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A Study on the Correlation of Cecal Anaerobic Bacterial Counts with Cecal Length in Growing Chicks

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성장중인 닭에 있어서 맹장내의 혐기성 미생물수와 맹장 길이와의 관계에 관한 연구

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ABSTRACT : A study was conducted to investigate the correlation of cecal anaerobic bacterial counts with the cecal length in growing chicks. Half of 160 chicks of five weeks old were housed in cages and the remainings were kept with goats in free-range and allowed to have free access to goat's feed and faeces. All the experimental birds were fed ad libitum on a commercial chick formula diet during the period of 5 to 12 weeks of age. Body weight was larger in birds reared in the cage than in those reared on the field at 8 weeks of age ($P<0.05$), but vice versa at the end of experiment ($P<0.05$). The cecal length was longer in field-rearing than in cage-rearing at 6, 9, 10 and 11 weeks of age ($P<0.05$). The cecal length was correlated with body weight gain in both rearing groups ($r=0.816$ for cage-rearing, $r=0.816$ for field-rearing). The cecal anaerobic bacterial counts were significantly higher in field- rearing than in cage-rearing at 6, 9, 10 and 11 weeks of age ($P<0.05$). The cecal length was highly correlated with cecal anaerobic bacterial counts in cage- ($r=0.9549$) and field- ($r=0.9866$) rearing.

It is concluded that the correlation of increase cecal length with increased cecal anaerobic bacterial counts fed a fiberous of goat's faeces in growing chicks.

(Key words: field-rearing, cage-rearing, cecal anaerobic bacterial counts, cecal length, growing chicks)

INTRODUCTION

It has been reported that 88% of the total urease activity in intestinal contents and tissues of the chicken is observed in the intestinal contents, of which 95% of the activity is accounted for by the cecal contents (Karasawa et al., 1994a). Further studies show that dietary protein and urea stimulates the urease activity while dietary penicillin inhibits it and decreases nitrogen retention (Karasawa et al., 1993, 1994b). It has also been reported that the intestinal and cecal length and their weight of the red grouse increase as dietary fiber contents increase (Moss, 1983) and seasonal changes in diet and volatile fatty acids production affect the size of the ceca of the rock ptarmigan (*Lagopus mutus*) (Gassaway, 1976a,b). These findings suggest that various rearing conditions affect the bacterial counts of the cecum, cecal length and weight, and resultant growth in the chicken.

The present experiment was carried out to examine the effect of fluctuation of circumstances of growing chicks on cecal anaerobic bacterial counts, cecal length and growth.

MATERIALS AND METHODS

Five-week-old layer-type male chicks, Isa Brown, were used

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as experimental animals. Ten birds were housed in each of 8 cages (80 cm D × 40 cm L × 40 cm H), and 80 birds were kept with goats on the floor in the barn (50 m D × 70 m L). Two places were isolated. One is the entry of a person was strictly controlled, the other is the animal keeper sterilized hands and foots whenever the enters there.

A typical commercial formula diet was fed to all experimental birds ad libitum for 7 weeks. The composition of the commercial diet was as follows; CP : 185.1 g/kg, crude fat : 25.6 g/kg, crude fiber : 57.8 g/kg, calcium : 5 g/kg, phosphorus : 4 g/kg, Met.+Cys. : 5.6 g/kg and ME : 2,850 kcal/kg.

Ten birds of each of cage- and field-rearing were weighed and killed by intra-cardiac injection with Nembtal (Abbot Lab. Inc.) at 0, 1, 2, 3, 4, 5, 6 and 7 weeks of the experimental period. Immediately after they were slaughtered the abdomen was opened and the ceca were tied with silk thread at the ileo-cecal junction as near as possible to prevent the distribution of cecal bacteria from changing. After the cecal length and weight were measured, and squeezed cecal contents from the ceal body using fingers of five cecal body. the cecal contents was recovered and weighed an anaerobically under CO_2 gas as promptly as possible. The net cecal contents was calculated before and after squeeze. The cecal anaerobic bacterial counts were done by a roll-tube technique using of 100 ml test tube (Ogimoto and Imai, 1981). Test of significance of differences between means was determined by *t*-test (Snedecor and Cochran, 1967).

