



The Effect of Early Feeding and Transferring Time on the Histological Properties of the Small Intestine of Broilers

Mohammed Abbas Yaseen Hussein¹, Hasan S.A. Jawad^{2*}

Abstract

An experiment was conducted to evaluate the effect of early feeding on the small intestine of broiler chickens. 225 chicks, one-day old of broiler chickens Ross 308 with mean live body weight of 45 g were used, and were randomly distributed to five treatments by 45 chicks per treatment with three replicates (15 chicks per replicate). The experimental treatments were as follows: T1 (control treatment) – the chicks were transferred 24 hours after hatching to the field without feeding, T2 – the chicks were fed immediately and transferred to the field 24 hours after hatching, T3 – the chicks were fed immediately and transferred to the field 6 hours after hatching, T4 – the chicks were fed immediately and transferred to the field 12 hours after hatching, T5 – the chicks were fed immediately and transferred to the field 18 hours after hatching. The results of the present study showed no significant effects ($P > 0.05$) of the experimental treatments on the histological characteristics of the ileum and jejunum. However, significant differences in the length of the villi, the depth of the crypts, the thickness of the mucous layer and the thickness of the total wall of the duodenum was detected.

1114

Key Words: Early Feeding, Transferring Time, Histological Properties, Small Intestine, Broilers.

DOI Number: 10.14704/nq.2022.20.8.NQ44122

NeuroQuantology 2022; 20(8): 1114-1118

Introduction

The poultry industry has risen quickly in recent decades, with worldwide chicken consumption growing, and this trend is projected to continue, particularly in the development countries (National Research Council, 2015). Broiler chickens have been subjected to intense genetic selection pressure in order to increase growth performance. A healthy gut is vital for improved poultry development performance. Commercial broilers are brought to market weight at ever-younger ages, therefore the first week posthatch constitutes an increasing share of the whole growing period, and thus an essential phase for optimizing intestine growth and development (Bigot et al., 2003). During the first several days after hatching, the rate of small intestine growth outpaces the rate of BW increase (Katanbaf et al. 1988; Sell et al. 1991). To achieve the ability to gain greater weight, the birds

undergo fast functional growth of the small intestine (Uni et al. 1999). Bigot et al. (2003) previously shown that inadequate development of the small intestine during this period might result in growth retardation. As a result, the time immediately after hatch is important for small intestine growth, and availability to nutrition during this period promotes the small intestine (Peng et al. 2010). The aim of the current study is evaluating the effect of early feeding and transferring time on the histological properties of the small intestine of broilers.

Corresponding author: Hasan S.A. Jawad

Address: ^{1,2*}Department of Animal Production, Faculty of Agricultural Engineering Sciences, University of Baghdad, Iraq.
E-mail: ^{2*}dr.hassan198366@yahoo.com, hasan.s@coagri.uobaghdad.edu.iq



Materials and Methods

Study Site

The field experiment was conducted in the Agricultural Research Department/Livestock Research Department/Poultry Research Station/Hall 14/Abu Ghraib, for a period from 28/11/2021 to 3/1/2022 for a period of 35 days to find out the effect of early feeding and the date of transferring from the hatchery on histological characteristics of small intestine of broilers.

Experimental Design

The experiment involving, 225 one day Ross 308 chicks were used, with an average weight of 45g, prepared from the hatchery of Al-Shakr Al-Ahlia Company for the production of broilers in Abu Ghraib district. The chicks were randomly distributed among five treatments, 45 chicks/treatment, three replicates for each treatment, at a rate of 15 chicks/ repeat. The replicates were randomly distributed to the pens since the first day of the age, and the area of each pen was 5.1 x 2 m.

Intestinal Morphological Analyses

A sample of 3 cm in length, each from the duodenum, jejunum and ileum, was taken from 2 birds from each replicate (6 birds/treatment) and kept in a preservative containing formalin diluted by tap water to a concentration of 10%. The samples were sent to the laboratory (Educational Laboratories / Medical City) after a period of 7 days from the date of taking samples for the purpose of obtaining tissue sections. The aim of conducting histological measurements was to determine the extent of tissue growth in the layers of the small intestine parts and its relationship to the early feeding. The samples taken went through several stages, following the method recommended by Bancroft and Steven (1982).

