Volume-2, Issue-7,July-2019: 35-42
International Journal of Current Innovations in Advanced Research ISSN: 2636-6282

The Effect of L-Glutamine and Broiler Albumin Supplementation through In Ovo Feeding Technique to Hatchability, Hatching Weight and Native Chicken Performance

Muh Ridwan, B[1]., Djoni Prawira Rahardja[2] and Muhammad Yusuf[2]

[1]Animal Science Faculty, Hasanuddin University
[2]Postgraduate Program, Hasanuddin University
Corresponding Author E-mail: ridwanbahar@yahoo.com

Received: July 15, 2019; **Accepted:**July22, 2019; **Published:** July 26, 2019

Abstract: The aim of the study is to identify hatching performance and native chicken hatching result resulted from *L-glutamin in ovo feeding* and broiler albumine. *In Ovo Feeding* (IOF) is the additional nutrient supplementation from the outside to the inside of the amnion of the chick embryo prior to hatching. The eggs were collected from native hens at the age of 40-60 weeks old. There are as many as 450 eggs used in this study. The study applied Randomized Block Design (RBD) with 5 treatments and 3 groups, P0: no injection (negative control), P1: injection of physiological NaCL (positive control), P2: injection with 1,5 % L-Glutamin in physiological NaCl solution, P3: injection of broiler albumin mixed with physiological NaCl solution, P4: injection of 0,75 % broiler albumin mixed with 0,75% glutamin. In this study, the observed parameters are divided into two stages. For the first stage, the observed parameters are hatchability, hatching weight, and hatching weight ratio. For the second stage the observed parameters included feed consumption, weight gain, feed conversion and growth. The result of the study showed that the treatment of hatchability, hatching weight, hatching weight ration and native chicken performance of the in ovo feeding did not significantly affect on the treatment final result. On the contrary, the apparent trend showed that the result was better compared to the control treatment.
Keywords: In ovo feeding, L-Glutamine, Broiler albumin, hatchability, hatching weight, performance.

Citation: Muh Ridwan, B., Djoni Prawira Rahardjaand Muhammad Yusuf. 2019. The Effect of L-Glutamine and Broiler Albumin Supplementation through In Ovo Feeding Technique to Hatchability, Hatching Weight and Native Chicken Performance.International Journal of Current Innovations in Advanced Research, 2(7): 35-42.

Introduction

High demand for native chicken meat and egg as poultry product still cannot be fulfilled by the native chicken farmer particularly during highly continuous demand for production. Accurate method to improve native chicken performance is necessary. Various studies have been performed to improve broiler productivity such as crossbreeding between species where it was reported to be capable of transforming genetical structure of native chicken (Zakaria, 2004), amino acid supplementation for laying hens, maintenance management setting (Ohta *et al*., 2001), however, the results of these studies were considered to be less optimal in improving broiler productivity. In the last decade, there has been an innovative study in improving native chicken productivity by performing nutrient supplementation during incubation process. The availability of feed contained in eggs is improved through the *in ovo feeding. In ovo feeding* aims to maximize the growth and the development of the embryo during the incubation period and to maximize the activities of the organogenesis of the embryo in chicken (McGruder *et al.,* 2011; Al-Daraji *et al.,* 2012; Salmanzadeh, 2012; Grodzik *et al.,* 2013; Asmawati *et al.,* 2014; Shafey *et al.,* 2014; Azhar *et al.,* 2016).

Feed availability contained in eggs is improved through the *in ovo* process or the nutrients the injection technique (Azhar *et al.,* 2016). The process needs to be completed because during the incubation period, necessary nutrition for the embryo in eggs occasionally is insufficient which lead to embryo death before hatching. Protein is considered to be the most primary nutrition to improve growth and development of the chicken during the incubation process with in ovo feeding technique. (Foye *et al.,* 2006: Zhai *et al.,* 2008: Grodzik *et al.,* 2013).

