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The Hatching and Post-Hatch Performance of Native Chicken Resulted from *in* Ovo of L-Glutamine with Various Solutions

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Abstract

The study aimed to identify the effect of *in ovo* of *L-Glutamine* with various solutions to the hatching and post-hatch performance of native chicken. *In ovo* of nutrients is one method of external nutrient supplementation to the chicken embryo before hatching. As many as 300 eggs were used in this study. This study employed a completely randomized design (CRD) with 5 treatments and 3 replications, P0: Negative control, P1: Positive control (NaCl 0.9% solution), P2: Ringer Lactate, P3: *L-Glutamine* 1.0% in NaCl 0.9% solution, P4: *L-Glutamine* 1.0% in Ringer Lactate. The observed parameters in this study included the hatching performance and post-hatch performance of native chicken consisting of hatching weight, hatch and egg weight ratio, hatchability, feed consumption, final body weight and hematocrit value. The study indicated that the hatchability at the treatment P0, P2 and P4 was higher compared to P1 and P3. There was no significant effect of *in ovo* to the hatching weight, hatch and egg weight ratio, hatchability, feed consumption, final body weight and hematocrit value.

Keywords: In ovo; native chicken; L-Glutamine; NaCl 0.9%; Ringer Lactate.

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1. Introduction

Native chicken farming is one business that positively contributed to the availability of meat and egg, particularly for rural communities. However, the productivity of native chicken is still considered as low. One important factor to concern in improving the productivity of native chicken is the aspect of the hatching stage during the embryo formation in eggs. The injection of additional nutrients during the incubation through *in ovo* method to the eggs was reported to be capable of improving the embryonic formation and intestinal absorption as well as improving the chicken performance after hatching [1]. A study performed in [4] reported that the injection of *L-Arginine* through *in ovo* method after 10 days of incubation could increase the embryo weight, hatching weight, bodyweight increase and growth rate as well as to improve the feed conversion. In contrast, this had no effect on hatchability and native chicken consumption. In addition, the *in ovo* of *L-Glutamine* on the chicken eggs after 7 days of incubation resulted in better hatchability at the inoculation of NaCl physiological solution without *L-Glutamine* while hatching weight tends to be higher on 1.5% *L-Glutamine* inoculation [8]. According the authors in [15], *L-Glutamine* functions as a source of energy for cell division and several metabolic pathways, regulating the metabolism of nutrients, gene expression and protein synthesis, and stimulating the immune response. There is still a few research on the use of *L-Glutamine* to the native chicken embryo aimed to improve the quality of the chicks produced. Based on the description above, it is necessary to perform the *in ovo* inoculation of *L-Glutamine* during the incubation period that will support the embryonic development, particularly, during the cell division and organ formation. In addition, the inoculation would also optimize the muscle development and energy source that encourages the improvement in hatchability, hatching weight, and reduction in embryo mortality rate. This study aimed to identify the hatching and post-hatch performance of native chicken resulted from *in ovo L-Glutamine* with various solutions.

2. Material and Methodology

2.1. Material Research

The materials employed in this study were native chicken eggs collected from the poultry husbandry of Poultry Production Laboratory, L-Glutamine, NaCl 0.9% solution, ringer lactate solution, alcohol, seal tape, commercial feed, vaccine, vitamin, blood sample, anticoagulant, and disinfectant. The equipment and tools used in this study included the semi-automatic incubators, egg candler, analytical balance, automatic syringe, thermometer, stirrer, egg shelf, pin, feeder, drinker, chicken cage, digital balance, container, syringe, capillary pipe, centrifuge, microhematocrit and SPSS 16.0. software.

2.2. Research Design

The research was performed experimentally by Completely Randomized Design (CRD) with 5 treatments and 3 replications. Each replicate consisted of 20 eggs. The overall total samples were 300 native chicken eggs with an average weight of ±48,73 grams. The design of the experiment was presented as follows: P0: Negative control, P1: Positive control (NaCl 0.9% solution), P2: Ringer Lactate, P3: L-Glutamine 1.0% in NaCl 0.9% solution, P4: L-Glutamine 1.0% in Ringer Lactate. The injection results of the hatched eggs or the DOC samples were reared for 7 weeks in 5 cages. Blood samples were collected from the 7-week old chicks. In each replicate, the

blood sample of one male chick was collected. As many as 15 chicks were used as the samples.

