

**PENURUNAN KONSENTRASI TRIGLISERIDA DARAH OLEH PROGRAM
PEMBATASAN PAKAN DI AWAL PERTUMBUHAN PADA BROILER**Urip Santoso¹**INTISARI**

Penelitian ini bertujuan untuk mengevaluasi pengaruh pembatasan pakan di awal pertumbuhan terhadap performans, konsentrasi trigliserida dan kolesterol darah dan aktivitas enzim yang berperan dalam sintesis asam lemak pada broiler. Delapan puluh ekor broiler betina didistribusikan ke dalam empat kelompok perlakuan yaitu satu kelompok sebagai kontrol yakni broiler yang diberi pakan secara bebas (*ad libitum*) dan tiga kelompok lainnya diberi pakan sebesar 75% dari kontrol selama 5, 10 atau 15 hari. Hasil penelitian menunjukkan bahwa pembatasan pakan tidak berpengaruh secara nyata terhadap berat badan pada umur 56 hari. Pembatasan pakan secara nyata menurunkan konsentrasi trigliserida pada serum pada umur 56 hari ($P<0,05$), dan menurunkan kadar trigliserida di hati pada broiler yang dibatasi pakannya selama 15 hari ($P<0,05$). Pembatasan pakan secara nyata menaikkan aktivitas enzim *acetyl-CoA carboxylase* di hati ($P<0,05$) pada umur 28 hari. Aktivitas enzim *fatty acid synthetase* di hati pada broiler yang dibatasi pakannya selama 15 hari secara nyata lebih rendah dibandingkan dengan kelompok perlakuan lainnya ($P<0,01$). Dapat disimpulkan bahwa pembatasan pakan di awal pertumbuhan menurunkan konsentrasi trigliserida darah tanpa menurunkan berat badan broiler pada umur 56 hari.

(Kata kunci: Pembatasan pakan konsentrasi, Trigliserida, Broiler).

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REDUCTION OF TRIGLYCERIDE CONTENT BY EARLY FEED RESTRICTION IN BROILER CHICKS

ABSTRACT

This study was conducted to evaluate effect of early feed restriction on performance, lipid fractions in serum and hepatic lipogenic enzyme activity of broilers. Eighty female broilers were distributed to four groups. One group was the control group and other three groups were fed 75% of control feed intake for 5, 10 or 15 days. Results show that early feed restriction had no effect on body weight at 56 days of age. At 56 days of age, it significantly reduced triglyceride concentration of serum ($P < 0.05$), and reduced hepatic triglyceride in broilers restricted for 15 days. Early feed restriction significantly increased the activity of acetyl-CoA carboxylase activity at 28 days of age ($P < 0.05$). Activities of fatty acid synthetase in broilers restricted for 15 days were significantly lower than those of the control group ($P < 0.05$). In conclusion, early feed restriction reduced the concentration of triglyceride in serum with no effect on body weight at 56 days of age.

(Key words: Feed restriction, Triglyceride concentration, Broiler).

Introduction

An attempt has been conducted by many investigators to reduce body fat content using early feed restriction. This method was based on the fact that this program exerted a negative effect on subsequent lipid deposition. The recent investigation showed that *de novo* hepatic fatty acid synthesis pathway contains three important extramitochondrial enzymes necessary for the synthesis of long chain fatty acid, ATP-citrate lyase, acetyl-CoA carboxylase (ACC) and fatty acid synthetase (FAS). Since AAC has been proposed as the rate-limiting enzyme of fatty acid synthesis by a number of investigators, a change in ACC activity might reflect a change in fatty acid synthesis. A reduced hepatic acetyl-CoA carboxylase activity which may indicate lower hepatic fatty acid synthesis is of major factor influencing hepatic triglyceride synthesis (Scorve *et al.*, 1993). Arbeeny *et al.* (1992) reported that in hamster, inhibition of fatty acid synthesis decreases VLDL triglyceride secretion into the blood and therefore reducing plasma triglyceride.

There was inconsistent response of broiler to early feed restriction on reduction of triglyceride concentration in plasma. Therefore, the present study was conducted to

evaluate early feed restriction effect on triglyceride reduction of plasma and the possible mechanism was discussed.

Methodology

One hundred and eighty one-day-old female broiler chicks obtained from commercial hatchery were used in this study. From 1 to 14 days of age, supplemental heat was provided with a hanging heat lamp. The chicks were maintained on the floor in a windowless house, under continuous fluorescent lighting with feed and water available *ad libitum*. At 5 days of age, chicks were divided into 4 groups as follows. One group was fed *ad libitum* (60 chicks) as control group and other three groups were fed 75% *ad libitum* for 5, 10 or 15 day (40 chicks each group). Water was provided *ad libitum* and recommended husbandry practices were applied in this experiment.