The injection process was performed on eggs during the incubation period *(in ovo feeding)* with amino acid supplementation, either essential amino acids or non-essential can provide energy in the embryo either at the cell development period in eggs or after hacthing period. L-glutamin is one amino acid used in the injection process apart from other amino acids such as methionine, lysine, arginine and others. The amino acid L-glutamine is a non-essential amino acid that plays an important role as a source of energy in the formation of the digestive tract, stimulate the proliferation of intestinal cells, and plays an important role in the synthesis of biological molecules (Salmanzadeh *et al.,* 2016) the amino Acid L-glutamine (Gln) plays a role as a source of energy for cell division and some of the metabolic pathways Shafey *et al.,* (2013). The aim of the study is to compare the performance of hatching eggs in native chicken as the result of *L-Glutamin in ovo feeding* and broiler albumin and to identify the performance of the hatching eggs of native chicken resulted from *L-Glutamine and broiler albumin in ovo feeding*

Material and Method

This research was conducted in the Laboratory of Poultry Production, Faculty of Animal Science, Hasanuddin University, Makassar. Materials used in this research were chicken eggs, amino acid L-Glutamin, Albumin, saline solution (0,9% NaCl physiological) aquades, 70% alcohol, 70% formalin, commercial feed, vaccine, vitamin and antibiotics. Supporting equipment used is semi-automatic incubator, egg-candler, analytical scales, 500 ml hand sprayer, thermometer/ digital hygrometer (DC 102), the automatic injector, scalpel, tweezer, a 50-ml beaker, a 10-ml sample pot, surgical scissors, pencil, petri dish, hanging feeder and drinker.

Research Design

1. Stage 1 (Incubation Period)

The study applied Randomized Block Design (CRD) with 5 treatments and 3 groups, P0: no injection (negative control), P1: injection of physiological NaCL (positive control), P2: injection with 1,5 % L-Glutamin in physiological NaCl solution, P3: injection of broiler albumin mixed with physiological NaCl solution, P4: injection of 0,75 % broiler albumin mixed with 0,75% glutamin. Group: K1: Hatching period 1; K2: Hatching period 2; K3: Hatching period 3

2. Stage 2 (maintenance period)

Research stage 2 is the following step from the research stage 1 with similar treatment order using samples (DOC) from hatching period 1. Research stage 2 was performed experimentally by applying Randomized Block Design (RBD) with 5 treatments and 3 similar replications with research stage 1.

Parameters

The observed parameters observed in the research stage 1 were as follows: hatchability; hatching weight; hatching weight ratio : egg weight; The observed parameters in the study stage 2 were as follows Performance parameters were measured at 1-56 days after the chicks hatch, the measured performance were as follows : feed Consumption; weight Gain; Feed Conversion; Growth.

Result

Hatchability, hatching weight, and the hatching weight ration of native chicken resulted from in ovo feeding is presented in Table 1.

Table 1. Hatchability, hatching weight, and the hatching weight ration of native chicken resulted from in ovo feeding

In Ovo Feeding	Parameters		
	Hatchability (%)	Hatching Weight (g)	The Weight ratio Hatchability (%)
P0	39,14± 5,76	29,62±2,43	71,01±1,07
P1	43,06±15,43	31,36±1,45	73,31±0,23
P2	40,62±11,86	31,02±0,19	73,23±0,32
P3	36,64±7,89	30,79±0,67	73,16±0,41
P4	30,52±16,58	31,30±3,32	72,59±1,16

Description : P0 : no injection (negative control); P1 : Injection with 0.9% NaCl (positive control); P2: Injection with 1,5 % L-Gluitamin of in 0,9% NaCl; P3 : Injection with broiler albumin in 0,9% NaCl; P4 : Injection with 0,75% broiler albumin mixed with 0,75% Gluitamin.

Native chicken performance at the age of 56 days the results of the *in ovo feeding* is presented in Table 2.

Table 2. Native chicken performance at the age of 56 days the results of the *in ovo feeding*

In Ovo Feeding	Parameters			
	Body Weight Gain (g/h/day)	Feed Consumption (g/h/day)	Final Body Weight (g/head)	Feed Conversion
P0	8,46±0,88	48,16±9,02	552±19.17	5,65±0,50
P1	8,10±0,71	48,54±9,05	520±2.08	5,95±0,65
P2	8,66±1,57	50,22±10,35	537±83.18	5,88±1,49
P3	9,01±1,62	46,33±8,74	599±91.22	5,16±0,59
P4	7,25±0,21	50,71±10,91	521±48.50	6,37±1,20

Description : P0 : no injection (negative control); P1 : Injection with 0.9% NaCl (positive control); P2: Injection with 1,5 % L-Gluitamin of in 0,9% NaCl; P3 : Injection with broiler albumin in 0,9% NaCl; P4 : Injection with 0,75% broiler albumin mixed with 0,75% Gluitamin.

