RESEARCH ARTICLE OPEN ACCESS

Effects of Using Either Calcium and Acidifier Enhanced Nanotechnology on Egg Quality of Laying Quails

Mahayu Sekarini Putri[1], Osfar Sjofjan[2], Irfan H. Djunaidi[3], Muhammad Halim Natsir[4], Yuli Frita Nuningtyas[5], Danung Nur Adli[6]

[1](Magister Student at Faculty of Animal Science, Universitas Brawijaya,Malang, Indonesia Email:mahayusp@student.ub.ac.id)

[2](Lecture at the Faculty of Animal Science, Universitas Brawijaya,Malang Indonesia Email:osfar@ub.ac.id)

[3](Lecture at the Faculty of Animal Science, Universitas Brawijaya,Malang Indonesia Email: irjuna@ub.ac.id)

[4](Lecture at the Faculty of Animal Science, Universitas Brawijaya,Malang Indonesia Email: emhanatsir@ub.ac.id)

[5](Lecture at the Faculty of Animal Science, Universitas Brawijaya,Malang Indonesia Email:fritanuningtyas@ub.ac.id)

[6](Lecture at the Faculty of Animal Science, Universitas Brawijaya,Malang Indonesia Email: danungnuradli@ub.ac.id)

----------**********----------

Abstract:

This study aims to determine the effect of using either calcium and acidifier enhanced nanotechnology on egg quality of laying quails. The 200 laying quails reared for 6 weeks on the experimental diet. A completely randomized design (CRD) with five treatments and five replications was employed, with each experimental unit consisting of eight laying quails. The treatments consisted of T_0 = basal diet, T_1 = basal diet + 0.25% calcidifier, T_2 = basal diet + 0,5% calcidifier, T_3 = basal diet + 0,75% calcidifier and T_4 = basal diet + 1% calcidifier. Results were analyzed via one-way ANOVA and if a significant effect ($p \leq 0.05$) was identified, least significant difference (LSD) testing was then applied. The effect of treatment on egg weight, length egg, width egg, thickness egg and index egg were no significant (P>0,05) but on egg yolk cholesterol level was highly significant ($p \leq 0.01$) and from the results it was concluded that the best treatment was T_4, namely basal feeding with the addition of 1% calcidifier.

Keywords —Calcidifier, Feed Additive, Egg Quality, Laying quails

----------**********----------

I. INTRODUCTION

Several factors influence the success of laying quail management, including strain, management, housing, and feed. Feed costs 60-70% of the production cost in the poultry industry, so feed was one of important factor in livestock production. It is recommended that agricultural by products be used as alternative feed ingredients to reduce production costs and maximize income. Feed additives in modern poultry farming are generally used to spur growth or increase livestock productivity and feed efficiency (Sjofjan et al., 2020)[10]

Bioactive substances in plants that are sources of natural antibiotics have received attention from both the general public and researchers as alternatives to synthetic antibiotics. Acidifiers are a type of feed additive that works by improving the digestive tract and inhibiting pathogenic microbes. The acidifier from *Averrhoa bilimbi* L. was used in the research. Because it contains acids such as acetic acid, citric acid, and formic acid, this star fruit is classified as an organic acid source. Rasdi et al. (2010)[6] reported that due to its antibacterial properties, starfruit can prevent the growth of the salmonella typhi bacteria.

Calcium is a mineral element required by quail. It is involved in the formation of bones, egg shells, muscle contractions, and as a component that affects electrolyte and acid-base levels in the blood. Saraswati (2017)[7] reported that as a result, calcium supplementation in feed has a significant impact on production and immune requirements. Calcium addition to livestock must be done within limits so that it does not interfere with livestock growth and metabolism.

Star fruit (Averrhoa bilimbi L.) has the potential to be used as a natural acidifier because it functions as an acidifier that is used as an additive for poultry to maintain the pH of the digestive tract and create a pH condition that is suitable for digestion of food substances that enter the digestive tract, suppress pathogenic microbes and promote the growth of beneficial microbes. In a previous study, the used of calcidifier in feed gives a positive result on egg quality the laying hens (Sjofjan et al., 2021)[9]. This study aims to evaluate the effect of using either calcium and acidifier enhanced nanotechnology on egg quality of laying quails.

II. MATERIAL AND METHODS

Experimental design

Experimental design: A total of 200 heads of laying quails were used in the layer phase with a six weeks maintenance period. Laying quails that are 30 days old and the layer phase will be given commercial feed using feed from commercial feed and an additional *calcidifier* as a feed additive. The quail variety utilized (*Coturnix coturnix japonica L.*). Treatments were as follows with control (T0), basal diet + calcidifier 0.25% (T1), basal diet + 0.5% calcidifier (T2), basal diet + 0.75% calcidifier (T3), basal diet + calcidifier1% (T4). The laying quails were allowed ad libitum access to feed and water through a self-feeder and nipple drinker throughout the experimental period. All treatments were measured into analysis egg weight, egg length, width egg, thickness egg, index egg and egg yolk cholesterol of laying quails.