RESULTS AND DISCUSSION

The results are shown in Table 1 and Fig. 1. to 5. Body weight was larger in birds reared in the cage than in those reared on the field at 8 weeks of age ($P<0.05$), but vice versa at the end of experiment ($P<0.05$). The cecal length was longer in field-rearing than in cage-rearing at 6, 9, 10 and 11 weeks of age ($P<0.05$). The cecal length was correlated with body weight in both rearing groups ($r=0.816$ for cage-rearing, $r=0.816$ for field-rearing). In this experiment food intake and the intake of fiber and goat's faeces were not determined, but we can speculate that chicks reared on the floor in goat"s barn ate a lot of fiberous substances because they were allowed to have free access to feed and faeces of goat in addition to a mash commercial diet. The longer cecal length of chicks reared on

Table 1. Effect of rearing style on body weight gain, cecal length, cecal anaerobic bacterial counts (CABC) in the growing chick

Rearing style	Experimental period-chicks age (weeks)							
	0(5)[a]	1(6)	2(7)	3(8)	4(9)	5(10)	6(11)	7(12)
	Body weight (gram)							
Cage (10)[b]	487	592	743	920	1,050	1,240	1,200	1,250
Field (10)	490	510	610	670*	710	1,050	1,160	1,480*
SEM	20	45	20	70	240	170	120	45
	Cecal length (cm)							
Cage (10)	3.5	4.7	14.3	14.4	13.4	13.3	14.6	15.4
Field (10)	3.5	7.2*	15.0	14.1	19.0*	16.9*	17.9*	18.4
SEM	0.1	0.6	0.5	0.9	0.6	0.6	0.6	1.2
	Cecal anaerobic bacterial counts (CABC; logarithm, Number/ total cecal wet weight)							
Cage (5)	8.1	9.2	11.6	11.1	11.6	11.1	12.5	12.5
Field (5)	8.1	10.3*	12.4	12.4	13.4**	13.1**	13.6*	13.7
SEM	0.1	0.2	0.2	0.5	0.2	0.1	0.1	0.5

Values are means.

[a]Age of chicks, [b]The number of birds tested is shown in parentheses.

* and ** Significantly different from each rearing style at $P<0.05$ and $P<0.01$, respectively.

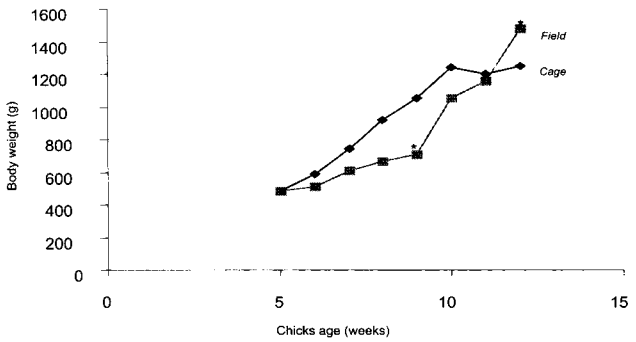

Fig. 1. Effect of rearing style on body weight change.

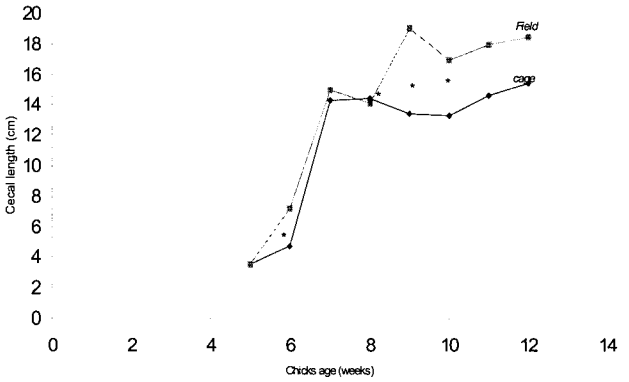

Fig. 2. Effect of rearing style on cecal length change.

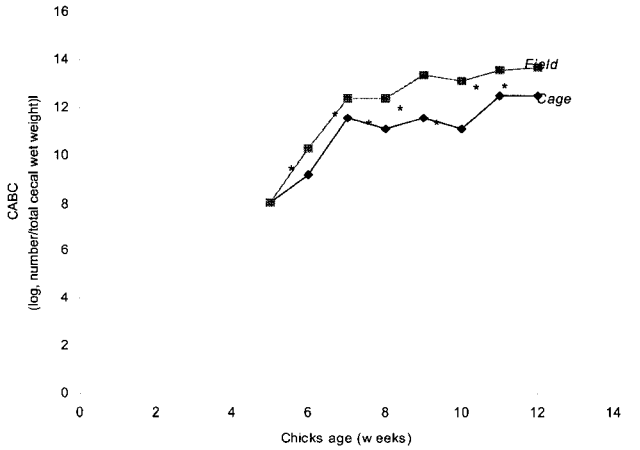

Fig. 3. Effect of rearing style on cecal anaerobic bacterial counts (CABC) change.