Discussion

Hatchability, hatching weight, and hatching weight ratio, native chicken eggs resulted from *in ovo feeding*

Hatchability

Hatchability of eggs from each treatment can be seen in table 1. The lowest hatchability was on the treatment P4 and the highest hatchability was on the treatment P1. This indicated if the amino acid glutamine mixed with physiological NaCl or mixed with broiler albumin will lower the osmolarity of the NaCl. This condition can be indicated by low hatchability in the treatment of the amino acid glutamin compared to physiological NaC without glutamin and albumin. The main causes of low hatchability of *in ovo feeding* treatment is the contamination of microorganisms in solution characterized by a number of rotten eggs (Asmawati *et al.,* 2014). The microbial contamination occurred because the small eggs are unable to contain the volume of injected solution (sloshing) that causes the contact between the solution and the microbes on the surface of the egg's shell and absorbed back into the albumin. Another cause of high death rate of the embryo is due to an allergic reaction that occurs in the egg during the injection with a variety of solution of amino acids, especially albumin of laying hens and the mixed solution resulted in inability of eggs to hatch. In addition, the dose of solution injection is too high, especially for a solution of white egg laying hens that trigger allergic reactions. The more eggs that did not hatch, the lower value of hatchability was and vice versa. The death of the embryo during the incubation period can be caused by many factors such as the temperature exceeding the epigenetic temperature (Loyau *et al.,* 2014), low humidity (El-Hanoun *et al.,* 2012), the egg's nutrition (Moran, 2007), egg's abnormality (Onbasilar *et al.*, 2014).

Hatching Weight

Egg's injection using *in ovo feeding* with L-Glutamin and broiler albumin generated higher hatching weight compared to control treatment. This is due to the sufficient licyn and metionin in the embrio's growth resulting in high hatching weight. In addition, the occurrence of different hatching weight also caused differences in the albumin and yolk content used as nutrition to grow embryo (Hartmann et al., 2003).The increase in hatching weight was also triggered by the increase in liver glycogen and muscles and the effect of various amino acid solution supplementation. The increasing concentration of liver glycogen and muscles will be the cause of the increase in hatching weight (Foye *et al.*, 2006 and Dong *et al.*, 2013). Towards the hatching period, a greater quantity of energy supply (glycogen) was required to support hatching process. Heavier embryo with higher glycogen supply had effect on the increase of hatching weight.

Hatching weight ratio and weight ratio

The parameters of the hatching weight ratio and egg weight are observed to avoid the effect of egg weight to hatching weight (Azhar *et al.*, 2016). Eggs that were used as the samples had relatively similar size and weight. However, there were diferences in terms of egg's weight. Determining factor of hatching weight is the egg's weight. Heavier eggs were reported to result in higher hatching weight compared to the lighter eggs (Onbasiliar *et al.*, 2011: Dymond *et al.*, 2013). The higher the value of hatching weight ratio with egg's weight, the higher the growth rate of embryo although the value comes from the lighter eggs.

Native chicken performance resulted from various amino acid mixture injection

Weight Gain

Weight gain is an important indicator to measure the growth rate. Weight gain can be seen in the table 2. The results of variance analysis showed that the treatment does not affect the chicken weight gain. This occurred because a type of native chickens that does not have distinctive characteristics that they varied greatly. Varied characteristics in native chickens were indicated by the presence of genetic variation although the treatment given was similar, the responses of each chicken will be different as the nutrients needed by chickens for their growth. This is in accordance with the study performed by Wahyu (2004) that the nutrients required for livestock depends on genetic variation, age, body weight, activity, energy content of the ration and the environmental temperature.

Feed Consumption

The amount of chicken consumption with high protein and metabolism energy level tends to decrease. On the contrary it will increase when the level of protein and energy metabolism is low (Hernandez *et al.*, 2004). The results showed that there was no difference in feed consumption of all treatments, which indicated that the metabolism energy needs of the chicken had no differences between injected chicken and chicken with no injection. This happened because the feed used in each treatment had similar nutritional content, type and shape. The chicken will continue to consume the feed if the metabolism energy is not fulfilled (Li *et al.*, 2013). Metabolism energy in native chickens at their growth phase is 84, 59-99, 63 kcal/ head/ day (Ariesta, 2011).

Final Body Weight

The growth of the whole body was measured by body weight gain measurement. The increase of final body weight can be identified by measuring repeatedly within a particular period (Anggorodi, 1990). The more nutrients are absorbed, the heavier the organs and the higher the increase in body weight gain. The results showed that no effect occurred. In addition to that, it was possibly due to lack of response in native chicken to supplemented amino acid. It was related to the type of poultry used. It is similar with the study conducted by Salmanzadeh *et al.*, (2016) using hatching eggs from broilers where it was reported that *in ovo feeding* of amino acid L-glutamine on the 7-days old incubated eggs with the target to improve chicken growth and carcass characteristics on the chest, thigh and gizzard at the age of 42 days by using albumin injection.

