Journal of Animal & Plant Sciences, 2009. Vol. 4, Issue 3: 399 - 405.
Publication date: 19 October 2009, http://www.biosciences.elewa.org/JAPS; **ISSN 2071 - 7024**

Effects of starter feeding time on yolk sac absorption of new hatched goslings

H. M. Yang, Z. Y. Wang*, X. H. Zhu, J. Lu and J. M. Wang

College of Animal Science and Technology, Yangzhou University, Yangzhou, Jiangsu Province, 225009 P. R. China
**Corresponding author email:* dkwzy@263.net

Key words
Geese, starter feeding time, growth performance, yolk sac

1 SUMMARY

An experiment was conducted to investigate the effects of starter feeding time on yolk sac absorption of newly hatched Yangzhou gosling. A total of 480 Yangzhou geese with an similar average weight of 92.3 g 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 T_{12}, T_{24}, T_{36} and T_{48}. 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 156 h of age. At 12, 36, 60, 108, and 156h posthatch, two geese (1 male and 1 female) per replicate of each experimental group were randomly selected and individually weighed. The yolk sac of each gosling was then taken out and the content of water, crude protein and crude fat in the yolk sac was determined. Results showed that the initial food deprivation reduced body weight (BW) of experimental geese, with less BW realized as the fasting period was prolonged. BW of the group T_{12} was significantly higher than that of the group T_{48} (fasted for 48h) at 36 h of weighing posthatch $P<0.05$. BW of group T_{24} was more than that of T48 from 60 to 156 h of age（$P<0.05$). The yolk sac weight of group T_{48} was more than the other three groups at all the designated times, though the difference was not significant ($P>0.05$). At the same time, the content of crude protein and crude fat in yolk sac of group T_{48} was the highest, however the content of water was the lowest. Results of the present study demonstrated that the maximum fasting period with no significantly negative effect on final performance of the bird was at 36 h posthatch. Therefore, to ensure good performance, Yangzhou geese should be fed from 12 to 36 h posthatch.

2 INTRODUCTION

Egg yolk is the sole nutrient source during embryonic development of all poultry. During the last days of incubation the egg yolk is internalized into the abdominal cavity and provides immediate posthatch energy and protein for maintenance and growth (Romanoff, 1960; Noble & Ogunyemi, 1989). The residual yolk is usually used up within 4 days after hatching (Noy & Sklan, 1999a). Recent results indicate that the residual yolk is used up more quickly in birds that have access to feed immediately after hatching than in those fasted for 48h post hatching (Juul-Madsen *et al*., 2004; Yang *et al*., 2008). This is because nutrients stimulate intestinal peristalsis and yolk utilization (Noy & Sklan, 1996). In addition, previous studies indicate that early feeding with complete diet results in considerable performance benefits, such as fast growth and high survival ratio. The enhanced growth caused by early feeding may be due to effects, such as stimulation of the utilization of yolk and increased intestinal development (Noy & Sklan, 1998a).

So far studies on the effects of starter feeding time on the yolk sac absorption have mainly concentrated on the chick and no similar studies employing goslings have been reported. The objective of this study, therefore, was to assess the difference in body weight, yolk sac weight, protein, fat and water content in yolk sac in the different starter feeding times of goslings during posthatch period.

3 MATERIALS AND METHODS

3.1 Experimental design and bird management: A total of 480 Yangzhou goslings which were hatched within 4 hours were selected for this experiment. After removal from the hatchery, goslings were shank-sexed, vaccinated for Marek's and Gumboro diseases, and transported to the experimental houses. The goslings were randomly assigned to four groups according to four feeding schedules (fasting for 12, 24, 36 or 48 h posthatch), designated respectively as group T12, T24, T36 and T48. Each group of 120 birds had 4 replicate subgroups, each with 30 gosling (15 males and 15 females).

Group T12 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 156 h of age. The ingredients for the feeds supplied are presented in Table 1.

Goslings were reared in a broiler experimental facility built to house up to 30 geese per pen (5 birds/m^2). During the whole experiment period, birds received light for 24 h (11h natural sunlight and 13h artificial light), and the housing temperature was maintained at 32 °C.

3.2 Yolk sac utilization: At 12, 36, 60, 108 and 156h posthatch, two goslings (1 male and 1 female) per replicate of each experimental group were selected randomly, weighed individually and slaughtered. Yolk sac of each gosling was taken out, and dried to a constant weight at 65°C in oven. The yolk sac was allowed to reach an equilibrium with the atmospheric moisture for 24 h, then it was weighed, and ground to pass through a 40-mesh sieve. These samples were then immediately frozen and stored at –20°C for further analysis.