the field might be due to the high fiber contents of the ingested foods since fiberous low nutritious diet in winter stimulates cecal length of rock ptarmigan (*Lagopus mutus*) (Gassaway, 1976) and of red grouse (Moss, 1967, 1968)

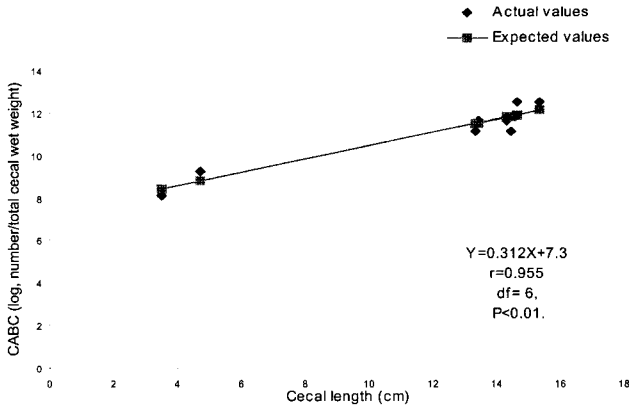

Fig. 4. Effect of cage-rearing on cecal length vs cecal anaerobic bacterial counts (CABC).

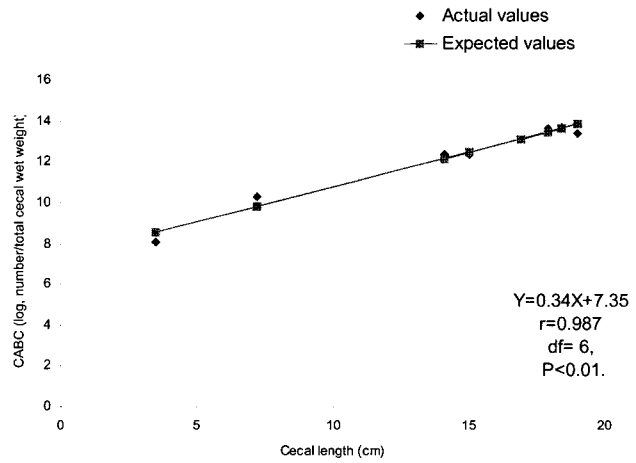

Fig. 5. Effect of field-rearing on cecal length vs cecal anaerobic bacterial counts (CABC).

The cecal anaerobic bacterial counts were significantly higher in field-rearing than in cage-rearing at 6, 9, 10 and 11 weeks of age ($P<0.05$), and highly correlated with the cecal length in field- ($r=0.9549$) and cage- ($r=0.9866$) rearing. There should be many chances for chicks reared on the field to ingest goat's faeces and food contaminated with rumen bacteria. This exposure to the contamination and the ingestion of high fiber diet are likely to cause high cecal anaerobic bacterial counts in the field-rearing. It is concluded that the correlating of increase cecal length with increased cecal anaerobic bacterial counts and body weight gain in growing chicks.

적 요

본 연구는 성장중인 닭에 있어서 맹장내 혐기성 미생물수와 맹장의 길이와의 관계를 구명하기 위해서 실시되었다. 5주령의 160수의 닭을 80수씩 분리하여 케이지내 사육 (대조구) 및 염소 방목장내 염소와 같이 사육 (처리구)의 2처리로 구분하여 실시하였으며, 본 시험기간동안의 사료는 닭의 성장단계에 적합한 시판의 사료를 기초사료로 활용하였다. 시험기간 (5~8주령)까지의 증체량은 8주령에서는 대조구가 처리구보다 유의하게 높았으며($P<0.05$), 12주령에서는 처리구가 대조구보다도 유의하게 높았다($p<0.05$). 맹장의 길이는 6, 9, 10 및 11주령에 처리구가 대조구보다 유의하게 길었다 ($P<0.05$). 맹장내 총 혐기성미생물수도 6, 9, 10 및 11주령에 처리구가 대조구보다 유의하게 많았다($P<0.05$). 대조구 및 처리구 함께 맹장의 길이와 증체량간에는 $r= 0.816$의 상관관계가 인정되었다. 맹장의 길이와 맹장내 혐기성 미생물 수는 대조구 및 처리구 함께 $r=0.95$이상의 높은 상관 관계가 인정되었다($P<0.01$).

결론적으로 성장중인 닭에 있어서 섬유소 함량이 높은 염소의 배설물 섭취 등의 영향에 따른 맹장내 혐기성 미생물수의 증가가 맹장의 길이 증가에 관계되어진다.

(색인어: 방목사육, 케이지사육, 맹장내 혐기성 미생물 수, 맹장의 길이, 성장중인 닭)

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