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GROWTH AND CHROMIUM CONTENT OF KIDNEY, LIVER, EXCRETA AND IN THE BODY OF BROILER AFTER FED WITH RATIONS SUPPLEMENTED BY CHROMOSAL

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Abstract

The aim of this research was to investigate the effect of chromium supplementation on the growth and chromium content in kidney, liver, excreta and in the bodies of broilers. Twelve-day-old chicks were used and divided into four treatments, in which each treatment consisted of 3 birds. Those treatments were chromium supplementation with 0, 500, 1000, and 1500 mg/kg ration. The birds were reared in 4 cages and was fed broiler ration (BR I). The chromosal was added to the ration and given to the broilers starting from 10 to 40 days of rearing. Broilers were killed at 40 days old. Data collected were gain weight, feed intake, weight of excreta, chromium content in kidney, liver, excreta and in the body of broilers. The results showed that the growth of broiler was not significantly affected by chromium supplementation. Chromium supplementation up to 1500 mg/kg ration did not decrease the growth of broiler. Level of chromium supplementation above the requirement resulted in chromium accumulation in the body including kidney and liver.

Key words: Growth, Chromium content, Liver, Kidney, Excreta, Body, Broiler

Introduction

Chrome compounds such chromic chloride and chromic sulphates are often used as tanning agent. Chrome tanning is not as efficient as that of other tanning since only 60-70% of chrome can be bound by protein collagen, the rest (30-40%) still in the tanning bath. Therefore, there is still plenty of mineral chrome in the effluent that should be handled properly, otherwise it polluted environment. Around 90% chromium of the tanning bath may be settled and reused. The content of chrome in the tanning bath highly saved and it depends on the content of chrome compounds used and efficiency of tanning. Every 100 kg hide needs 5000 l of water; furthermore, there is 80 mg/l Cr_2O_3 or about 70 mg/l in the effluent (Sarkar, 1995). The maximum amount of chromium allowed in the effluent of tanning industry is 2-4 mg/l Cr(III). Liquid waste of tanning process is usually drained into the river and this will polluted crops around the factory since the water from the river also used to

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irrigate the paddy field. Chromium can be accumulated in the plant (Vajpayee *et al.*, 1999; Triatmojo, 1999 and 2000), if the plants (leaves, stem and straw) are consumed by animals (cattle, sheep, and buffalo), they are contaminated by that metal. Accumulation oh chromium may take place in kidney, liver and other organs or tissue in the body. The high consumption oh chromium certainly poisoned the livestock, furthermore, it can reduce the production and at fatal concentration cause mortality.

Chrome found in the environment cannot be degraded by microorganism but it can be transformed into less toxic chromium compound. Tanning waste contained Cr (III) and Cr (VI) (Triatmojo, 2002). Cr (VI) is highly soluble, very toxic, corrosive and carcinogenic (Rai *et al.*, 1987; Kendrick *et al.*, 1992) as well as mutagenic (Petrilli and Flora, 1997); Llovera *et al.*, 1993). Hexavalent chromium (CrVI) may form complex compound and able to penetrate biological cell membrane and undergoes reduction in the cell, thus causes poisonous to animal and human. Chrome (III) is less toxic than Cr (VI), not corrosive and irritative, and at micro concentration needed for metabolism of carbohydrate and fat in mammalian (Rai *et al.*, 1987). Cr (III) plays important role as active ingredient (glucose tolerance factor) to optimalise insulin activity in the tissue of mammalian (Harrison and Hoare, 1980).

Although, studies of the accumulation oh chrome in microorganism (Komori *et al.*, 1990; Gadd, 1992; Kapoor and Viraraghavan, 1995; and Triatmojo, 2000), aquatic plant (Vajpayee *et al.*, 1999; Triatmojo, 2000) have been conducted, but there is still lack of information on effect of chrome at the animals. The experiment was conducted to investigate the chrome accumulation in body of broiler as well as its several organ and live performance.

Materials and Method

Twelve-day-old broiler chicks were used in the experiment. They were divided into four groups consisted of 3 birds. Chrome was given to the bird in form of chromosal.

The amount of chromosal supplemented in the ration are 0 mg/kg (as control), 500, 1000 and 1500 mg/kg. The birds were reared in cages. Broiler feed (BR I) with chrome supplementation was given to the birds from 10 to 40 days of rearing. Feed and drinking water was given *ad libitum*. Feed consumption was recorded everyday, whereas body weight and dropping was measured once a week. All birds were slaughtered at the end of the trial. Total chrome of kidney and liver of broiler was analysed. The droppings was dried under sunrays for 2-3 days and it was then analysed it moisture and total chrome. Analyses of total chrome were carried out using method of Atomic absorbance spectrophotometre (APHA, 1976). The design of the experiment used was completely randomised design (CRD). The data

collected was analysed using analyses of variance and any significant means different was further tested using Duncan's test (DMRT).

