

Influence of fat addition to feed mixtures on the rate of yolk sac resorption in chickens, blood and pancreas enzyme activity

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ABSTRACT

The experiment was carried out on 476 Starbro chickens (♂) divided into 4 groups, each in seven replications with 17 birds kept in cages in standard environment conditions. Chickens were fed mixtures contained 21.7% (starter), 20.0% (grower) crude protein and 9, 6, 3 or 0% of rape seed oil. In 1, 2, 3, 4, 7, 12, 21 and 35 days of life and 2 h after feeding chickens were weighted and killed. The resorption rate of yolk sac and changes of α -amylase and lipase activity in blood serum and pancreas were estimated. The body weight of chickens was the best in group II, III and IV. Highest level of oil in mixture has reduced the growth after 21 days of life. Addition of fat to feed mixtures for chickens in their first 21 days of life influences the rate of yolk sac resorption, decreases feed intake and activity of α -amylase in the pancreas, while conversely lipase activity in the pancreas increases together with increase in quantity of rape seed oil added.

KEY WORDS: blood enzymes, pancreas enzymes, fat, chickens

INTRODUCTION

The resorption rate of yolk sac contents and the development of the digestive tract of chickens substantially influences the utilization of nutrients. The concentration of carbohydrates, dietary fibre level and energy density in feeds can also modify the growth of the intestine tract, secretion and activity of endogenous enzymes (Jamroz and Wertelecki, 1998; Wertelecki and Jamroz, 1998a,b). In the present experiment, the rate of yolk sac resorption and the activity of amylase and lipase in the blood and pancreas have been investigated in chickens fed mixtures supplemented with different quantities of rape seed oil.

TABLE 1

Composition of starter feed mixtures, %

	Groups			
	I	II	III	IV
Maize	46.0	49.5	53.5	57.5
Soyabean meal	41.0	40.5	39.5	38.5
Rape seed oil	9.0	6.0	3.0	0.0
Chalk	1.5	1.5	1.5	1.5
Dicalcium phosphates	1.2	1.2	1.2	1.2
Salt	0.3	0.3	0.3	0.3
Premix DKA	1.0	1.0	1.0	1.0
Crude protein	21.7	21.8	21.8	21.7
Ether extract	11.5	8.7	5.8	2.9
Crude fibre	4.2	4.3	4.4	4.4
Starch	28.7	30.9	33.4	35.9
Metabolizable energy, MJ/kg	13.2	12.6	12.0	11.4
Lysine, g/kg	12.4	12.3	12.2	12.0
Methionine, g/kg	3.6	3.6	3.6	3.7
Met + Cys, g/kg	7.2	7.3	7.3	7.4
Tryptophane, g/kg	2.6	2.6	2.6	2.6
Threonine, g/kg	8.4	8.5	8.4	8.4
Ca, g/kg	9.6	9.6	9.5	9.5
P-available, g/kg	3.2	3.3	3.3	3.3
Na, g/kg	1.5	1.5	1.5	1.5

TABLE 2

Body weight of chickens, g

Days of life	Level of rape seed oil, %			
	9(I)	6(II)	3(III)	3(III)
1	39.1	38.9	39.4	39.5
	3.38	3.42	2.18	2.55
2	46.3 ^b	43.2 ^a	46.2 ^b	46.8 ^b
	1.52	4.12	4.20	2.66
3	52.8	52.4	52.6	53.4
	3.17	4.16	2.78	6.40
4	61.2 ^{AB}	63.7 ^b	56.6 ^a	60.3 ^{AB}
	5.71	5.06	5.78	4.39
7	99.2	93.8	91.9	91.7
	10.00	10.74	8.23	11.91
12	193.9	199.1	178.5	190.7
	30.48	18.07	26.66	23.95
21	457.1b	448.1 ^{ab}	404.5 ^a	434.2 ^{ab}
	43.50	54.69	64.52	62.22
35	1161.1 ^A	1402.4B	1386.9 ^B	1273.2 ^{AB}
	176.52	85.84	146.54	264.16

