Effect of Mung Bean Sprout and Acidifier Supplementation on Fertility, Survival Rate, and Egg Weight of Native Chicken

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Abstract. This research aimed to analyze fertility, survival rate and egg weight of Native chicken with Mung bean sprout and acidifier supplementation in feed. This research was conducted in 50 days, from July to August, 2019. This is an in vivo research which used 12 months old of Native chicken, consisted of 24 roosters with average body weight of 2.29 ± 0.23 kg and 96 hens with average body weight of 2.24 ± 0.25 kg. The roosters were chosen from minimum fertility category of 40%. The factorial design used feed formulation with 17% level of crude protein and the average of metabolic energy of 2804 kcal/kg, with 48 hours germination of Mung bean sprout and acidifier supplementation. The supplementation level of Mung bean sprout were 0% and 1.8%, and the supplementation level of acidifier were 0%; 0.6%; and 1.2%. The roosters and hens were then grouped into 24 groups of mating with 1 roster and 4 hens proportion, then fed by treatment feed in 15 days. The semen was collected from all roosters by using a teaser female method with artificial cloaca, and directly inseminated to all hens which were on the group. Each egg from the groups was collected everyday within 5 days, then put into an incubator and then repeated twice using the second incubator for 2 days after the first incubator operated. The data was collected and analyzed by ANOVA, and continued with Tukey test, if there was a significant impact. The result showed that there was no significant increase on fertility level, survival rate and egg weight along with the increased feed consumption and better conversion. It can be concluded that feed treatment did not gave a direct impact to this research parameters, but was likely implicated to the inseminated semen quality and increased the feed palatability. It is recommended to scale up the level of Mung bean sprout and acidifier supplement in feed to optimize and to control the non research parametric factors.

1. Introduction

Native chicken is known as Indonesian indigenous chicken which population significantly increases. The national statistic bureau recorded in 2017, the Native chicken population were 294.2 millions, it increased more than 40 million or 3.10% within 8 years. This was a great development for Native chicken, as reported by Iskandar et al. [1] that on average 10 heads of Native chicken are owned by a farmer household and it has potential to increase up to 20–150 heads per farmer household. Supported by Zulkarnaen [2] research that reported 21.5 million of farmer households in all over Indonesia are Native chicken owners.

This is a great opportunity to develop Native chicken, but it is still threatened by a low productivity caused by its fertility that has not been optimum yet. The fertility factors of chicken stated by Rukmana (2003) are (1) sperm quality; (2) feed quality; (3) hormones; (4) ligth response; (5) mating age; and (6) heritability. Suprijatna et al. [3] added on his report that sex ratio mating was the fertility factors of chicken too. Based on those factors, a great effort
to optimize the chicken fertility is by developing the chicken management, especially in feed and reproductive management. This means optimizing the sperm quality, feed quality, hormones, and mating age are essential, as stated by Wijayanti et al. [4] that Native chicken can get an optimum productivity and fertility genetically if they meet good feed. So, the solution is by using artificial insemination with a better quality of semen from the roosters which were fed by quality feed.

Quality feed is the feed formulated from abundant and inexpensive available ingredients composed of nutrients needed by chicken, such as carbohydrates, fats, proteins, amino acids, vitamins and minerals. Those nutrients according to Suprijatna et al. [3] are the nutrition needed by chicken and carbohydrates as the main energy source and fats as the reserve energy source. Bell and Weaver [5] reported that chicken can live, grow and reproduce well when they got enough nutrition and energy source from their feed. In order to reproduce well, Rukmana [6] suggested that the chicken feed must meet the energy and protein needs with high vitamin E to preserve semen quality. Mustafa et al. [7] research reported that fermented feed combination with multienzymes and vitamin E could significantly increase the semen macroscopic quality but not significantly impacted to semen microscopic quality of Arabian roosters. Basyri [8] defined that vitamin C added on Native chicken feed could increase semen concentration and spermatozoa motility which decreased the percentage of spermatozoa abnormality.