Statistical Analysis

The complete randomized design (CRD) was used to study the effect of different treatments on the studied traits, and the significant differences between the means were compared with Duncan's (1955) polynomial test and the ready-made program (SAS 1996) was used in the statistical analysis according to the following mathematical model: $Y_{ij} = \mu + t_i + e_{ij}$.

Results and Discussion

The results of the current experiment showed the effect of early feeding and transferring time on some histological characteristics of the duodenum, jejunum and ileum segments. As for the duodenum, a significant ($P < 0.05$) superiority was recorded in the length of the villi, the total mucous layer and the total wall thickness of the treatment T3 compared to the treatments T1, T2, T4 and T5. While a significant difference ($P < 0.05$) in the depth of crypts for T2 treatment compared to the rest of the treatments was observed (Table 2). Consistent with the present finding, previous studies have shown that feeding assays of broiler chickens immediately after hatching accelerate the morphological development of the small intestine (Noy and Sklan 1998b), whereas a delay in reaching the first feed for 24 to 48 hours after hatching reduced the length of villi (Yamauchi et al. 1996). The current study also agreed with Uni et al. (1998) revealed that early feeding immediately after hatching increased the height of the villi and the surface area of the small intestine and enhanced the development of crypt depth. The recorded superiority may be attributed to the fact that the chicks had an increased absorption area and were therefore able to absorb more available nutrients. In regard with the jejunum, finding of this study showed no significant differences ($P > 0.05$) between treatments in all studied histological characteristics was demonstrated (Table 3). Conversely, Wang et al., (2020) reported that chicks fed immediately scored higher values ($P < 0.05$) in villus height and crypt depth compared to chicks that were delayed feeding. Moreover, chicks that received early feeding recorded a significant superiority in the height of the villus and the depth of the crypts compared with the fasting chicks (Gonzales et al., 2003). In the ileum, an insignificant differences ($P < 0.05$) between treatments in villi length, crypt depth, total mucosal layer thickness, and total wall thickness was found (Table 4). The current results differed with finding of Furuse et al., (1999) who stated that early feeding led to an increase in the length of the villi and the depth of the crypts, compared with the chicks that received a late feeding. Furthermore, immediate access to the feed after hatching scored higher values ($P < 0.05$) in terms of villus height and crypt depth compared to chicks that were fed later (Wang et al., 2020). The absence of nutrients provided by exogenous feeds may be responsible for changes in



the shape of the intestinal mucosa.

Conclusion

In the present study, the effect of early feeding and transferring time on the histological characteristics of the ileum and jejunum was not found. However,

the results showed significant differences in the length of the villi, the depth of the crypts, the thickness of the mucous layer and the thickness of the total wall of the duodenum, but this superiority did not affect the intestine development in this study.

Table 1. Feed ingredients of the research

Feed ingredients	Starter diet 1-14d	Grower diet 14-35d
Crushed yellow corn	43.8	44.6
local crushed wheat	14	15.4
soybean meal 48%	32.7	29.1
protein concentrate (1)	5	5
sunflower oil	2.2	3.5
limestone	1.1	1.5
Dicalcium Phosphate DCP	0.7	0.4
salt	0.3	0.3
Mixture of vitamins and minerals	0.2	0.2
Total	100	100

(1) Brocon-5 Special W vegetable protein concentrate, each kg contains: 40% protein, 5% fat, 2.26% fiber, 7.60% moisture, 24.52% ash, 3.53% calcium, 2.65% phosphorous available Lysine, 3.85% Lysine, 3.70% Methionine, 4.12% Methionine + Cysteine, 0.43% Tryptophan, 1.80% Threonine, 1.68% Valine, 2.57% Arginine, Kcal/kg 2183.70 Energy Representative, 2.40% Sodium,

4.04% Chloride, 200,000 IU Vitamin A, 60,000 IU Vitamin D3, 600 mg Vitamin E, 60 mg Vitamin B1, 140 mg Vitamin B2, 80 mg Vitamin B6, 700 mg Vitamin B12, 2 mg Vitamin H (Biotin), 800 Niacin, 20 mg Folic Acid, 50 mg Vitamin K3, 300 mg Calcium-D-Pantothenate, 7000 mg Choline Chloride, 6073.20 mg Choline.