Results and Discussion

Growth and Chrome Content of Broiler Liver and Kidney

Broilers Chickens fed with ration containing chromosal did not affect their ADG (trial body weight), but it increased the chrome content of liver and kidney (Table 1).

Table 1. Average daily gain (ADG) and chrome content of liver and kidney of broiler fed with ration containing different level of chromosal

	Level of chromosal in ration (mg/kg)				Means
	0	500	1000	1500	
ADG bird/day	41.66	51.20	47.48	44.35	46.17
Kidney (mg/kg)	3.954[a]	23.653[b]	26.316[b]	29.523[b]	20.862
Liver (mg/kg)	6.739[a]	21.986[a]	57.189[b]	68.059[b]	38.526

[a,b] Different superscript in the same row indicating the significant different of treatment ($P<0.05$)

Chrome (III) was needed by the body at the very little amount for carbohydrate and fat metabolism (Rutland, 1991; Manahan, 1992). Deficiency of Cr (III) showed similar symptoms of diabetes mellitus (Manahan, 1992). Excessive chrome in the body will be excreted in droppings and urine. However, if the amount of chrome consumed excessively beyond the requirement of the body and in the long term, this will accumulated in liver, kidney and lymph (Subiyarso *et al.*, 1993). This will give negative effect to the bird. According to Heryando-Palar (1994), cat fed with Cr (III) amounting to 20-100 mg/head did not shown any symptom of toxicity. Toxicity of Cr (III) is only one thousandth toxicity of Cr (VI) (Chirwa and Wang, 2000). Cr (III) at pH > 4.0 will precipitate and can easily be excreted from the body of animals through faeces. Organic Chrome (III) plays important role in metabolism, whereas inorganic chromium did not need by the animals. Some studies showed that the effect of chrome on the average daily gain was very little, nevertheless the increase of chrome level in the ration tended to decrease the growth of the chicken, but this did not caused mortality to the bird.

The increase of chrome level in the ration caused increasing accumulation of chrome content in kidney and liver. Table 1 showed that accumulation of chrome in the liver was higher than in the kidney. This result was in agreement with Subiyarso *et al.* (1998) that chrome might accumulate in the liver and kidney.

Chrome Content in the Broiler Dropping and the Body of Broiler

The result showed that the higher the level of chromosal in the ration would increase the excretion of chrome via the droppings (Table 2). But compare to the amount of chrome consumed, the chrome excreted via the droppings was only in small quantity, this meant that chrome was absorbed and accumulated in the tissue of broiler.

Table 2. Chrome content of the droppings of the broiler fed with different level of chromosal in the ration (ppm/bird/day)

Age of the bird (days)	Level of chromosal (mg/kg)				Means
	0	500	1000	1500	
17	1.58	6.14	9.66	13.12	7.62
24	1.99	6.47	11.63	15.92	9.00
30	0.49	5.96	18.38	14.63	9.86
35	2.18	3.23	6.99	5.70	4.52
Means	1.56^{a}	5.45^{b}	11.66^{c}	12.34^{d}	

^{a,b,c,d} Different superscript in the same row indicating the significant different of treatment ($P<0.05$)

Feeding for 30 days at the level of 500 mg chromosal in the ration indicated that 153.5 mg chrome was found in the faeces of broiler. Furthermore, higher level of chromosal i.e. 1500 mg/kg in the ration resulted higher amount of chrome in the droppings i.e. 360.2 mg.

It should be note that supplementation of chromosal for a long time and at high quantity may accumulate in the body of animals. Result of the present study also indicated that the increase in the chromosal level of ration significantly increase the chrome content in the body of broiler (Table 3).

Table 3. Chrome content in the body of broiler fed with different level of chromosal (ppm/bird/day)

Age of the bird (days)	Level of chromosal (mg/kg)				Means
	0	500	1000	1500	
17	110.65	111.91	133.46	121.43	119.36^{a}
24	163.67	165.85	187.72	178.88	174.03^{b}
30	185.55	204.15	198.51	213.84	200.51^{c}
35	242.82	354.77	262.33	314.59	293.63^{d}
Means	175.67	209.16	195.50	207.18	

$^{a, b, c, d,}$ Different superscript at the same column showed significant different at $P<0.05$

Table 3 indicated that the longer the bird fed with chromosal significantly increased the chrome accumulation in the body. The withdrawal of chromosal supplementation might reduce chrome content in the body, since Cr(III) in the body

of broiler was found in the form of insoluble chrome and would be excreted in the faeces.

Conclusion

The excessive supplementation of chromosal in the ration would be accumulated in the tissue of broiler chicken including liver and kidney. The excretion of chrome from the body through the droppings increased as the amount of chrome consumed by the birds increased as well.

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