2.3. Observed Parameters

The observed parameter of hatching performance in this study encompassed hatching weight, hatch and egg weight ratio, and the hatchability. While the performance parameters after hatching measured were feed consumption the measurements performed during the 7 weeks of maintenance, the final weight and the hematocrit value of the blood measurement at the end of the maintenance of the 7 weeks.

2.4. Data Analysis

The obtained data were analyzed with analysis of variance based on the completely randomized design. If *in ovo L-Glitamin* indicated any significant effect, it will be tested using Duncan Multiple Range Test (DMRT) [7]. While on the parameter of feed consumption, data analysis was not performed since there was no replication.

3. Result and Discussion

3.1. The Hatching Performance of Native Chicken

Egg weight, hatching weight, hatch and egg weight ratio and the hatchability of native chicken resulted from in ovo of L-Glutamine 1.0% with various solutions were presented in Table 1.

Table 1: Egg weight, hatching weight, hatch and egg weight ratio and the hatchability of native chicken

Treatment	Parameter			
	Egg Weight (g)	**Hatching Weight (g)**	**Hatch and Egg Weight Ratio (%)**	**Hatchability (%)**
P0	48.79 ±5.14	33.41 ±4.24	68.50 ±1.78	75.43 ±2.94[b]
P1	48.72 ±4.83	34.77 ±2.50	71.52 ±2.53	37.73 ±14.00[a]
P2	48.69 ±4.88	34.05 ±3.58	69.90 ±0.82	65.81 ±3.91[b]
P3	48.71 ±4.85	34.24 ±2.82	70.42 ±2.78	30.89 ±2.38[a]
P4	48.72 ±4.79	34.10 ±3.14	70.08 ±3.38	65.38 ±17.62[b]

Note : *[a,b] Different superscript letters in the same row indicate significant difference ($p<0.05$).

*P0: Negative control, P1: Positive control (NaCl 0.9% solution), P2: Ringer Lactate, P3: *L-Glutamine* 1.0% in NaCl 0.9% solution, P4: *L-Glutamine* 1.0% in Ringer Lactate.

Hatching Weight

Hatching weight of each treatment was presented in Table 1. The value of resulted hatching weight did not indicate any significant difference. However, the injection treatment had a tendency to be higher than the other treatments. This indicated that the supplementation of nutrients through *in ovo* method could help the embryonic development resulting in higher hatching weight. Refers to research [18], noted that crushed earlier supplementation of nutrients through *in ovo* method could improve growth, embryonic development, energy status, and intestinal development. Teh results of the study [3] confirmed the improvement of native chicken performance after applying *in ovo feeding* by using amino acid triggering *hyperplasia* and *hypertrophy* in the embryo, this contributes to embryonic development and has a positive effect on hatching weight. Moreover, injection *L-Glutamine* that could fulfil the energy needs after embryonic growth. Newsholme [12] stated that *L-Glutamine* was used as a precursor for synthetic glucose (*gluconeogenesis*). Glucose will enter the Krebs cycle to produce ATP as an energy source.

Hatch and Egg Weight Ratio

Injection of *L-Glutamine*, indicated that the percentage of hatching weight in comparison with egg weight was not significantly affected in all treatments. This is probably because the egg weight used tends to be the same. Nevertheless, the resulted value ranged from 68-72%. This indicated that during the hatching process, *in ovo L-Glutamine* was already on its optimal performance. This is in the with the results of the study [16], the normal hatching weight is 70% of the egg weight and hatching weight below that value would imply nonoptimal hatching performance. Azhar [4] stated that the higher the value of hatching weight ratio compared to the egg weight, the higher the growth rate of embryo although it is from an egg with smaller size.