Based on the research the need to get abundant and inexpensive alternative feed ingredients which were composed with carbohydrates, fats, proteins, minerals and vitamin C becomes important. It leads to Mung bean sprouts as feed ingredients of Native chicken feed. Mung bean sprouts is the germination of mung bean. Anggrahini [9] stated that germination of Mung bean could increase the nutrition composition, such as proteins and vitamins, also reduce the antinutrition contain. During the germination, starch is changed into small parts of maltosa by amilase enzyme (alpha and beta amilase) and the fats are hydrolized into digestible fatty acids [10]. One of the method to optimize the Mung bean sprouts as feed ingredients is by combining it with other feed ingredients, that have similar beneficial potential, and one of them is acidifier.

Acidifier is an organic acid as feed additive [11]. Organic acid as feed additive, is cell metabolism compound with low toxicity [12]. As a result, organic acids can effectively increase nutrient absorption as reported by Soltan [13]. Based on this benefit, the combination of acidifier and mung bean sprouts as feed ingredients for Native chicken feed is interesting to study, in order to optimize the fertility and productivity of Native chicken. Accordingly, the research needed to be done to analyze fertility, survival rate and egg weight of Native chicken with acidifier and Mung bean sprouts supplementation in feed.

2. Materials and methods
This research was conducted in 50 days, from July to August, 2019. This is an in vivo research which used 12 months old Native chickens, consisted of 24 roosters with the average body weight of 2.29 ± 0.23 kg and 96 hens with average body weight of 2.24 ± 0.25 kg. Elite roosters were choosen from minimum fertility category of 40%.

This research was conducted in The Feed and Nutrition Laboratory and Field Laboratory of Animal Science Faculty of Brawijaya University. The first location was used to characterize the mung bean sprouts and proximate analyze for the feed. The second location was for in vivo research for feeding, artificial insemination, and also hatching eggs.

The factorial design used a feed formulation with 17% level of protein and the average of metabolic energy of 2804 kkal/kg, with 48 hours germination of Mung bean sprouts and acidifer supplementation. The supplementation level of Mung bean sprout were 0% and 1.8%, and the supplementation level of acidifer were 0%; 0.6%; and 1.2%. The feed ingredients were Mung bean sprouts and acidifer were yellow corn, MBM (Meat Bone Meals), soybean meal, rice bran, palm oil, vitamin and mineral premix. NaCl solvent was also used to dilutate the semen before insemination. The research tools were floor pens (100
x 170 cm) with feeders, waterers, and wood-shavings during the experimental period; digital weight scale; artificial cloaca; spuit; knife; and 2 units semi-automatic incubators with 50 eggs capacity.

Roosters and hens were grouped into 24 groups of mating with 1 rooster and 4 hens proportion, then fed by treatment feed in 15 days. Semen was collected from all roosters using a teaser female method with an artificial cloaca as confirmed by Iswati et al. [14] method, i.e. semen collection was done in a way feathers around the cloaca could be shaven, the area around the cloaca was cleaned from dirt with a tissue soaked with disinfectant. The rooster was then fitted in an artificial cloaca tube as an artificial vagina and brought closer to the hen and the rooster would climb the hen and in a few seconds the ejaculation of semen occurred and it was collected in the artificial cloaca tube, and directly inseminated to all the hens in the group. Each egg from the groups was collected everyday within 5 days, then put into an incubator, and was then repeated twice using the second incubator within 2 days after first incubator operated. The data was collected and analyzed by ANOVA, and continued with Tukey test, if there was a significant impact.

![Figure 1. Rooster and the artificial cloaca](image1)

![Figure 2. Hen artificial insemination](image2)

3. Result and discussion

Table 1 shows that the data of the average feed consumption, fertility, survival rate, and the average egg weight. This data generally shows that there are no significant impact of mung bean sprouts and acidifier supplementation to average daily feed consumption, fertility, survival rate and egg weight, although there is an increase and a better value in all those limits within the increase level of Mung bean sprouts and acidifier supplementation. It indicated that Mung bean sprouts and acidifier supplementation have potential to optimize all the parameters.

