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Effects of starter feeding time on growth of Yangzhou geese

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Geese, starter feeding time, growth performance

1 SUMMARY

An experiment was conducted to investigate effects of starter feeding time on growth and development of Yangzhou geese. A total of 480 Yangzhou geese of similar weight were selected and randomly assigned to four groups according to four feeding schedules (fasting for 12, 24, 36 and 48 h posthatch), designated respectively as group 1, 2, 3, 4. Each group of 120 birds comprised of four replicate subgroups with 30 geese per group comprising of 15 males and 15 females. After fasting, all birds were provided with feedstuff *ad libitum* until 28 d of age. At 12h, 36h, 60h, 108h, 156h, 14d, 21d and 28d posthatch, two geese (1 male and 1 female) per replicate of each experimental group were randomly selected and individually weighed. Gizzard, small intestine, heart, liver, pancreas, spleen, and bursa of Fabricus of each goose were taken out and weighed. Results showed that initial food deprivation reduced body weight (BW) of experimental geese, with less BW realized as the fasting period was prolonged. At 28 d of age, BW of the first three groups of geese (fasted for 12-36h) was significantly higher ($P<0.05$) than that of group 4 (fasted for 48h). The starter feeding time influenced the growth of viscera apparatus, and all the viscera of geese in groups 1, 2 and 3 were heavier than for geese in group 4, though the difference was not significant ($P>0.05$). Results of the present study demonstrated that the maximum fasting period with no significantly negative effect on final performance was 36 h posthatch. Therefore, to ensure good performance, Yangzhou geese should be fed within 36h posthatch.

2 INTRODUCTION

Several investigations have shown that the weight of chicken when six and seven weeks old has a linear relationship to their weight in the first week of rearing (Nobakht, 2001; Pezeshkian, 2002). Some studies have shown that early feeding can affect early growth of birds significantly, leading to increased weight gains that persist throughout the broiler production period (Noy & Sklan, 1999b; Sklan & Noy, 2000; Boersma *et al*., 2003; Henderson *et al*., 2008). In addition, early feeding is highly important for the development of the gastrointestinal system.

During the early stages of development, the relative growth rate is highest, due to a marked increase in the weight of the gastrointestinal tract (Nitsan *et al*., 1991a). However, in hatchlings the development of the gastrointestinal tract and maturation of the secretion of digestive enzymes are impaired when feed is restricted (Noy & Sklan, 1999a; Sklan & Noy, 2000). Moreover, the weight of 42- or 49-d-old birds subjected to some type of feed restriction early posthatch rarely equals those of birds fed *ad libitum.* Variations in environmental temperature, nutritional levels provided, amount of feed intake in the period after feed restriction, genetic line, sex, and severity of restriction are some of the causes of the observed differences (Yu & Robinson, 1992).

Recently, more attention has been given to the effect of feeding time on performance of birds, and the physiological basis remains to be elucidated (Noy & Pinchasov, 1993; Noy & Sklan, 1998b; Sklan & Noy, 2000; Bigot *et al.*, 2001; Franco *et al.*, 2006; Yang *et al.*, 2008). However, research on geese has been seldom. It is, therefore, necessary to study the effect of feeding time to ensure it does not negatively affect production.

The objective of this trial was to illuminate the effects of starter feeding time on body growth of Yangzhou geese.

3 MATERIALS AND METHODS

3.1 Experimental design and bird management: A total of 480 Yangzhou Geese were selected for this experiment. After removal from the hatchery, geese were shank-sexed, vaccinated for Marek's and Gumboro diseases, and transported to the experimental houses. The geese were randomly assigned to four groups according to four feeding schedules (fasting for 12, 24, 36 or 48 h posthatch), designated respectively as group 1, 2, 3 and 4. Each group of 120 birds had 4 replicate subgroups, each with 30 geese (15 males and 15 females).

Group 1 received feed and water 12 h posthatch. The other groups received water but were fed only 24, 36 or 48 h posthatch, respectively. After fasting for the set period of time, the birds were fed on granule diet *ad libitum* until 28 d of age. The ingredients for the feeds supplied are presented in Table 1.

Geese were reared in a broiler experimental facility built to house up to 30 geese per pen (5 birds/m^2). During the first 7 d of the experiment period, birds received light for 24 h, and the housing temperature was maintained at 32 °C. After 7d, the temperature was reduced gradually until the 15th day, after which the birds were maintained at room temperature (about 20 to 25°C) with natural light only.