Hatchability

The hatchability of the eggs indicating a significant difference from all treatments. The value of hatchability at the treatment P0 (Negative Control), P2 (Ringer Lactate Solution) and P4 (*L-Glutamine* 1.0% in Ringer Lactate Solution) were higher compared to the treatment P1 (NaCl 0.9% solution) and P3 (*L-Glutamin* 1.0% in NaCl 0.9% solution). This was due to the ringer lactate solution that contained more compleks composition and lower osmolarity compared to NaCl 0.9% solution. Novara [13] stated that NaCl 0.9% solution contained an osmolarity value of 300 mOsm/L. The osmolarity of ringer lactate solution is 273 mOsm/L [9]. The osmolarity of *L-Glutamin* was 280 mOsm/L [10]. It is suspected that the higher the osmolarity value, it can endanger the embryo. This is in line with the results of the study in[6] reported that high osmolarity (>300 mOsm/L) may destroy an embryo. Furthermore, ringer lactate solution could provide additional energy and when *L-Glutamine* is dissolved to the ringer lactate solution, it could provide an additional energy source for the embryo that improves hatchability. The author in [9] noted that lactate contained in ringer lactate solution function as an available energy substrate for active organs such as brain, heart, and muscle through *gluconeogenesis* mechanism.

3.2. The Post-Hatch Performance of Native Chicken

Feed consumption, Final Weight, and Hematocrit of Native Chicken resulted from in ovo of L-Glutamine 1.0% with various solutions were presented in Table 2.

Table 2: Feed consumption, final weight, and hematocrit of native chicken

Treatment	Parameter		
	Feed Consumption (g/e/h)	**Final Weight (g)**	**Hematocrit (%)**
P0	35.02	411.00 ± 16.82	31.16 ±0.76
P1	34.67	354.44 ± 33.23	30.50 ±1.00
P2	34.89	402.33 ± 22.36	31.00 ±2.17
P3	32.01	392.50 ± 28.17	30.83 ±2.30
P4	34.86	399.33 ± 38.69	31.33 ±1.60

Note : *P0: Negative control, P1: Positive control (NaCl 0.9% solution), P2: Ringer Lactate,

P3: *L-Glutamine* 1.0% in NaCl 0.9% solution, P4: *L-Glutamine* 1.0% in Ringer Lactate.

Feed Consumption

On this study, the generated feed consumption value tended to be equal in all treatments. This was possibly becaused by the equal type of feed in all treatment. However, it was apparent that the treatment P0 (Control negative) was higher compared to the other treatments. This is correlated to the resulted final body weight, the higher the body weight, the higher the feed consumption. Refers to reseach [14] noted that the ration consumption is affected by several factors. Some of them include ration palatability, ration physical characteristics, body weight, sex, temperature, hormonal balance, and growth phase. Furthermore, nutritional content from various rations will provide ration consumption value and different body weight [2].

Final Body Weight

The value of final body weight did not indicate any significant effect. However, it was apparent that the treatment P0 (Control negative) was higher compared to the other treatments. This is correlated to the resulted feed consumption. If the feed comsumption is higher then the higher the final body weight. This may be possibly caused by the lack of native chicken's response to the supplemented amino acid. It is related to the employed poultry type. The author [14] noted that one that affects final body weight is the level of feed

consumption.

Hematocrit Value

Based on table 1, the hematocrit value had no significant difference in each treatment. The hematocrit generated from *in ovo L-Glutamine* with various solutions in each treatment tended to show equal value. In spite of that, the value was categorized as normal. Ulupi and Ihwantoro [19] stated that the hematocrit value of native chicken is 29.8%. added again by [17] stated that the normal range of native chicken's hematocrit was 30-33%. Furthermore, Hematocrit value commonly becomes a determining indicator for blood capacity in carrying oxygen (O_2). In case of deviation from the hematocrit value of the blood can affect the ability of blood to carry oxygen [11]. The results of reseach [5] noted that the hematocrit value in chicken may be decreased and increased depending on the physical body condition of the chicken or the homeostasis.

4. Conclusion

In ovo L-Glutamine with various solutions at the 7th day of incubation generated higher hatchability compared to the control negative (P0), ringer lactate solution (P2), and *L-Glutamine* 1.0% in ringer lactate solution (P4). However, hatching weight, hatch and egg weight ration, feed consumption, final body weight and hematocrit value did not indicate any significant effect.

5. Suggestion

Further research is expected regarding the supplementation of amino acids especially *L-Glutamine* to native chikens with more diverse levels, precise injection times and more diverse solutions.

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