Feed Conversion

The results of this study showed that the treatment had no effect on the conversion of native chicken feed. This condition was caused by the amount of feed consumed in each treatment tend to be relatively similar and also had an impact with the increase of weight gain identified from this study. Feed conversion in native chicken the age of 8 weeks ranged from 2,60-2,89 (Husmaini, 2000). The value of feed conversion in native chicken at the grower period for 12 weeks ranges from 4.1 to 6.8 (Usman, 2009). Differences in the study result were caused by different maintenance management and different time. Some previous studies have been performed and they showed that the higher the survival rate of the chicken, the higher the value of feed conversion (Suprijatna *et al.*, 2005).

Conclusion

Treatment in ovo feeding by using the amino acids L-Glutamine and also albumin has not been able to improve hatchability and hatching weight. However, a positive trend was shown from the results of in ovo feeding with a higher result when it was compared to control treatment (P0) and also the performance of the chicken.

Author's Contributions

Muh. Ridwan B: Conceived the manuscript and performed the field experiments

Djoni Prawira Rahardja: Designed field experiments.
Muhammad Yusuf: Performed chemical analyzed data.

EthicsThis Manuscript
EthicsThis Manuscript has not been published or presented elsewhere in part or in entirely and is not under the consideration by another journal. All the authors have approved the manuscript and agree with submission of interest to be declared.

Acknowledgements
The authors would like to express their gratitude toHasanuddin University that has provided inspirations andexpertise that greatly contributed to the research. The authorswould like to show their gratitude to laboratory staff for sharingtheir knowledge during this research.

References

1. Al-Daraji, H.J., Al-Mashadani, A.A., Al-Mashadani, W.K., Al-Hassani, A.S. and Mirza, H. A. 2012. Effect of in ovo injection with L-arginine on productive and physiological traits of Japanese quail. South African Journal of Animal Science, 42(2): 139-145.
2. Anggorodi, R. 1985. Poultry Food Science. Advanced progress. Universitas Indonesia Press.
3. Ariesta, A.H. 2011.The Effect of the Energy and Protein Content of the Diet on the Appearance of 0-10 weeks of Kampung Chicken. Thesis in Postgraduate Animal Husbandry Science. Udayana University.
4. Ariesta, A.H. 2012. Effect of Protein Energy Content on Rations on the Appearance of 0-10 Age Hens. Thesis, Udayana University, Denpasar.
5. Asmawati, H.S., Natsir, A., Pakiding, W. and Fachruddin, H. 2014. The effect of in ovo feeding on hatching weight and small intestinal tissue development of native chicken. Fakultas Peternakan Universitas Hasanuddin. Makassar.
6. Azhar, M., Rahardja, D.P. and Pakiding, W. 2016. Embryo Development and Post-Hatch Performances of Kampung Chicken by in Ovo Feeding of L-Arginine. Media Peternakan, 39(3): 168-172.
7. Dong, X.Y., Jiang, Y.J., Wang, M.Q., Wang, Y.M. and Zou, X.T. 2013. Effects of in ovo feeding of carbohydrates on hatchability, body weight, and energy status in domestic pigeons (Columba livia). Poultry Science, 92(8): 2118-2123.
8. Dymond, J., Vinyard, B., Nicholson, A.D., French, N.A. and Bakst, M.R. 2013. Short periods of incubation during egg storage increase hatchability and chick quality in long-stored broiler eggs. Poultry Science, 92(11): 2977-2987.
9. El-Hanoun, A.M., Rizk, R.E., Shahein, E.H.A., Hassan, N.S. and Brake, J. 2012. Effect of incubation humidity and flock age on hatchability traits and posthatch growth in Pekin ducks. Poultry Science, 91(9): 2390-2397.
10. Foye, O.T., Uni, Z., McMurtry, J.P. and Ferket, P.R. 2006. The effects of amniotic nutrient administration,“in-ovo feeding” of arginine and/or ß-hydroxy-ß-methyl butyrate (HMB) on insulin-like growth factors, energy metabolism and growth in turkey poults. International Journal of Poultry Science, 5(4): 309-317.

11. Grodzik, M., Sawosz, F., Sawosz, E., Hotowy, A., Wierzbicki, M., Kutwin, M., Jaworsi, S.,and Chwalibog, A. 2013. Nano-nutrition of chicken embryos. The effect of in ovo administration of diamond nanoparticles and L-glutamine on molecular responses in chicken embryo pectoral muscles. International Journal of Molecular Sciences, 14(11): 23033-23044.

