16±0.60	
T1	54.16±2.56		35.66±2.10		10.16±0.54	
T2	61.66±3.77		40.00±2.01		11.83±0.47	
Sex						
♂	59.66±3.17		39.55±1.67		10.77±0.54	
♀	57.00±2.38		36.33±1.39		11.33±0.40	
Interaction						
	♂	♀	♂	♀	♂	♀
Control	59.3±2.96	59.0±7.23	38.6±1.20	37.6±3.33	10.3±0.33	12.0±1.00
T1	54.3±5.33	54.0±2.08	37.0±3.51	34.3±2.84	10.0±1.15	10.3±0.33
T2	65.3±7.31	58.0±2.08	43.0±3.21	37.0±1.00	12.0±1.00	11.6±0.33

Table (5): Effect of different chromium levels and sex on chemical composition of breast(mean± SD error).

Traits	Breast									
	Moisture (%)		DM (%)		Ash (%)		EE (%)		CP (%)	
	Treatments									
Ctrl	74.00±1.03		26.00±1.03		2.06±0.64		24.85±1.79		12.75±0.68	
T1	73.42±0.45		26.66±0.50		1.19±0.15		17.79±1.57		12.65±0.86	
T2	73.34±0.50		26.65±0.50		3.68±0.88		18.52±2.66		12.97±0.65	
	Sex									
♂	73.96±0.65		26.03±0.66		1.93±0.59		20.98±1.49		12.90±0.61	
♀	73.21±0.43		26.84±0.45		2.03±0.81		19.80±2.34		12.68±0.55	
	Interaction									
	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
Ctrl.	75.36±1.79	72.63±0.51	24.63±1.79	27.36±0.51	1.88±0.92	2.24±1.10	25.38±2.53	24.32±3.07	13.01±1.33	12.49±0.68
T1	72.92±0.21	73.93±0.84	27.08±0.21	26.25±1.03	1.34±0.31	2.04±0.90	19.61±1.85	15.98±2.36	13.70±1.40	11.61±0.81
T2	73.61±0.61	73.07±0.90	26.38±0.61	26.92±0.90	3.56±0.84	3.81±1.77	17.95±1.37	19.09±5.76	11.99±0.33	13.94±1.05

Table (6): Effect of different chromium levels and sex on chemical composition of leg(mean± SD error).

Traits	Leg									
	Moisture (%)		DM (%)		Ash (%)		EE (%)		CP (%)	
	Treatments									
Control	74.33±1.64		25.83±0.75		1.91±0.97		19.72±2.05		14.32±0.73	
T1	73.51±0.90		26.48±0.90		0.92±0.64		17.41±2.04		13.59±0.66	
T2	73.68±1.25		26.31±1.25		2.51±0.44		15.30±1.71		13.01±0.54	
	Sex									
Male	73.61±1.78		26.48±0.78		2.21±0.67		17.62±1.59		13.30±0.57	
Female	74.52±1.68		25.58±0.73		1.36±0.49		17.33±1.73		13.98±0.48	
	Interaction									
	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
Control	75.47±1.76	73.18±1.42	24.52±0.76	27.14±0.75	2.76±1.71	1.07±1.03	22.17±2.43	17.27±3.04	13.65±1.46	14.99±0.28
T1	71.62±0.59	75.40±1.37	28.38±0.59	24.59±0.37	2.51±0.47	1.33±1.29	17.27±1.87	17.56±4.17	13.12±0.68	14.06±1.22
T2	72.38±1.53	74.97±1.97	27.61±1.53	25.02±1.97	2.35±0.35	1.67±0.38	13.43±1.36	17.16±3.04	13.12±1.12	12.90±0.45

ratio and this experiment conditions and traits, also we might be conclude that the ration and water chromium is adequate to normal quail requirement and chromium supplementation may not be essential or we should test higher chromium ratio.

Conclusions

There were no clear effects of chromium picolinate supplementation on measurements that might be due to the chromium adequate percentage present in ration and water that provided to quail. Quail does not need additional chromium than already present in the water. However , higher chromium ratio should be tested.

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