III. DATA ANALYSIS

The data obtained from the research findings is then processed using Microsoft Excel. Furthermore, the observed values are averaged, and statistical analysis is performed using analysis of variance (ANOVA) with the Completely Randomized Design (CRD)

method. If the results are significantly different, Duncan's Multiple Distance Test is used.

IV. RESULT AND DISCUSSION

Table 1. Effect of calcidifier in feed on the external egg quality and egg yolk cholesterol level

Item	Egg weight (g)	Egg length (mm)	Width egg (mm)	thickness egg (mm)	Index egg (%)	Egg yolk Cholesterol (mg/100 g)
T0	10,98 ± 0,48	3,01 ± 0,25	2,33 ± 0,20	0,35 ± 0,04	7,52 ± 0,69	742.98 ± 6.13^{c}
T1	10,40 ± 0,25	2,72 ± 0,21	2,15 ± 0,20	0,34 ± 0,05	7,00 ± 0,30	729.99 ± 11.30^{bc}
T2	10,68 ± 0,50	2,85 ± 0,26	2,24 ± 0,23	0,35 ± 0,02	7,24 ± 0,62	713.02 ± 4.14^{b}
T3	10,54 ± 0,30	2,77 ± 0,35	2,19 ± 0,29	0,35 ± 0,08	7,16 ± 0,56	677.98 ± 5.87^{ab}
T4	10,88 ± 0,41	3,03 ± 0,13	2,38 ± 0,11	0,38 ± 0,01	7,58 ± 0,33	674.81 ± 7.52^{a}

$^{a\text{-}b}$ Means within row followed by different superscript differ at $p<0.05$

Based on the results of research that has been done, the average effect of the treatment of the egg weight in Table 1 shows the treatments T0 (10.98 ± 0.48), T1 (10.40 ± 0.25), T2 (10.68 ± 0.50), T3 (10.54 ± 0.30), and T4 (10.88 ± 0.41) in grams. In Table 1. the highest egg weight is found in treatment P0 and the lowest egg weight occurs in treatment P1.

According to Arifin et al. (2016)[1], quail productivity can reach 250-300 eggs per year, with an average weight of 10 g/grain (about 8% of the parent's body weight) or close to 11.91 g. This is consistent with the study's data, which showed that the average weight of the eggs produced was around 10 g/grain. Statistical analysis of egg weight, as shown in the appendix, reveals that adding a calcidifier to the feed has no significant effect. Feed consumption, feed protein content, and hormonal factors in the egg formation process all have a big impact on egg weight and production (Hanapis et al., 2020)[4].

The effect of adding a calcidifier on egg length is shown in Table 1. which shows the treatments T0 (3.01 ± 0.25), T1 (2.72 ± 0.21), T2 (2.85 ± 0.26), T3 (2.77 ± 0.35), T4(3.03 ± 0.13) in mm. Meanwhile, the average effect of treatment on the width of quail eggs is in Table T. which shows the treatments T0 (2.33 ± 0.20), T1 (2.15 ± 0.20), T2 (2.24 ± 0.23), T3 (2.19 ± 0.29), T4 (2.38 ± 0.11) in mm. In Table 1. the highest egg length and width is found in treatment T4. Of the two data, the highest length and width are found in P4 where the calcidifier given is the most numerous. This shows that by giving different calcidifier, it can affect the length and width of quail eggs.

According to the research, the length and width of the eggs affect the index value

of the eggs, which affects the shape of the eggs that will be produced. According to Harmayanda et al. (2016)[5], eggs that are relatively long and narrow will have a lower index, whereas eggs that are short and broad, whether small or large in size, will have a higher index. To determine the length of the egg, position the caliper facing the direction of the longest axis (horizontal axis), while for the width, position the caliper facing the direction of the shortest axis (vertical axis).

Table 1 shows the average effect of treatment on quail egg shell thickness based on the results of the research, which shows the treatment T0 (0.35 0.04), T1 (0.34 0.05), T2 (0.35 0.02), T3 (0.35 0.08), and T4 (0.38 0.01). According to the tabel, the average value of egg shell thickness is about the same size. Treatment T4 had the highest shell thickness values and T0, T2, T3 had the same shell thickness values. This demonstrates that different calcidifier can have the same value.

According to Shoimah et al. (2019)[8], an increase or decrease in Ca and P consumption can affect egg shell weight. The higher the calcium content of the feed, the greater the egg shell weight. Maintenance management, health, nutritional content of rations, nutritional adequacy of livestock, and environmental conditions can all influence shell weight. According to research, Ca can strengthen eggshells so that they are not easily broken, and factors such as management, livestock health, and nutrition influence the process of eggshell formation.

