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CHROMIUM PICOLINATE FEED SUPPLEMENT AND COMPOSITION OF MEAT IN BIRD

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Abstract
The aim of this study was to investigate the effects of varying chromium picolinate feed supplement and composition of meant in bird. The study was carried out at a university farm in Diponegoro University in Indonesia. Ninety quail chicks were kept in a temperature of 340 degrees Celsius for one day. The chicks were then fed and monitored continuously. For three treatment sessions, the birds were placed in cages with a weight average of 14 days old. Each treatment consisted of three replicates and ten birds. The birds were kept in a cage with a weight of 50x50x50cm for four weeks. The control treatment was given without chromium while treatment one (T1) adding 250µg (0.25mlg) chromium picolinate/kg ration, treatment two (T2) adding 500µg (0.5mlg) chromium picolinate/kg ration. After the experiment ended, six birds were randomly selected for the study. They were weighed and measured for various parameters, such as carcass weight, cooking loss, and meat chemical composition. Statistical analyses revealed that the chromium supplementation did not affect the quail's measurements. It also suggested that the chromium in their ration was adequate to meet their normal requirements.

Keywords*:* Chromium picolinate, supplement feed, bird meat.

Introduction

In the past couple of years, the demand for quail products has increased due to the 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.

Aside from its small size and small rearing area, quail has other advantages such as its high growth rate and resistance to diseases. This animal also provides a low consumption of food and a high conversion rate(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).

Chromium (Cr) is a metallic element that's found naturally in the earth crust. It's used as a marker for the completion of food and nutrient passes through the gastrointestinal tract (Lindemann, 2007). There are various forms of Chromium, each of which has its own stable form. The most common form is trivalent chromium, which also exists in organic and inorganic forms.

Various studies conducted during the last decades indicated that chromium can have a positive effect on the development and weight gain of various bird species (Amata, 2013; Vincent and Stallings, 2007). It also helps in increasing the animal's muscle development (Anandhi et al., 2006) and feed conversion efficiency (Khan et al., 2014).

The main reason why Cr is commonly used as a mineral supplement is that it increases the retention of certain essential elements in the blood, such as iron and chromium. This benefit is linked to the various metabolic effects it has on different body systems (Vincent, 2000).

Chromium can also improve the function of various organs in the digestive system, such as the liver and the pancreas. It is also known to reduce the secretion of digestive enzymes in animals. 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 focused on the effects of feed additives containing chromium on the characteristics of quail meat.

Materials and Methods

The study was carried out at the Diponegoro University in Indonesia. It involved breeding 90 Japanese quail chicks in a farm environment with temperatures ranging from 34 to 32 degrees Celsius. The chicks were fed continuously and monitored by a temperature monitor.

Three treatments were given to the birds at 14 days old. The first treatment consisted of three replicates and ten birds, the second treatment contained 500g chromium picolinate/kg ration, and the third treatment contained 250g chromium picolinate/kg ration. The birds were reared for four weeks, 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. . Six birds were selected for the experiment, and their carcasses were weighted before they were slaughtered. The cold carcass weight was then calculated. Carcasses were then cut and samples of the meat were taken from the same point. The samples were then frozen (4 ºC for 12 hours) for a week before they were dried and weighted. The quail were then cooked at room temperature for 15 minutes, and they were dried with blotting paper to measure the cooking loss. The statistical analysis was performed to investigate the effects of different treatments on different measurements. The results were compared by the Duncan polynomial test (Duncan 1955).

Results and Discussion

Table 1: **Statistics analysis of chromium levels and sex on weights (slaughter, hot and cold) and dressing percentage**

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

In Table 1, The effects of varying chromium levels and sex on various traits (dressing percentage, hot weight, cold weight, and slaughtering weight) were studied. 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. It was concluded that the interactions between sex and treatments did not have any significant effects on these traits. Those results were agree with Al-Hajo et al. (2012) and Ahmed (2017) 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 2: **Statistical analysis of chromium levels and sex (♀: Female, ♂: Male) on carcass cuts weight**

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

In Table 2, The effects of varying chromium levels and sex on quail cuts weight were studied. It was concluded that there was no significant effect on the main quail cuts weight.

Table 3: **Statistical analysis of chromium levels and sex on breast and leg cooking and thawing loss**

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

The effects of different levels of chromium and sex on the development of breast and leg cooking loss are shown in Table 3. Although there was no significant difference between the treatment groups, the interaction between sex and chromium treatments did not lead to significant reduction in breast and leg cooking loss. 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 ($P \leq 0.01$) and non-significant decrease. It is believed that the reduction in cooking loss is due to the metabolic effect of chromium (Vincent, 2000 and Ahmed, 2017), which can affect the muscles' energy levels and prevent them from shedding more water.

Table 4: **Statistical analysis of chromium levels and sex on chemical composition of breast**

	Breast									
Traits	**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 5: **Statistical analysis of chromium levels and sex on chemical composition of leg**

	Leg									
Traits	**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

The effects of varying chromium levels and sex on the chemical composition of different breast and leg samples were studied in Table 4 and Table 5. They did not show significant effects. That is no significant effects of treatments and sex and their interaction on chemical composition of each breast and leg. It was concluded that adding organic chromium did not have any beneficial effects on the study conditions. Although the effects of varying treatments and sex on the chemical composition of a female breast and male leg were studied, they did not show significant effects. It was concluded that adding organic chromium did not have any beneficial effects on the study conditions.

Conclusions

It was hypothesized that the chromium content in the water and its effects on the quail's measurements were caused by the adequate amount of chromium in their ration. There were no clear effects of taking chromium picolinate on quail's measurements. It might be due to the adequate percentage of chromium in their water. Quail does not need additional chromium than already present in the water. However, higher chromium ratio should be tested.

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