

# The effect of live maggot (*Hermetia illucens*) supplementation on organoleptic quality and yolk color of duck egg

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## The effect of live maggot (*Hermetia illucens*) supplementation on organoleptic quality and yolk color of duck egg

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**Abstract.** Black soldier fly (BSF) maggot is a biological agent that can solve the problem of converting organic waste into biomass for poultry feed as well as fertilizers. Although live maggot supplementation in ducks functions as cheap feeds, it raises significant concerns because it can affect egg quality, changing the taste and odor. Therefore, this study aims to determine the organoleptic quality of duck eggs fed with live maggot (*Hermetia illucens*) using 20 Alabio ducks (*Anas platyrhynchos*) placed in postal cages. It was conducted using a completely randomized design with a 2x2 factorial pattern to investigate the effect of two independent factors, namely protein level at 15% and 21%, as well as the concentration of live maggot supplementation given at 0 and 40 g/day. The texture, flavor, and odor were tested using 67 moderately trained panelists, while the yolk color was determined using a yolk color fan, then the data obtained were analyzed for variance. The results showed that the protein level of the diet significantly affected the yolk's texture and odor, but not the flavor and color. Furthermore, an interaction occurred between the protein level of the diet with the live maggot supplementation on the texture. Based on the results, Alabio ducks fed with a high protein diet namely 21% plus 40 g/bird/day live maggots produced eggs with a soft texture, good flavor, fishy odor, and the highest average color score of 8.69 compared to other treatment combinations.

### 1. Introduction

Eggs are highly nutritious, inexpensive, nutritionally balanced, and beneficial for human health. They contain sufficient amounts of proteins, fats, vitamins, minerals, and bioactive compounds, but the composition is influenced by strain, age, feed, and environmental conditions [1]. Furthermore, duck eggs have a distinctive taste that differs from chicken's or quail's, and the sensory characteristics such as color, texture, odor, and taste are influenced by the type of feed consumed [2-4].

The increase in duck egg production needs to be supported by the provision of quality diets at relatively low prices. The role of diets in duck farming can reach 70-80% of the total production cost. Moreover, Donohue *et al.* [5] stated that the broiler chickens' feed cost can be more than 70% of the main portion to fulfill the metabolic energy needs. To reduce expenses, there is a need to find cheaper alternatives with complete nutrients. An example of such substitute feed ingredients is maggots, which are still being developed. They contain proteins and are also high in fats up to 35% and minerals such as Ca (5-8%) and P 0.6%-1.5% [6].



Black soldier fly (BSF) maggot has the potential to solve several environmental problems related to the volume of waste, unpleasant odors, and greenhouse gas emissions. The previous study stated that BSF larvae are very greedy to eat organic material, hence, they can be used through a simple technique to reduce organic waste [7]. The nature of maggot that eats kitchen scraps, as well as feces of chickens, pigs, cows, and humans can reduce waste by approximately 50% and eliminate pathogenic bacteria.

The previous study showed that maggots are suitable as an alternative feed for poultry [8]. Generally, they are used in the diets in the dry form [9,10], which have been reduced of its fat content [11], the live form of BSF maggot [12], and the fat is utilized for broiler feed [13,14].

Generally, the organoleptic qualities of eggs, such as color, odor, and taste, are affected by the feeds. The study of Świątkiewicz *et al.* [15] added algal oil to laying hens' diets, and the eggs' flavor was affected. Moreover, a previous study added *Moringa oleifera L* leaf flour to layers' feeds and it affected eggs' taste, although the odor, flavor, and color remained relatively the same [4]. Furthermore, Damaziak *et al.* [3] used garlic and onion extracts with layers' diets, and it changed the odor as well as the flavor of boiled eggs. This study aims to determine the effect of live maggots on the organoleptic quality of duck eggs.

## 2. Materials and methods

### 2.1. Materials

Live BSF maggot in the pre-pupa phase obtained from cultivation using palm kernel meal media and other organic materials. Experimental livestock, including 7-month-old 120 Alabio ducks, randomly divided into 24 units of cages, each having 5 ducks. Trial diet, consisting of duck concentrate (KIP 333 Production of PT. Wonokoyo Jaya Corporindo Company Surabaya), rice bran, corn, and fish meal. Tables 1 and 2 present the composition and the nutrient content of the experimental diet, respectively.