3.2 Data collection: At 12h, 36h, 60h, 108h, 156h, 14d, 21d and 28d posthatch, two geese (1 male and 1 female) per replicate of each experimental group were selected randomly, weighed individually and slaughtered. Heart, liver, pancreas, spleen, and bursa of Fabricus of each goose were taken out and weighed. At the same time, the gizzard was picked out, rid of keratose, and weighed. The small intestine was also collected, wiped off all the matter and weighed.

3.3 Data analyses: The data were analyzed by one-way analyses of variance and linear regression. Statistical analysis was run on the SPSS software package (2006). Statements of significance were based on $P < 0.05$ unless otherwise stated.

Table 1: Ingredients of experimental diet fed to Yangzhou geese.

Ingredients	Content (%)
Corn	65.0
Soybean Meal	29.3
Fish Meal	2.0
Limestone	2.0
Calcium Hydrogenphosphate	0.4
Vitamin and trace mineral premix[1]	1.0
Salt	0.3
Total	100.0
Metabolizable energy (MJ/Kg)	11.75
Crude protein (%)	19.10
Crude fibre (%)	2.18
Calcium (%)	1.07
Phosphorus (%)	0.75
Salt (%)	0.37
Lysine (%)	1.02
Methionine (%)	0.31

[1]Supplied per kilogram of total diet: vitamin A, 20000IU, vitamin D3, 4500IU, vitamin E, 300IU, vitamin K3, 20mg, vitamin B1, l0mg, vitamin B2, 120mg, vitamin B6, 20mg, vitamin B12, 0.2mg, nicotinic acid, 600mg, pantothenic acid, 180mg, folic acid, l0mg, folate, l0mg, biotin, 0.8mg, choline, 7g, Fe, 1.2g, Cu, 0.2g, Mn, 1.9g , Zn, 1.8g, I, l0mg, Se, 6mg.

4 RESULTS

4.1 Growth performance: Food deprivation reduced body weight (BW) of experimental geese, with less BW as the fasting duration was prolonged (Table 2). When feeding commenced BW of geese

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increased, with more rapid increases observed for birds that had been denied feed longest. However, the body weight of geese subjected to fasting for 48 h posthatch was always lower than that of geese fed before 36 h posthatch. At 28 d of age, BW of group 1 to group 3 geese (fasted for 12 – 36h) was significantly higher (P<0.05) than that of group 4 geese (fasted for 48h).

4.2 Organ and tissue development

4.2.1 Gizzard and small intestines: The weight of gizzard in all the four experimental groups of birds increased continuously over time. The earlier the feed was given, the more rapidly the gizzard weight increased (Table 3). During the experiment, gizzard weight of geese in groups 1 – 3 (fasted for 12 – 36h) was higher than that of geese in group 4 (fasted for 48h), but the difference was not significant (P>0.05).

There was a common trend in that the weight of small intestines increased rapidly after feeding commenced.

4.2.2 Spleen and bursa of Fabricus: The average weight of spleen in group 4 geese was less than that of geese in group 1, 2 and 3 before 14 d, but the difference was not significant (Table 3). After 14 d, there was a general tendency of the spleen weight of group 2 and group 3 geese being heavier than that of geese in groups 1 and 4. At 28 d of age, the spleen weight, which increased most rapidly compared to all other organs was over 30 times than that of newly hatched birds. The change of bursal weight followed a similar trend to that of spleen weight (Table 3).

4.2.3 Heart, liver and pancreas: The heart weight increased regardless of the geese feeding time. However, the heart weight of group 4 geese was less than that of the other geese in groups 1, 2 and 3 during the entire experiment. There were significant differences between group 4 and the others at 60 h, 156 h and 21 d (Table 3).

The liver weight of geese in groups 1, 2 and 3 that were fed 12 - 36 h posthatch increased continuously, while that of geese in group 4 (fed after 48 h) improved significantly slowly (P<0.05) within 60 h of age (Table 3), so the heart weight of group 4 remained less than for the birds in other groups.

Earlier feeding was associated with more rapid increase in the weight of pancreas, and there was a marked difference at 36 h and 60 h (Table 3).