Table 2. Effect of early feeding and transferring time on the histological characteristics of the duodenum of broilers

Duodenum							
Treatments	Villi length micrometer	Crypts depth micrometer	Mucosa l layer microm eter	Total thickness of the mucous layer micrometer	Muscle layer micrometer	Serous layer micrometer	Total wall thickness micrometer
T1	1.93b±30.11	0.16b±8.66	0±1	1.94b±39.77	0.23±4.66	0.16±2.33	1.97b±46.77
T2	1.53b±31.44	0.40a±11	0±1	1.34b±43.44	0.23±5	0.16±2.33	1.32ab±50.77
T3	4.65a±40.11	0.30b±8.88	0±1	4.57a±50	0.23±4.66	0.16±2.33	4.44a±57
T4	2.86ab±34.88	0.60b±8.44	0±1	2.39ab±44.33	0.23±5	0.16±2.33	2.51ab±51.66
T5	1.32b±27.66	0.54b±9.22	0±1	1.09b±37.88	0.23±4.66	0.16±2.33	1.05b±44.88
SEM	*	*	N.S	*	N.S	N.S	*

T1: Control diet and the chicks were transferred 24 hours after hatching to the field without feeding; T2: the chicks were fed immediately and transferred to the field 24 hours after hatching; T3: the chicks were fed immediately and transferred to the field 6 hours after hatching; T4: the chicks were fed immediately and transferred to the field 12

hours after hatching; T5: the chicks were fed immediately and transferred to the field 18 hours after hatching; abc Means with different superscripts within the same column differ significantly (*p < 0.05), ns p > 0.05; SEM: Standard error of means.



Table 3. Effect of early feeding and transferring time on the histological characteristics of the jejunum of broilers

Jejunum							
Treatments	Villi length micrometer	Crypts depth micrometer	Mucosal layer micrometer	Total thickness of the mucous layer micrometer	Muscle layer micrometer	Serous layer micrometer	Total wall thickness micrometer
T1	1.63±25.22	0.89±9.22	0±1	2.18±35.44	0.32±4.22	0.44±3.33	2.56±43
T2	2.59±26.22	0.86±9.77	0±1	3.32±37	0.32±4.77	0.44±3.33	3.52±45.11
T3	0.93±27.11	0.37±9.44	0±1	1.08±37.55	0.32±4.22	0.44±3.33	1.43±45.11
T4	2.93±27.55	0.68±7.66	0±1	3.21±36.22	0.32±4	0.38±3.11	3.29±43.33
T5	4.03±27.44	0.42±8.11	0±1	4.31±36.55	0.16±3.66	0.38±3.11	4.35±43.33
SEM	N.S	N.S	N.S	N.S	N.S	N.S	N.S

T1: Control diet and the chicks were transferred 24 hours after hatching to the field without feeding; T2: the chicks were fed immediately and transferred to the field 24 hours after hatching; T3: the chicks were fed immediately and transferred to the field 6 hours after hatching; T4: the chicks were fed immediately and transferred to the field 12

hours after hatching; T5: the chicks were fed immediately and transferred to the field 18 hours after hatching; abc Means with different superscripts within the same column differ significantly (*p < 0.05), ns p > 0.05; SEM: Standard error of means.

Table 4. Effect of early feeding and transferring time on the histological characteristics of the ileum of broilers

Ileum							
Treatment s	Villi length micromete r	Crypts depth micromete r	Mucosal layer micromete r	Total thickness of the mucous layer micromete r	Muscle layer micromete r	Serous layer micromete r	Total wall thickness micromete r
T1	4.96±27.66	0.43±8.22	0±1	4.65±36.88	0.16±4.33	0.16±2.66	4.65±43.88
T2	2.32±27.77	0.66±8.66	0±1	2.48±37.44	0.20±4.11	0.17±2.55	2.60±44.11
T3	2.03±26.77	0.40±6.77	0±1	1.95±34.55	0.20±4.11	0.17±2.44	1.98±41.11
T4	1.68±26.44	0.68±7.66	0±1	1.92±35.11	0.11±4.11	0.16±2.66	1.93±41.88
T5	2.62±30	0.55±8.66	0±1	2.67±39.66	0.1±4	0.16±2.66	2.71±46.33
SEM	N.S	N.S	N.S	N.S	N.S	N.S	N.S