**Table 1.** Nutrient composition of the experimental diet feed ingredients (*as-fed*)

| Feed ingredients | Crude protein (%) | Metabolizable Energy (Kcal/kg) |
|------------------|-------------------|--------------------------------|
| Duck concentrate | 38.00             | 3,300                          |
| Rice bran        | 14.67             | 2,005                          |
| Corn             | 8.50              | 3,244                          |
| Fish meal        | 42.76             | 2,845                          |

### 2.2. Experimental design

The study used a completely randomized design (CRD) with a 2x2 factorial pattern, the first factor was the protein content of diet consisting of 2 levels, namely 15% and 21%, while the second was live maggot supplementation which comprised 2 levels of 0 and 40 g/bird/day concentrations. Each treatment combination is shown as follows with six replications. P1 = Low Protein Feed (15%) + Live BSF Maggot (0 g/bird/day); P2 = Low Protein Feed (15%) + Live BSF Maggot (40 g/bird/day); P3 = High Protein Feed (21%) + Live BSF Maggot (0 g/bird/day), and P4 = High Protein Feed (21%) + Live BSF Maggot (40 g/bird/day).

### 2.3. Maggot Production and Placement of ducks

A total of 20 basins, each filled with 3 kg of palm kernel meal and 6 liters of water, were covered with dried banana leaves and left in the open for 3 weeks. Maggots contained in the basin were then harvested, weighed, and given to ducks.

Newly arrived ducks were placed in each previously weighed uniformly cage plot, each having 5 ducks. Subsequently, each treatment diet material was weighed according to needs, and the four treatments were mixed to homogeneity and given to the ducks. The diets were given twice a day or *ad libitum*, in the morning and evening when food was completed, as well as drinking water was offered similarly. Moreover, all cage plots were equipped with a place to eat and drink that suited the ducks'

needs, and 15-watt incandescent lamps were used for lighting. The eggs produced in each treatment plot were marked and boiled for 30 minutes, cooled, and split into four for panelist test. The panel comprised 67 moderately trained people.

**Table 2.** Experimental diet composition and nutrient content

| Feed ingredients               | Treatment diet |               |
|--------------------------------|----------------|---------------|
|                                | Low protein    | High protein  |
|                                | ------(%)----- |               |
| Duck concentrate               | 17.00          | 17.00         |
| Rice bran                      | 24.10          | 21.40         |
| Corn                           | 58.90          | 43.60         |
| 20h meal                       | 0              | 18.00         |
| <b>Total</b>                   | <b>100.00</b>  | <b>100.00</b> |
| <b>Nutrient content</b>        |                |               |
| Crude protein (%)              | 15.00          | 21.00         |
| Metabolizable energy (kcal/kg) | 2,954          | 2,916         |

#### 2.4. Response variable measurement

The response variables comprised texture, flavor, and odor, which were analyzed for organoleptic properties using the hedonic test method [15] [16] and 67 moderately trained panelists. Texture score was based on 5-point scales including 1 = very hard, 2 = hard, 3 = adequate, 4 = soft, and 5 = very soft, while, 7-point scales represented flavor, and included 1 = extremely delicious, 2 = very delicious, 3 = delicious, 4 = adequate, 5 = lack of delicious, 6 = not delicious, and 7 = extremely not delicious. Furthermore, odor's 7-point scales comprised 1 = extremely fishy, 2 = very fishy, 3 = fishy, 4 = adequate fishy, 5 = lack of fishy, 6 = not fishy, and 7 = extremely not fishy, while the yolk color was determined using an egg yolk color fan.

#### 2.5. Data analysis

The observational data were collected, and the analysis of variance was conducted to determine the difference in the treatment effects of the observed variables. When the variance results showed a significant or highly significant effect, the test is then continued with the Duncan's Multiple Range Test (DMRT) using SPSS 23 for windows [17].