12. Hartmann, C., Johansson, K., Strandberg, E. and Rydhmer, L. 2003. Genetic correlations between the maternal genetic effect on chick weight and the direct genetic effects on egg composition traits in a White Leghorn line. Poultry Science, 82(1): 1-8.

13. Husmaini, 2000. Effect of Increased Protein Levels and Ration Energy on Refeeding on Wild Chicken Performance. Jurnal Peternakan dan Lingkungan. Vol. 6(01).

14. Li, F., Zhang, L.M., Wu, X.H., Li, C.Y., Yang, X.J., Dong, Y., Lemme, A., Han, J.C. and Yao, J.H. 2013. Effects of metabolizable energy and balanced protein on egg production, quality, and components of Lohmann Brown laying hens. Journal of Applied Poultry Research, 22(1): 36-46.

15. Loyau, T., Collin, A., Yenisey, C., Crochet, S., Siegel, P.B., Akşit, M. and Yalçin, S. 2014. Exposure of embryos to cyclically cold incubation temperatures durably affects energy metabolism and antioxidant pathways in broiler chickens. Poultry Science, 93(8): 2078-2086.

16. McGruder, B.M., Zhai, W., Keralapurath, M.M., Gerard, P.D. and Peebles, E.D. 2011. Effects of in ovo injection of stimulant solutions on growth and yolk utilization in broiler embryo. Poultry Science 90: 1058–1066.

17. Moran Jr, E.T. 2007. Nutrition of the developing embryo and hatchling. Poultry Science, 86(5): 1043-1049.

18. Ohta, Y., Kidd, M.T. and Ishibashi, T. 2001. Embryo growth and amino acid concentration profiles of broiler breeder eggs, embryos, and chicks after in ovo administration of amino acids. Poultry Science, 80(10): 1430-1436.

19. OnbaŞılar, E.E., Erdem, E., Poyraz, Ö. and Yalçın, S. 2011. Effects of hen production cycle and egg weight on egg quality and composition, hatchability, duckling quality, and first-week body weight in Pekin ducks. Poultry Science, 90(11): 2642-2647.

20. Onbaşılar, E.E., Erdem, E., Hacan, Ö. and Yalçın, S. 2014. Effects of breeder age on mineral contents and weight of yolk sac, embryo development, and hatchability in Pekin ducks. Poultry Science, 93(2): 473-478.

21. Salmanzadeh, M. 2012. The effects of in-ovo injection of glucose on hatchability, hatching weight and subsequent performance of newly-hatched chicks. Brazilian Journal of Poultry Science, 14(2): 137-140.

22. Salmanzadeh, M., Ebrahimnezhad, Y., Aghdam Shahryar, H. and Ghiasi Ghaleh-Kandi, J. 2016. The effects of in ovo feeding of glutamine in broiler breeder eggs on hatchability, development of the gastrointestinal tract, growth performance and carcass characteristics of broiler chickens. Archives Animal Breeding, 59(2): 235-242.

23. Shafey, T.M., Sami, A.S. and Abouheif, M.A. 2013. Effects of in ovo feeding of L-glutamine on hatchability performance and hatching time of meat-type breeder eggs. Journal of Animal Veterinary Advances, 12(1): 135-139.

24. Shafey, T.M., Alodan, M.A., Al-Ruqaie, I.M. and Abouheif, M.A. 2012. In ovo feeding of carbohydrates and incubated at a high incubation temperature on hatchability and glycogen status of chicks. South African Journal of Animal Science, 42(3): 210-220.

25. Suprijatna, E., Atmomarsono, U. and Kartasudjana, R. 2005. Ilmu dasar ternak unggas. Penebar Swadaya, Jakarta, 227.

26. Usman, 2009. Growth of Wild Chicken in the Grower Period through the Provision of Red Fruit Seed Flour (*Pandanus conoideus* Lamk) as an Alternative Feed. National Seminar on Animal Husbandry and Veterinary.

27. Zakaria, S. 2004. The effect of the enclosure area on the production and quality of domestic chicken eggs maintained by the litter system. Bulletin Nutrisi dan Makanan Ternak, 5(1): 1−11.

28. Zhai, W., Neuman, S., Latour, M.A. and Hester, P.Y. 2008. The effect of in ovo injection of L-carnitine on hatchability of white leghorns. Poultry Science, 87(3): 569-572.