Table 1 shows that there are no significant increase of the average of daily feed consumption of Native chicken in this research. This means Mung bean sprouts and acidifier supplementation can increase the average daily feed consumption but not significant. The increase value of daily feed consumption presumably caused by palatability increase, as stated by Huang et al. [15] that germinated Mung bean could change its nutrients, which one of the impact was a change in flavour and palatability. This germinated Mung bean as sprouts could also inactivate antinutrition, so it could increase the digestibility efficiency, as stated by [16]. A higher consumption of Mung bean sprouts will increase the digestibility efficiency of Native chicken. This digestibility efficiency might be caused by Mung bean sprouts performance optimization with acidifier added. Natsir [11] stated that acidifier as organic acid can keep digestive pH and keep the microbial balance, as a result can increase the digestibility efficiency. Based on that, it can be seen in table 1 that higher levels of Mung bean sprouts and acidifier can increase the value of average daily consumption. This increased value is higher than the level of Adi et al. [17] research which reported that the average of daily feed consumption of Native chicken was 101.56 g/each, because of body weight and energy level of feed differences. The differences of chicken feed consumption
depend on size, age, breed, physiological status, activity, health, temperature, growth rate, balanced nutrition and energy level of feed, as stated by Widodo [18].

### Table 1. Data research result

| Research Code | Average Daily Feed Consumption (g/head) | Fertility | Survival Rate | Average Egg Weight (g/egg) |
|---------------|----------------------------------------|-----------|---------------|----------------------------|
| A0G0          | 100.8978 ± 9.2107                      | 50.00%    | 75.00%        | 30.50± 0.71                |
| A0G1          | 111.7454 ± 4.6943                      | 62.50%    | 80.00%        | 33.00± 2.83                |
| A1G0          | 106.7917 ± 4.3084                      | 50.00%    | 75.00%        | 34.50± 0.71                |
| A1G1          | 107.1694 ± 0.2986                      | 68.75%    | 81.82%        | 34.50± 0.71                |
| A2G0          | 102.2745 ± 1.6681                      | 87.50%    | 85.71%        | 35.50± 0.71                |
| A2G1          | 110.7311 ± 1.9467                      | 93.75%    | 93.33%        | 42.50± 3.54                |
| AVERAGE       | 106.6016 ± 0.1284                      | 68.75%    | 81.81%        | 35.08 ± 1.53               |

Note: A: acidifier level (0 = 0%; 1 = 0.6%; 2 = 1.2%); G: germinated mung bean level (0 = 0%; 1 = 18%)

The impact of the increasing value of daily consumption average is the increasing of fertility, survival rate and average egg weight as shown in table 1. But, this increase value had no significant differences in feed treatments. This condition illustrated that feed treatments with higher level supplementation in feed have potential to be used, but still need to analyze the amount to control various data that caused by non treatments influence of the research environment, as stated by Hanafiah [19]. In other words, Mung bean sprouts and acidifier supplementation as feed treatments did not give a direct impact to fertility, survival rate and average egg weight, but they were likely implicated to the inseminated semen.

The quality semen can be seen from the fertility data in table 1. It is mentioned that fertility value minimum 50% and maximum of 93.75%, it was counted from 48 eggs, which were hatched 24 eggs in each incubator. This fertility value has an increase trend along with the rise of supplementation level of Mung bean sprouts and acidifier. It indicated that bioactive substances contained in vitamin C and E functioning as antioxidants which prevent free radicals and to prevent cell damage as stated by Mohiti et al. [20], including sex cell, that could preserve the spermatozoa and ovum quality. These qualities verify Rukmana [6] statement that chicken feed must meet the energy and protein needs and must be high in vitamin E to preserve semen quality. This performance indicated that Mung bean sprouts were optimalized by acidifier as stated by Natsir [11] that acidifier could increase the digestibility by increasing the digestive enzymes performance, decreasing intestinal pH and preserving the digestive microbial balance. This performance could directly impact to optimize the digestibility of Mung bean sprouts supplemented in feed.