Table 2: The effects of starter feeding time on body weight (g) of Yangzhou geese.

Sampling time	Feed access time (h)			
	12	24	36	48
12 h	91.7±13.43a	92.1±10.96a	92.4±13.20a	92.8±11.29a
36 h	100.8±2.96a	93.6±2.82ab	90.7±1.18b	90.6±1.20b
60 h	114.8±4.41a	115.3±1.99a	110.3±2.48ab	102.5±9.99b
108 h	155.4±6.92ab	158.7±4.27a	150.1±3.98ab	142.1±5.14b
156 h (7 d)	182.0±10.09ab	199.6±8.00a	183.4±11.15ab	159.1±8.93b
14 d	389.2±63.32a	380.1±71.03a	379.8±64.02a	348.1±64.44b
21 d	717.3±121.15a	709.1±149.27a	706.6±131.03a	661.2±140.14a
28 d	1185.0±184.07a	1191.7±208.85a	1195.3±189.11a	1078.7±205.46b

a,b Means followed by different letters within the same line are statistically different（P<0.05）.

5 DISCUSSION

The beneficial effect of early feeding of geese posthatch on growth performance was observed in the present study. It was demonstrated that 36 h posthatch is the maximum fasting period, which has almost no negative effects on body weight of Yangzhou geese at 28 d of age. Our findings confirmed previous reports that birds with early access to feed have improved growth performance (Noy & Sklan, 1999a; Batal & Parsons, 2002).

The initial growth of geese after hatching concentrates more on viscera development. In this study the viscera grew along whether the birds were fed or not. In addition, the growth rate of viscera was more rapid than that of the other body parts. Furthermore, even in cases where the body weight of geese declined, the viscera weight was observed to be increasing, especially that of the small intestine which could digest and absorb nutrition. In addition, from the change of organic exponent, i.e. the ratio of organic weight to BW, it was easy to find that the growth of spleen, pancreas, bursa of Fabricus and liver was important after hatching, besides the

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intestine. In other words, the digestive, metabolic and the immune systems are of much importance to newly hatched birds and thus are given preference in organ development.

There was a significant effect of fasting for upto 48 h posthatch on growth of the small intestines, liver, heart and pancreas. Numerous reports (Gonzales *et al.*, 2003; Sakil., 2005) have demonstrated that delayed feeding retards maturation of systems that began developing after hatching. In our study, this was particularly evident in the digestive and metabolic system, including liver, pancreas and other visceras. Changes in the development of small intestine also indicated that the initial lower performance of geese had a repercussion on final performance at market age, which was due to the decrease in small intestine weight, villus area, and crypt development, particularly at the duodenum and jejunum, when the birds were fasted after hatching (Geyra *et al.*, 2001).

Table 3: The effects of starter feeding time on organ growth (g) of Yangzhou geese.