3.3 Chemical analyses: The content of water, crude protein and crude fat in yolk sac was determined. The water content was calculated as = wet weight – dry weight. The nitrogen (N) content of feed and yolk was determined by the Kjeldahl process (AOAC, 1990). The crude fat content was determined by the Suo' extraction (AOAC, 1990).

3.4 Statistical analyses: The data were analyzed by one-way analyses of variance and linear regression. Statistical analysis was run on the SPSS software package (Version 12. for Windows). Statements of significance were based on $P < 0.05$ unless otherwise stated.

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

Ingredients	Content (%)	Ingredients	Content
Corn	64.0	Metabolizable energy (MJ/Kg)	11.63
Soybean Meal	27.0	Crude protein (%)	19.10
Fish Meal	3.0	Crude fibre (%)	3.48
Alfalfa Meal	2.0	Calcium (%)	1.08
Limestone	0.9	Phosphorus (%)	0.60
Calcium Hydrogenphosphate	1.8	Salt (%)	0.37
Vitamin and trace mineral premix[1]	1.0	Lysine (%)	1.02
Salt	0.3	Methionine (%)	0.45
Total	100		

[1]Supplied per kilogram of total diet: vitamin A, 1200KIU; vitamin D, 400KIU; vitamin E, 1800IU; vitamin K, 150mg; vitamin B1, 60mg; vitamin B2, 600mg; vitamin B6, 100mg; vitamin B12, 1mg; nicotinic acid, 3g; pantothenic acid, 900mg; folic acid, 50mg; biotin, 4mg; choline, 35g; Fe, 6g; Cu, 1g; Mn, 9.5g; Zn, 9g; I, 50mg; Se, 30mg.

4 RESULTS

4.1 Growth performance: Food deprivation reduced body weight (BW) of experimental goslings, with lower BW as the fasting duration was prolonged (Table 2). When feeding commenced BW of goslings increased, with more rapid increases observed for birds that had been denied feed longest. However, the body weight of goslings subjected to fasting for 48 h posthatch was always lower than that of goslings fed before 36 h posthatch. The body weight of the group T12 was significantly higher than that of the group T48 at 36 h of posthatch ($P<0.05$), thereafter group T24 increased faster, and from then on the BW for this group was more than for the other groups, with the difference between group T24 and T48 being significant from 60 to 156h ($P<0.05$)

Table 2: Effects of starter feeding time on body weight (g) of Yangzhou gosling.

Age (h)	Feed access time (h)			
	12	24	36	48
12	91.7±13.4	92.1±11.0	92.4±13.2	92.8±11.3
36	100.8±3.0a	93.6±8.0ab	90.7±3.3b	90.6±3.3b
60	114.8±4.4a	115.3±2.0a	110.3±2.5ab	102.5±10.0b
108	155.4±6.9ab	158.7±4.3a	150.1±4.0ab	142.1±5.1b
156	182.0±10.1ab	199.6±8.0a	183.4±11.2ab	159.1±8.9b

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

4.2 Yolk sac absorption

4.2.1 Yolk sac weight: The effects of starter feeding time on wet weight of yolk sac of Yangzhou goslings are presented in Table 3.

Whether starter feeding was provided or not, yolk sac weight decreased with the goslings' growth. No significant differences were observed for yolk sac weight among all groups at all time phases (P>0.05). However, residual yolk weight of the group T48 was higher than other groups during the experimental time; and at 156 h, yolk sac weight of birds in group T24 and T36 was higher than of those in group T12 and T48.

The highest yolk sac weight reduction occurred in the 12-60 h in all groups, more than 70% of the yolk sac was absorbed, but the decline rate varied. During this period, group T24 birds had the fastest reduction rate and lost 81.6%, while group T48 birds had the slowest reduction and lost 70.8%. Birds in groups T12 and T48 lost 77.2 and 80.1%, respectively. At 156 h of age, more than 98% yolk sac was absorbed in each group.

Table 3: Effects of starter feeding time on the weight of yolk sac (g).

Feed access time	Age (h)				
	12	36	60	108	156
12	12.39±1.25	6.65±4.62	2.94±2.71	0.67±0.58	0.21±0.15
24	12.78±1.81	7.03±2.44	2.37±1.29	0.82±0.52	0.09±0.06
36	12.95±1.96	7.24±4.72	2.56±1.30	0.87±0.54	0.15±0.10
48	13.33±1.99	7.87±6.36	3.77±2.48	1.17±0.72	0.29±0.14

Table 4: Effects of starter feeding time on contents (g) of crude protein and crude fat in yolk sac.