a, b – significant at P<0.05; A, B – significant at P<0.01

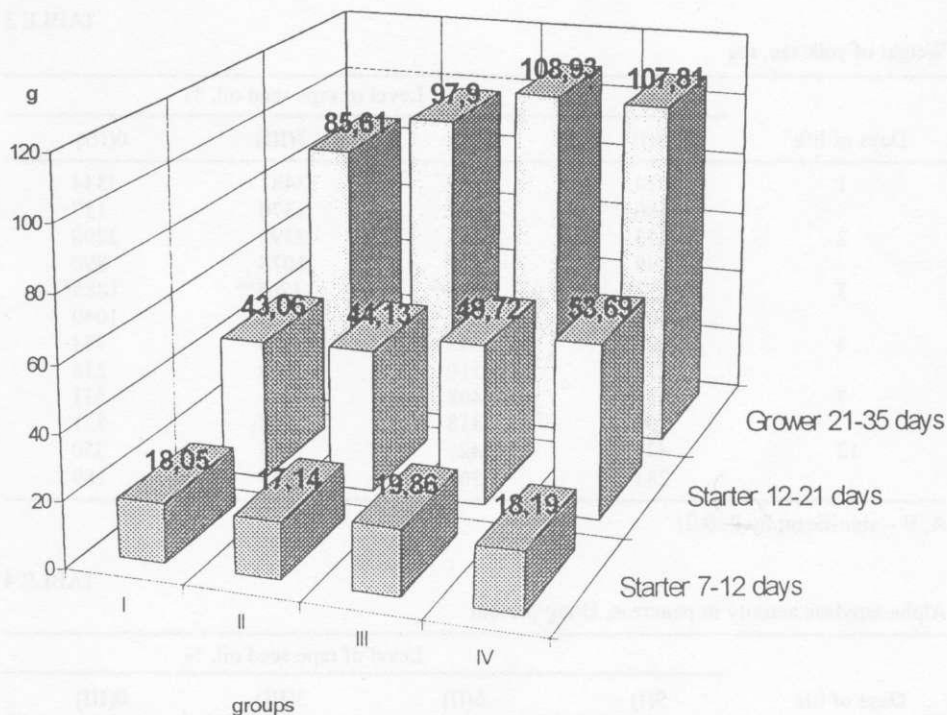


Figure 1. Feed intake, g/head/day

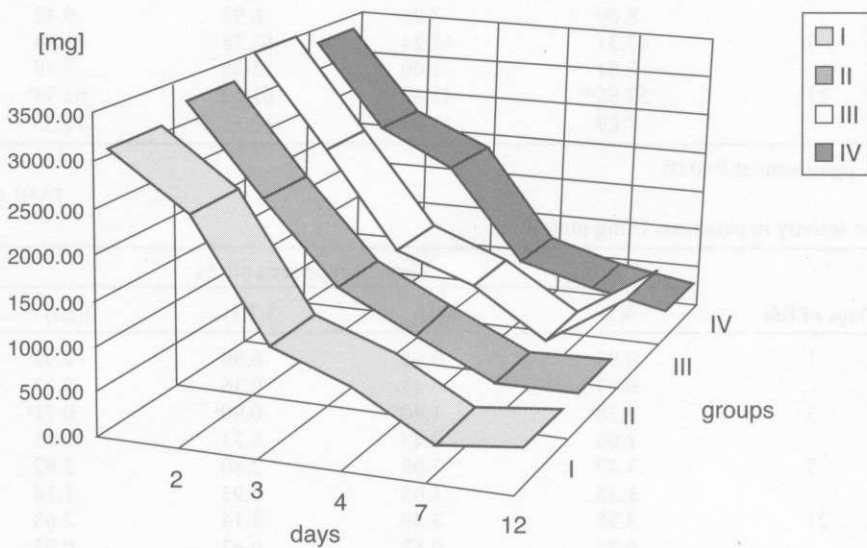


Figure 2. Resorption rate of yolk sac, mg

TABLE 3

Weight of yolk sac, mg

Days of life	Level of rape seed oil, %			
	9(I)	6(II)	3(III)	0(III)
1	3074	3255	3481	3344
	1486	1257	1370	137
2	2453	2223	2392	2298
	749	762	1078	890
3	1147 ^A	1286 ^{AB}	1265 ^{AB}	1885 ^B
	404	461	485	1040
4	829	848	930	774
	279	310	520	238
7	326	408	371	511
	259	318	168	521
12	429	426	983	350
	281	368	1767	189