Organ	Feed access time (h)	12 h	36 h	60 h	108 h	156 h	14 d	21 d	28 d
Gizzard	12		5.279±0.74a	7.248±1.39ab	11.491±1.43	13.353±2.12ab	25.880±2.38	41.456±8.15	57.267±7.21
	24	3.683±0.32	4.336±0.61b	7.283±0.90a	11.330±1.27	14.637±1.76b	25.017±3.04	40.238±4.45	56.693±5.91
	36		4.764±0.77ab	6.848±0.74ab	10.227±1.48	13.165±1.94ab	25.222±3.88	40.614±6.66	56.262±5.41
	48		4.764±0.77ab	6.217±0.64b	10.150±1.65	11.852±0.94a	21.928±3.57	38.365±5.97	55.511±6.72
Small intestine	12		2.671±0.83	4.404±1.09ac	7.783±1.45ab	9.982±2.12ab	18.035±3.30	31.583±6.12	50.670±8.68
	24	1.738±0.18	2.348±0.41	5.119±0.47ad	8.724±1.02a	10.472±1.62a	19.655±2.61	27.999±2.20	48.126±9.95
	36		2.290±0.25	4.210±0.53bc	7.793±1.15ab	9.989±2.15ab	17.043±2.00	30.591±4.35	48.159±6.75
	48		2.290±0.25	3.539±0.89bd	6.951±1.29b	9.312±1.31b	16.547±2.80	27.395±3.77	47.193±9.47
Heart	12		0.780±0.16	0.938±0.20a	1.264±0.12	1.494±0.32ab	2.869±0.38	6.414±1.57a	7.693±0.43
	24	0.681±0.07	0.712±0.11	0.907±0.10a	1.284±0.26	1.555±0.35a	3.152±0.60	5.718±1.27ab	7.862±1.81
	36		0.708±0.06	0.837±0.07ab	1.293±0.11	1.423±0.20ab	2.912±0.75	6.061±1.17ab	7.336±1.62
	48		0.708±0.06	0.748±0.12b	1.236±0.15	1.268±0.16b	2.718±0.59	5.179±0.56b	7.261±1.56
Liver	12		3.533±0.69ab	5.893±1.19a	8.754±2.24	9.648±1.54ab	16.803±3.04	30.392±8.69	45.366±5.16
	24	2.421±0.24	3.243±0.56a	6.180±0.98a	8.685±0.97	10.449±0.98a	17.712±1.66	29.129±4.01	41.514±10.79
	36		2.678±0.28b	5.821±0.59a	8.065±0.96	9.382±1.45ab	16.951±3.02	29.365±4.45	44.520±13.53
	48		2.678±0.28b	4.441±0.67b	8.421±1.48	8.847±1.27b	14.759±4.32	28.869±7.76	37.804±6.23
Pancreas	12		0.512±0.23a	0.718±0.05a	1.197±0.33	1.345±0.31	2.959±0.65	5.103±1.12	7.066±1.41
	24	0.211±0.03	0.295±0.08b	0.740±0.03a	1.266±0.12	1.411±0.40	3.016±0.42	4.334±0.85	6.523±1.21
	36		0.306±0.08b	0.595±0.05b	1.114±0.29	1.344±0.43	3.007±0.55	4.887±0.02	6.436±1.42
	48		0.306±0.08b	0.510±0.04b	1.016±0.20	1.209±0.22	2.425±0.69	4.131±0.95	6.478±1.13
Spleen	12		0.076±0.03	0.119±0.08	0.162±0.04	0.243±0.11	0.678±0.36	1.192±0.21	1.669±0.29
	24	0.050±0.03	0.074±0.03	0.113±0.04	0.176±0.05	0.242±0.03	0.737±0.36	1.334±0.75	1.967±0.69
	36		0.063±0.03	0.108±0.06	0.146±0.04	0.240±0.10	0.687±0.25	1.254±0.35	1.937±0.96
	48		0.063±0.03	0.081±0.02	0.133±0.05	0.200±0.02	0.609±0.22	1.095±0.22	1.613±0.46
Bursa of Fabricus	12		0.076±0.03	0.102±0.04	0.139±0.05	0.211±0.09	0.454±0.11	0.914±0.17	1.169±0.13
	24	0.051±0.01	0.060±0.01	0.095±0.03	0.168±0.04	0.213±0.05	0.494±0.26	0.979±0.25	1.280±0.43
	36		0.061±0.01	0.090±0.04	0.137±0.03	0.174±0.07	0.480±0.17	1.079±0.26	1.116±0.54
	48		0.061±0.01	0.075±0.04	0.130±0.04	0.172±0.07	0.419±0.14	0.862±0.39	1.086±0.34

a,b Means followed by different letters within the same column in the same organ are statistically different ($P<0.05$).

In a commercial hatchery, the average starter feeding time is between 24 and 36 h posthatch. So the geese that hatch early would remain in the hatchery until a large portion of the eggs have hatched. During this period, early-hatched geese, having no food and water, are faced with adverse conditions because of the prolonged fasting period and potential dehydration (Tweed, 2005). After hatching is over, other procedures such as sex determination and sorting, vaccinations and transport are performed which further prolong the fasting period (Batal & Parsons, 2002). Previous research has established that 10% loss of body weight can occur during the 48h interval between hatch and placement (Pinchasov & Noy, 1993).

As shown in this study fasting for long periods of time could cause permanent, negative effects on BW gain. Body weights at market age in fasted birds generally did not catch up with or exceed BW from birds that were given immediate access to feed and water after hatching, confirming previous reports (Pinchasov & Noy, 1993; Sklan *et al.*,2000). Our findings indicate that the birds should be fed immediately when they reach the farm, and most appropriately within 36 h posthatch.

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