T1: Control diet and the chicks were transferred 24 hours after hatching to the field without feeding; T2: the chicks were fed immediately and transferred to the field 24 hours after hatching; T3: the chicks were fed immediately and transferred to the field 6 hours after hatching; T4: the chicks were fed immediately and transferred to the field 12 hours after hatching; T5: the chicks were fed immediately and transferred to the field 18 hours after hatching; abc Means with different superscripts within the same column differ significantly (*p < 0.05), ns p > 0.05; SEM: Standard error of means.

muscle development in neonate broilers. *Poult. Sci.*, 82: 781-788.

Bigot K, Mignon-Graстеau S, Picard M, Tesseraud S. Effects of delayed feed intake on body, intestine, and muscle development in neonate broilers. *Poult. Sci.*, 2003; 82: 781-788. doi: 10.1093/ps/82.5.781.

Duncan, D.B. 1995. Multiple range and Multiple F-test. *Biometrics*, 11: 1-42.

Furuse M., Ao R, Bungo T., Ando R., Shimojo M., Masuda Y., Saito N. Central gastrin inhibits feeding behavior and food passage in neonatal chicks. *Life Sci.*, 1999; 65: 305-311. doi: 10.1016/S0024-3205(99)00249-0.

Gonzales, E., N. Kondo, E.S. Saldanha, M.M. Loddy, C. Careghi, and E. Decuyperre. 2003. Performance and physiological parameters of broiler chickens subjected to fasting on the neonatal period. *Poult. Sci.*, 82: 1250-1256.

Katanbaf M.N., Dunnington E.A., and Siegel P.B. 1988. Allomorphic relationships from hatching to 56 days in parental lines and F1 crosses of chickens selected 27 generations for high or low body weight. *Growth Dev. Aging*, 52: 11-21.

References

Bancroft, J.D., and M, Steven. 1982. *Theory and practice of histological techniques churshill living ston.* New York.

Bigot K, Mignon-Geasteau S, Picard M, and Tesseraud S. 2003. Effects of delayed feed intake on body, intestine, and



National Research Council. Critical Role of Animal Science Research in Food Security and Sustainability. National Academies Press; Pittsburgh, PA, USA: 2015.

Noy, Yael, and David Sklan. "Metabolic responses to early nutrition." *Journal of Applied Poultry Research* 7.4 (1998b): 437-451.

Peng P., Xu J., Chen W., Tangara M., Qi Z.L., and Peng J. 2010. Effect of early feeding and exogenous putrescine on growth and small intestinal development in posthatch ducks. *Br. Poult. Sci.*, 51: 101-108.

SAS (1996) Statistical Analysis System. SAS System for Windows Version 6.12. SAS Institute Inc, Cary NC 27513, USA. *Sci.*, 79: 1306-1310.

Sell J.L., Angel G.R., Piquer F.J., Mallarino E.G., and Al-Batshan H.A. 1991. Developmental patterns of selected characteristics of the gastrointestinal tract of young turkeys. *Poult. Sci.*, 70: 1200-1205.

Uni Z., Noy Y., and Sklan D. 1999. Posthatch development of small intestinal function in the poult. *Poult. Sci.*, 78: 215-222.

Uni, Z., Ganot, S., and Sklan, D. 1998. Posthatch development of mucosal function in the broiler small intestine. *Poult. Sci.*, 77: 75-82. doi:10.1093/ps/77.1.75. PMID:9469755.

Wang, Jiangshui, Dianchun Wang, Kaixuan Li, Lei Xia, Yuanyuan Wang, Lei Jiang, Chianning Heng, Xiuyun Guo, Wei Liu, and Xiuan Zhan. 2020. "Effects of First Feed Administration on Small Intestinal Development and Plasma Hormones in Broiler Chicks" *Animals* 10, no. 9: 1568. <https://doi.org/10.3390/ani10091568>

Yamauchi K, Kamisoyama H, Isshiki Y. Effects of fasting and re-feeding on structures of the intestinal villi and epithelial cells in White Leghorn hens. *Br Poultry Sci.*, 37: 909-921 (1996).