Item	Feed access time	Age (h)				
		12	36	60	108	156
Protein	12	3.194±0.665	1.531±1.178	0.512±0.571	0.107±0.040	0.017±0.001
	24	3.115±0.553	1.679±0.671	0.463±0.355	0.163±0.090	0.013±0.001
	36	3.211±0.758	1.790±1.187	0.600±0.327	0.154±0.139	0.019±0.007
	48	3.176±0.617	1.787±1.078	0.818±0.682	0.207±0.055	0.028±0.009
Fat	12	3.705±0.742	2.079±1.476	0.835±0.680	0.158±0.043	0.055±0.012
	24	3.801±0.642	1.959±0.719	0.550±0.291	0.278±0.135	0.036±0.028
	36	3.771±0.797	1.953±0.746	0.704±0.257	0.218±0.141	0.045±0.025
	48	3.926±0.834	2.153±1.746	0.900±0.762	0.344±0.153	0.069±0.057

4.2.2 The contents of crude protein and crude fat in yolk sac: The effects of starter feeding time on contents of crude protein and crude fat in yolk sac are presented in table 4. There was a trend indicating that the crude protein and crude fat contents decreased with growth. During the experiment, the crude protein and crude fat contents of in group T48 were higher than those in other groups, but the differences were not significant (P>0.05).

4.2.3 Water content in yolk sac: The effects of starter feeding time on the content of water in yolk sac are presented in table 5. The change in regularity of water content was the opposite of other nutrients in the yolk sac. The nutrients of the yolk sac were absorbed continuously, which led to increase in the relative proportion of water content, but the differences among the four groups were not

Journal of Animal & Plant Sciences, 2009. Vol. 4, Issue 3: 399 - 405.
Publication date: 19 October 2009, http://www.biosciences.elewa.org/JAPS; ISSN 2071 - 7024

significant (P>0.05). However, it was clear that the earlier feeding started, the higher the water content.

Table 5: Effects of starter feeding time on content (%) of water in yolk sac.

Feed access time	Age (h)				
	12	36	60	108	156
12	39.83±5.07	45.01±5.75	51.40±5.88	60.92±5.44	69.19±3.00
24	39.39±4.88	44.02±5.00	50.76±3.11	54.22±9.18	68.26±4.95
36	40.25±5.15	41.38±3.59	49.09±5.03	58.06±6.17	65.60±8.18
48	39.12±4.21	40.57±2.71	48.67±5.34	54.87±5.90	65.81±3.49

5 DISCUSSION

The study showed a beneficial effect of feeding before 36 h on body weight of goslings. The body weight of birds fasted for 24 h was significantly higher than that of those fasted for 48 h. It has been demonstrated 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).

The period from hatching to the onset of receiving nutrition is a critical phase in the development of chicks. During this period the yolk sac provides immediate post-hatch energy and protein for maintenance and growth (Anthony *et al.*, 1989). A recent study indicated that residual yolk is used up more quickly in geese that have access to feed immediately after hatch than in those fasted (Yang *et al.*, 2008). According to the research of Noy & Sklan (1998b, 2001), the lack of feed in the very early stages of birds development could cause a negative effect on initial performance due to an inadequate use of the yolk sac, which seemed to be caused by low stimulation of the gastrointestinal tract.

The present study indicated that during the whole period, residual crude fat and crude protein contents of the yolk sac in goslings fasted for 48 h were more than that of other goslings, but had the least water content. The study of Yang (2009) showed that during this phase, the crude fat and crude protein contents in yolk sac decreased exponentially. Research has shown that provision of oral nutrients actually increases the rate of residual yolk utilization, perhaps by initiating growth or causing increases in gut motility and yolk emptying through the yolk stalk. Therefore, these observations confirmed that birds selected for high growth rates depended on exogenous, extra-yolk-sac feeding very soon after hatching.

The chick can not produce antibody itself within 6 d after incubation, and almost 90% of the antibody absorption occurs during the last 3 d of incubation, and the maternal antibody lasts up to 2 to 3 weeks after hatching (Kramer & Cho, 1970; Kowalczyk *et al.*, 1985; Kim *et al.*, 2006. So it is evident that the protein and lipid remaining at hatching plays a much more specific and important role. In optimal or even normal conditions, these specific proteins would be best used for passive immunity until the neonate can mount an effective immune response. Many of the residual yolk lipids, specifically the cholesterol and phospholipids, are important components of cell membranes (Dibner *et al.*, 1998). Thus, providing optimum nutrition in this important neonatal period could be the next tool for continued efficiency enhancements in poultry production.