The effect of adding a calcidifier on egg index is shown T0 (7.52 0.69), T1 (7.00 0.30), T2 (7.24 0.62), T3 (7.16 0.56) and T4 (7.58 0.33). In Table 1, T4 has the highest egg index value, while T1 has the lowest egg index value. This demonstrates that different calcidifiers can produce different values. The egg index was determined by measuring the length and width of the egg with a caliper. According to Gubali et al. (2022)[3], the egg index is calculated by comparing the width of the egg to the length of the egg and is expressed as a percentage.

The effect of adding a calcidifier on egg yolk cholesterol is shown in Table 1. Based on the data in the table. 1 it can be seen that the average treatment results from the largest to the smalest are T0 (742.98 $\pm$ 6.13^{c}), T1 (729.99 $\pm$ 11.30^{bc}), T2 (713.02 $\pm$ 4.14^{b}), T3 (677.98 $\pm$ 5.87^{ab}) and T4 (674.81 $\pm$ 7.52^{a}) in percent units. The results showed an decrease in T4 treatment with an average egg yolk cholesterol that was 674.81 $\pm$ 7.52^{a}. The results showed that the treatment feed had significant effect ($P < 0.01$) on the addition calcidifier of the egg yolk cholesterol of laying quail. The inclusion of feed additives in feed has a significant effect on the cholesterol content of egg yolks; additives can reduce the cholesterol content of egg yolks (Galik et al., 2014)[2].

V. CONCLUSION

Egg weight, length egg, width egg, thickness egg and index eggwasnot affected by the addition of calcidifier. But Egg yolk cholesterol level was affected by the addition of calcidifier. However, all the variable gave the best results with the addition of 1% calcidifier.

REFERENCES

[1]Arifin, H. D., Zulfanita dan J. M. W. Wibawanti. 2016. *BeratTelur, Indeks Dan Volume TelurPuyuh (Coturnix-Coturnix Japonica) PengaruhKonsentrasi Sari Markisa (Passion Fruit) Dan Lama Simpan Di Suhu Ruang.Sains terapan*. 1039(1013): 581-587.

[2]Gálik B., Arpášová H., Bíro D., Rolinec M., Šimko M., Juráček M. and RóbertHerkeľ . 2014. *The effect of dietary Rhus coriaria L. on table eggs yolk nutrients composition*. Acta fytotechn. zootechn. 17(3): 93–95.

[3]Gubali, S. I., S. Zainudin dan S. Dako. 2022. *ProduksiTelurBurungPuyuh (Coturnix-Coturnix Japanica) Yang Di Beri TepungJeroan Ikan cakalang.Gorontalo Journal of Equatorial Animals*. 1(1): 22-29.

[4]Hanapis, E. J. Guntoro dan Aswana. 2020. *PengaruhPenggantian Sebagian PakanKomersilDenganTepungWortelLimbah Pasar Sampai Level 12 % TerhadapBeratTelurPuyuh (Coturnix-Coturnix Japonica). Stock Peternakan*. 2(1): 16-25.

[5]Harmayanda, P. O. A., D. Rosyidi dan O. Sjofjan. 2016. *EvaluasiKualitasTelur Dari Hasil PemberianBeberapaJenisPakanKomersialAyamPetelur*. *J-PAI*. 7(1): 25-32.

[6]Rasdi N., Hafipah M., Samah, Othman A., Sule, Abubakar and Ahmed Q.U. 2010. *Antimicrobial studies of Cosmos caudatusKunth. (Compositae)*. Journal of Medicinal Plants Research. 4(8: 669-673.

[7]Saraswati, T. R. 2017. *Absorpsi dan MetabolismeKalsium Pada Puyuh (Coturnix-Coturnix Japonica). BuletinAnatomi dan Fisiologi*. 2(2): 178-186.

[8]Shoimah, D., I. H. Djunaidi and O. Sjofjan. 2019. Quality of Duck Eggs Maintained Using A Different Maintenance System in The Malang Raya Area. *International Research Journal of Advanced Engineering and Science*. 4(4): 273-277.

[9]Sjofjan O., Adli D. N., Choirunnisa R.R., Auwy I. and AchmadFadil Ihsan A.F. 2021. *The Effect of Combination of Calcidifier (CaCO3 and Averrhoa bilimbi L.) to External and Internal egg of ISA Brown Laying Hens*. Advances in Biological Sciences Research. 13(-): 140-143.

[10]Sjofjan O., Natsir M.H,. Adli D.N., Adelina D.D. and Triana L.M. 2020. *Effect of symbiotic flour (Lactobacillus sp. and fos) to the egg quality and performance of laying hens*. IOP Conference Series: Earth and Env. Sci. 465(1): 012-033.