At 28 and 56 days of age, 5 chicks were obtained in control and restricted fed groups, were killed and abdominal fat and liver were immediately removed and weighed. One portion of the liver was placed in an ice-cold saline to measure the activities of lipogenic and cholesterolgenic enzyme activities, and another portion was frozen and stored at -30°

C until analysis for various lipid fractions. Blood was also taken from wing vein with heparinized syringe and then centrifuged at 2,500 rpm for 10 minutes. Plasma obtained was stored and frozen at -30°C for analysis of lipid fraction concentration. The lipid fractions were separated by thin-layer chromatography on silica gel chromarod using hexane-diethylether-formic acid (60:10:1) and hexane-benzene (1:1) as developing solvent and quantified by IATROSCAN TH-10 TLC/FID Analyzer (Iatron Laboratories, Inc., Tokyo, Japan 101).

Liver homogenates for enzyme activity were obtained by the method previously described (Santoso *et al.*, 1993). ACC activity was assayed by the H^{14}CO_3 - fixation method (Qureshi *et al.*, 1980). FAS activity was assayed by the $1\text{-}^{14}\text{C}$ -acetyl-CoA incorporation method (Hsu *et al.*, 1965). The protein content of the solution used for enzyme assay was determined by the method of Lowry *et al.* (1951) using bovine serum albumin as the standard. ACC and FAS activities were expressed as nanomole of substrate converted to product per minute per milligram of protein at 37°C . Samples were analyzed in triplicate and they were accepted if the differences were less than 1%.

All data were statistically analyzed using analysis of variance (Shinjo, 1990). Sig-

nificant differences between treatments was determined by Duncan's multiple range test.

Results

Effects of early feed restriction on growth characteristics of female broilers were shown in Table 1. At 27 day of age, body weight of restricted chicks were significantly decreased ($P<0.01$) except for chicks restricted for 5 day. At 56 days of age, body weight was not significantly different.

Table 2 shows effect of early feed restriction on triglyceride and cholesterol concentration in serum and liver. At 27 day of age, triglyceride content of liver was significantly reduced ($P<0.01$), whereas triglyceride concentration of serum was significantly increased ($P<0.05$). At 56 days of age, triglyceride content of liver was significantly reduced in chicks restricted for 5 day. On the other hand, triglyceride concentration of serum was significantly reduced ($P<0.05$). Early feed restriction did not influence cholesterol content of the liver neither at 28 nor 56 days of age. At 28 days of age, chicks restricted for 10 or 15 days had lower cholesterol concentration of serum ($P<0.01$) as compared with the control. At 56 days of age however, the program had no effect on cholesterol concentration.

Table 1. Effect of early feed restriction on growth characteristics of female broilers¹⁾

	Control	5 days	10 days	15 days	SE	P ²⁾
27 days of age						
Body weight (g)	9831 ^a	976 ^a	908 ^b	863 ^b	17.1	<0.01
Feed intake (g)	1556	1479	1372	1340		
FCR	1.69	1.59	1.56	1.62		
56 day of age						
Body weight (g)	2702	2705	2668	2628	46.0	ns
Feed intake (g)	5837	5496	5451	5418		
FCR	2.25	2.11	2.09	2.11		

¹⁾: Values reported represent means for 40 chicks. Means within a row not followed by the same superscripts are significantly different.

²⁾: Probability of a significant treatment effect.

ns : not significantly different

Table 2. Effect of early feed restriction on triglyceride and cholesterol contents in liver and blood serum¹⁾

	Control	5 days	10 days	15 days	SE	p ²⁾
Triglyceride						
Liver, (mg/g)						
28 day of age	23.0 ^a	14.6 ^b	8.9 ^c	8.2 ^c	0.59	<0.01
56 days of age	22.5 ^a	25.1 ^a	25.8 ^a	9.5 ^b	5.87	<0.05
Serum, (mg/100 ml)						
28 day of age	24.2 ^b	31.9 ^b	34.0 ^{ab}	42.9 ^a	5.6	<0.05
56 days of age	134.5 ^a	100.9 ^a	75.6 ^b	88.0 ^b	16.6	<0.05
Cholesterol Liver, (mg/g)						
28 day of age	2.24	2.17	2.12	2.34	0.14	ns
56 days of age	2.44	2.73	2.45	2.33	0.17	ns
Blood Serum cholesterol, (mg/100 ml)						
28 days of age	244.8 ^a	233.5 ^a	196.5 ^b	189.0 ^b	6.2	<0.01
56 days of age	177.0	171.4	166.3	184.3	7.8	ns

¹⁾ : Values reported represent means for 5 chicks. Means within a row that not followed by the same superscripts are significant different.

²⁾ : Probability of a significantly treatment effect.

ns : not significantly different

Table 3. Effect of early feed restriction on carcass composition¹⁾

	Control	5 days	10 days	15 days	SE	p ²⁾
Moisture :						
27 days of age	62.9 ¹⁾	62.8	63.4	64.4	0.25	ns
56 days of age	56.5	57.9	56.4	57.0	0.23	ns
Crude protein :						
27 days of age	14.2	14.6	14.7	15.2	0.32	ns
56 days of age	13.8	14.2	13.8	14.0	0.28	ns
Ether extract :						
28 days of age	19.1	19.0	17.7	17.9	0.5	ns
56 days of age	25.9	25.8	25.9	25.6	0.4	ns
Ash :						
28 days of age	3.8 ^a	3.6 ^a	4.2 ^a	2.5 ^b	0.2	<0.05
56 days of age	3.8 ^a	2.1 ^b	3.9 ^a	3.4 ^a	0.3	<0.05

¹⁾ : Values reported represent means for 5 chicks. Means within a row that not followed by the same superscripts are significant different.