The research feed with 17% level of protein and average of metabolic energy was 2804 kcal/kg, and it was higher than the Native chicken nutrients needs as stated by Mahardika et al. [21] that Native chicken nutrients need for living and production in 10 – 20 weeks of age was 16.75% level of protein and 138.77 W^0.75 kcal/day or 2358 kcal/kg of metabolic energy level. This protein and metabolic energy level of research feed was higher than [17] report too, that the use of 15% level of protein and 2647 kcal/kg of metabolic energy level of feed could impacted average 75.33% of fertility. This fertility value was higher than the average fertility value of this research which was 68,75%. According to Nataamijaya [22] these differences were caused by genetic, chicken reproductive management, mating and hatching. Looking further to this statement, the differences in the fertility value was related to the genetic. Because there were many breed of Native chicken, as stated by Henuk [23] that the Native chicken domesticated from local partridge from all over Indonesia which impacted many of Native chicken breeds, and could be also different genetic of Native chicken used in this research. Furthermore, the mating used in this research with 1 : 4 proportion of rooster and hen was similar to Adi et al. [17] but better than Rajab and Papilaya [24] which reported
that in traditional management, farmer usually used 1:10 proportion of rooster and hen for mating. The incubator used in this research could be a better way of egg hatching as stated by Ekarius [25], that incubator act as a broody hen which laid on the eggs and provided its body heat for hatching. When a chicken lays eggs, the life of an embryo remains adjourned till incubation starts [26]. But, the usage of conventional incubators in this research could cause a lower fertility value as stated by Suyatno [27], that conventional incubator had disadvantages in (1) hand-turning the egg could give an excessive vibration that caused embryodied; (2) egg inversion was not done evenly; (3) limitation of egg turning frequency; (4) uneven incubator’s temperature and humidity; and (5) incubator’s unstable heat. This fertility value showed differences in survival rate.

The survival rate of this research as shown in table 1 describes a rising trend along with the Mung bean sprouts and acidifier higher level supplementation. It also indicated that bioactive substances contained in vitamin C and E as Mung bean sprouts and acidifier ingredients functioning as antioxidant which prevent free radicals to prevent cell damage [27], especially in embryonal cells stored in egg yolks, in the clutch period. The embryonal cell preserved by balanced nutrient of feed, especially in mineral content, as Suprijatna et al. [3] stated that mineral deficiency cases in hen have an effect on embryonic development, and could cause the dead embryo. The number of dead embryo in egg hatching impacted the survival rate. This result indicated that the average survival rate was 81.81%. This value is higher than Suryani et al. [28] research which reported that the Native chicken survival rate was 59.98% or the number of dead embryo cases was 40.02%. This research value is better considering the similar method by directly used semen for artificial insemination as Nafiu et al. [29] research. This method, stated by Nafiu et al. [29] could preserve the spermatozoa motility, that would increase along with the longer storage time. The egg hatching of this research was done carefully and could incubators performance kept stable, that caused higher value of survival rate, as stated by Iswanto [30], that unstable performance of incubator could caused the increase of dead embryo, and as a result decreased the survival rate.

The survival rate could be predicted from egg weight which was figured from its structure and composition. Nuryati et al. [31] stated that egg structure and composition have important role in embryo development. The egg weight also used as fertility, hatchability, and hatchiing weight prediction which was used as egg selection consideration [32]. Kurtini and Riyanti [33] stated that medium egg weight had better hatchability than the higher or lower one. Table 1 shows that the average egg weight of this research is 35.08 ± 1.53g/egg. This weight is lower than Ahmadani [34] research which was 36.77 ± 4.85 g/egg. This differences were influenced by genetic, as stated by Ensminger et al. [35] that the genetic influence in ovum development period. A longer ovum development period can develop bigger egg yolk and directly produce heavier egg weight. But, in table 1 shows that the egg weight values increase a hike trend along with the Mung bean sprouts and acidifier supplementation level. It is indicated that Mung bean sprouts and acidifier supplementation in feed can increase the nutrient quality as stated by Campbell et al. [36] that egg weight was influenced by nutrient, body size and age. A higher egg weight would have a significant correlation with a higher hatching weight as stated by Hermawan [37].
4. Conclusion
This research concluded that there was no significant increase of the fertility level, survival rate and egg weight along with the increase of feed consumption and better conversion. It means that feed treatment did not give direct impacts to fertility, survival rate, and average egg weight, but it was likely implicated the semen quality which were inseminated and increases the feed palatability. It is recommend to scale up the level of Mung bean sprout and acidifier supplementation in feed in order to optimize and control the non research parametric factors.

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