A, B – significant by $P < 0.01$

TABLE 4

Alpha-amylase activity in pancreas, U/mg protein

Days of life	Level of rape seed oil, %			
	9(I)	6(II)	3(III)	0(III)
1	28.66	32.48	27.52	30.91
	3.41	9.09	6.24	4.22
3	37.00	35.93	36.28	39.99
	8.09	7.96	6.97	9.42
7	47.31	45.24	52.78	43.94
	7.81	7.00	15.36	7.79
21	53.85 ^{ab}	43.80 ^a	61.63 ^b	61.94 ^b
	7.89	11.87	10.31	16.33

a, b – significant at $P < 0.05$

TABLE 5

Lipase activity in pancreas, U/mg protein

Days of life	Level of rape seed oil, %			
	9(I)	6(II)	3(III)	0(III)
1	0.95	0.98	0.90	0.99
	0.07	0.43	0.36	0.22
3	1.78 ^b	1.40 ^{ab}	0.90 ^a	0.71 ^a
	1.08	0.43	0.33	0.13
7	3.49	3.09	2.80	2.92
	1.35	1.05	0.93	1.14
21	3.50	3.40	3.14	2.68
	0.72	0.62	0.43	0.93

a, b – significant by $P < 0.05$

MATERIAL AND METHODS

The experiment was carried out on 476 Starbro chickens 1 which were divided into 4 groups, each in seven replications with 17 birds. The birds were kept in cages under standard conditions. The chickens were fed mixtures containing 21.7% (starter), 20.0% (grower) crude protein and 9, 6, 3 or 0% of rape seed oil (Table 1). Two h after feeding some chickens from each group were weighed and killed at 1, 2, 3, 4, 7, 12, 21 and 35 days after hatching: i.e., 21 birds from each group on the 1st day and 14 birds from each group on the other days. The resorption rate of the yolk sac and changes of α -amylase and lipase activity in blood serum and pancreas were estimated. The yolk sac was freeze-dried and the crude protein and fat content were analysed. The amylase activity in blood serum and the pancreas was determined according to the Enzyline α -Amylase RTU – kinetic determination of α -amylase activity (*in vitro* diagnostic test no. 63 115/ 63 116 / 63 117 bioMerieux sa); – the lipase activity was determined by Enzyline Lipase Color – kinetic determination of lipase activity (*in vitro* diagnostic test nr 63 108 / 63 109 bioMerieux sa).

RESULTS

The body weight of chickens was the best in group II, III and IV. The highest level of oil in the diet reduced the growth rate after 21 days of age (Table 2). The high fat addition has reduced the feed intake (Figure 1).

The slowest resorption of yolk sac was observed in the period from the 1st to 7th day after hatching in the chicks from group IV (0% of oil). Chickens fed mixtures without oil supplement absorbed the yolk sac content slowly but precisely (Table 3, Figure 2). Pancreatic α -amylase activity changed in relation to body weight, and increased from 29,9 U on day 1 to 55,3 U/mg protein on the 21st day of life ($P < 0.05$). Higher pancreatic amylase activity was found in chickens from groups III and IV compared to groups I and II ($P < 0.05$). Lipase activity in the pancreas increased together with the age of the chickens. The highest activity was present in birds from groups I and II, i.e., in chickens fed the highest level of oil supplement mixtures (Table 5). These results suggest that fat addition to the feed increases pancreatic lipase activity, which thus increases the chances of fat degradation.

CONCLUSIONS

Addition of fat to feed mixtures for chickens in their first 21 days of life influences the rate of yolk sac resorption, decreases feed intake and activity of α -amy-

lase in the pancreas, while conversely lipase activity in the pancreas increases together with increase in quantity of rape seed oil added.

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