²⁾ : Probability of a significantly treatment effect.

ns : not significantly different

Table 3 shows effect of early feed restriction on carcass composition. Early feed restriction did not affect moisture, fat and protein contents neither at 27 nor at 56 day of age.

Table 4 shows effect of early feed restriction on ACC and FAS activities. At 27

days of age, ACC was significantly different ($P < 0.05$) whereas FAS was not. At 56 days of age, ACC was significantly different ($P < 0.05$) and FAS was reduced in chicks restricted for 5 day ($P < 0.05$).

Table 4. Effect of early feed restriction on hepatic acetyl-CoA carboxylase (ACC) and fatty acid synthetase (FAS) activity¹⁾

	Control	5 days	10 days	15 days	SE	P ²⁾
A C C						
28 days of age	1.25 ^{1b}	1.94 ^a	1.38 ^b	0.88 ^c	0.26	<0.05
56 days of age	0.78 ^{ab}	0.89 ^{ab}	1.22 ^a	0.69 ^b	0.15	<0.05
F A S						
28 days of age	4.65	4.05	4.84	4.27	0.34	ns
56 days of age	4.96 ^a	5.60 ^a	5.00 ^{ab}	4.87 ^b	0.26	<0.01

¹⁾ Values reported represent means for 5 chicks. Means within a row that not followed by the same superscripts are significantly different.

²⁾ Probability of a significant treatment effect.

ns : not significantly different

Discussion

The present study showed that duration of early feed restriction influenced the broiler ability to achieve body weight similar to the control group. This observation was in agreement with the observation of Santoso *et al.* (1995). Longer duration of feed restriction resulted in shorter time for broiler to allow suitable oven compensatory growth. Consequently, it resulted in slightly lower body weight at 56 days of age. It is interesting to note that restricted chicks for 5 day could achieved normal body weight at 27 day of age with lower feed conversion ratio. In mixed-sex broiler, Santoso (1997) showed that restricting those broilers at level 25% for 3 days also resulted in complete oven compensatory growth at 28 days of age with lower feed conversion ratio (about 6.7%).

In general, early feed restriction tended to lower feed conversion ratio. This result was in agreement with the observation of Santoso *et al.* (1993a,b, 1995a,b; Santoso, 1997, 1998; and other authors). Mosier (1986) speculated that oven compensatory growth occurred because animals have a set point of body size at given age. Thus, when restricted chicks were provided ad libitum access to feed in the current study, they exhibited faster gain than the control, especially for chicks restricted for 5 days.

Higher hepatic ACC activity at 28 days of age, the rate-limiting enzyme in fatty acid synthesis, may result in higher fatty acid synthesis in the liver. Scorve *et al.* (1993) stated that fatty acid synthesis is of major importance for triglyceride synthesis in the liver. Therefore, triglyceride content of liver should be higher in restricted feed chicks. The current results however, showed lower hepatic triglyceride. This is logical for it is possible that triglyceride release into the blood of restricted feed chicks was increased, and thus increased the triglyceride concentration in serum as shown in the present study. In contrary, at 56 days of age, a change in ACC activity, which was accompanied by a change in hepatic triglyceride was not fully followed by a change in serum triglyceride. This phenomena, shows that lipid metabolism of younger broilers might be different from older ones.

It was postulated that an increase in serum triglyceride concentration was correlated with an increased in body/carcass fat content (Griffin *et al.*, 1982; Whitehead and Griffin, 1982). Present study however, failed to show this fact. It is possible that early feed restriction resulted in a shift in fat metabolism of broilers.

Ramirez *et al.* (1984) found that feed restriction produced a decrease in chicks liver 3-hydroxy-3methylglutaryl-CoA reductase activity, the rate-limiting enzyme of chole-

terogenesis, and in liver rat, refeeding had little effect on cholesterogenesis (Cockburn and Van-Brugger, 1959). Therefore, one of the factors responsible for decreasing cholesterol content in the serum of 28-day-old broiler restricted for 10 or 15 days is a decrease in cholesterogenesis of the liver. However, at 56 days of age serum cholesterol remain unchanged.

Early feed restriction decreased ash content of carcass in chicks restricted for 15 days at 28 days of age, and in those restricted for 5 days at 56 days of age. This result was not in agreement with the observation of Santoso *et al.* (1993b) who found that early feed restriction increase ash content. The present study failed to decrease body/carcass fat content. Plavnik and Hurwitz (1985) stated that duration and level of feed restriction influence the success of early feed restriction program to reduce body fat content.

Conclusion

It was conclude, that early feed restriction reduced the concentration of triglyceride in serum with no effect on body weight at 56 days of age of broiler.

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