In the present study the standard deviation values of yolk sac weight was large, indicating substantial differences between goslings. We recommend that the selected samples should be as uniform as possible, e.g the hatching time, quantity of feed and the BW posthatch, among others.

These results suggest that food deprivation for 48 h may be unfavorable to the growth and the absorption of yolk sac of goslings, whereas deprivation for 24 h appears to be acceptable for growth. Thus our findings indicate that birds should be fed immediately when they reach the farm, and most appropriately between 12 and 36 h posthatch

ACKNOWLEDGMENTS: This work was financially supported by a grant (08KJD230001) from the University Natural Science Project of Jiangsu Province, P.R. China.

6 REFERENCES

Anthony NB, Dunington EA. and Siegel PB: 1989. Embryo growth of normal and dwarf chickens from lines selected for high and low 56-day body weight. Arch. Geflugelkd 53:116-122.

AOAC: 1990. Official Methods of Analysis, 15th edn, pp. 69-90 (Arlington, VA, Association of Official Analytical Chemists).

Boersma SI, Robinson FE, Renema RA. and Fasenko GM: 2003. Administering oasis hatching supplement prior to chick placement increases initial growth with no effect on body weight uniformity of female broiler breeders after three weeks of age. Journal of Applied Poultry Research 12:428-434.

Dibner JJ, Knight CD. and Ivey FJ: 1998. The feeding of neonatal poultry. World Poultry 14(5): 20-31.

Henderson SN, Vicente JL, Pixley CM, Hargis BM. and Tellez G: 2008. Effect of an early nutritional supplement on broiler performance. International Journal Poultry Science 7 (3): 211-214.

Juul-Madsen HR, Su G. and Sorensen P: 2004. Influence of early or late start of first feeding on growth and immune phenotype of broilers. British Poultry Science 45: 210-220.

Kim YS, Bobbili NK, Paek KS. and Jin HJ: 2006. Production of a monoclonal anti-myostatin antibody and the effects of in ovo administration of the antibody on posthatch broiler growth and muscle mass. Poultry Science 85(6):1062-1071.

Kowalczyk K, Daiss J, Halpern J. and Roth TF: 1985. Quantitation of maternal-fetal IgG transport in the chicken. Immunology 54:755–762.

Kramer TT. and Cho HC: 1970. Transfer of immunoglobulins and antibodies in the hen's egg. Immunology 19:157–167.

Noble RC. and Ogunyemid: 1989. Lipid changes in the residual yolk and liver of the chick immediately after hatching. Biology Neeodox 56: 228–236.

Noy Y. and Sklan D: 1996. Utilization of yolk in the newly hatched chick. British Poultry Science 37:987-995.

Noy Y. and Sklan D: 1998a. Metabolic responses to early nutrition. Journal of Applied Poultry Research 7: 437-451.

Noy Y. and Sklan D: 1998b. Yolk utilization in the newly hatched poult. British Poultry Science 39:446-451.

Noy Y. and Sklan D: 1999a. Different types of early feeding and performance in chicks and poults. Journal of Applied Poultry Research 8:16-24.

Noy Y. and Sklan D: 1999b. Energy utilization in newly hatched chicks. Poultry Science 78:1750-1756.

Noy Y. and Sklan D: 2001. Yolk and exogenous feed utilization in the posthatch chick. Poultry Science 80:1490-1495.

Romanoff AL: 1960. The Avian Embryo. Macmillan, New York. P:1042–1081.

Sklan D. and Noy Y: 2000. Hydrolysis and absorption in the intestine of newly hatched chicks. Poultry Science 79:1306–1310.

Tweed S: 2005. The Hatch Window. Cobb-Vantress Technical Focus. Vol. 2. Siloam Springs, AR.

Yang HM, Wang ZY, Shi SR, Chen WL, Zhou QY, Fan L.and Xu MJ: 2008. Effect of early feeding on the yolk nutrient utilization by goslings after hatching. Archiv Fur Geflugelkunde 72 (6): 264-268.

Yang HM, Wang Z Y, Zhu XH, Lu J. and Liang ZC: 2009. Effects of starter feeding time on growth of Yangzhou geese. Journal of Animal & Plant Sciences 2(3): 104-108.