21

### 3. Results and discussion

#### 3.1. Texture

Table 3 presents the observational data for the organoleptic quality of eggs, as well as the yolk color from each treatment of protein level and live maggot supplementation in ducks.

Based on Table 3, this study obtained texture scores ranging from 2.94 to 3.59, classified as adequately soft to soft. The highest (3.59) and the lowest (2.94) scores were realized in the combinations of high protein diet, namely 21% with 40 g/bird/day maggot and low protein diet of 16% with 40 g/bird/day maggot, respectively. Based on the results, the live BSF maggot treatment and protein level significantly affected the texture of boiled eggs as demonstrated by P-values less than 0.05 and 0.01, respectively. Therefore, an interaction occurred between the diet's protein level and the maggot. The combination of 40 g/bird/day live maggot and a high protein diet also produced a different texture score from the other three.

Generally, the administration of up to 40 g/bird/day live maggots to the ducks can make the egg texture score softer because the birds have higher protein and fat contents that can be deposited in eggs. Al-Qazzaz *et al.* [18] reported that BSF larvae contain crude protein and fat content of 559.9 g/kg and 18.6 g/kg concentrations, respectively, but when the fat content is reduced, the egg texture will not be



significantly affected. This is confirmed by Zotte *et al.* [11] which stated that the quail eggs texture is relatively the same for the control and administration of reduced-fat maggot meal.

Additionally, a previous study explained that the use of 10% dry maggot in quail diets did not negatively affect the sensory profile of breast meat [19]. The three treatment groups, including control, 10% dry maggot reared in 100% chicken layer mash media, and 10% dry maggot reared in 50% chicken mash and 50% fish offal media, had the same sensory profile results on quail breast meat.

**Table 3.** Average organoleptic quality of duck eggs

| Variables  | Protein (%)       | BSF Maggot is alive (g)       |                               | Average $\pm$ SEM             |
|------------|-------------------|-------------------------------|-------------------------------|-------------------------------|
|            |                   | 0                             | 40                            |                               |
| Texture    | 15 (Low)          | 2.99                          | 2.94                          | 2.96 $\pm$ 0.062 <sup>b</sup> |
|            | 21 (High)         | 3.13                          | 3.59                          | 3.37 $\pm$ 0.088 <sup>a</sup> |
|            | Average $\pm$ SEM | 3.06 $\pm$ 0.067 <sup>b</sup> | 3.27 $\pm$ 0.087 <sup>a</sup> |                               |
| Flavor     | 15 (Low)          | 3.34                          | 3.48                          | 3.41 $\pm$ 0.063              |
|            | 21 (High)         | 3.40                          | 3.82                          | 3.61 $\pm$ 0.104              |
|            | Average $\pm$ SEM | 3.37 $\pm$ 0.073 <sup>a</sup> | 3.65 $\pm$ 0.096 <sup>b</sup> |                               |
| Odor       | 15 (Low)          | 3.87                          | 3.94                          | 3.90 $\pm$ 0.079 <sup>a</sup> |
|            | 21 (High)         | 3.39                          | 3.07                          | 3.23 $\pm$ 0.089 <sup>b</sup> |
|            | Average $\pm$ SEM | 3.63 $\pm$ 0.076              | 3.51 $\pm$ 0.100              |                               |
| Yolk color | 15 (Low)          | 8.50                          | 8.55                          | 8.52 $\pm$ 0.086              |
|            | 21 (High)         | 8.50                          | 8.69                          | 8.59 $\pm$ 0.092              |
|            | Average $\pm$ SEM | 8.50 $\pm$ 0.104              | 8.62 $\pm$ 0.068              |                               |

Information: Different superscript letters in the same line show a very significant effect ( $P < 0.01$ )

### 3.2. Flavor

The flavor scores ranged from 3.34 to 3.82, and were classified as delicious to adequately delicious, with the highest pick namely 3.82 coming from the combination of high protein diet treatment with 40 g/bird/day maggot addition, and the lowest of 3.34 originating from the low protein diet treatment combined with the 0 g/bird/day maggot. Based on the analysis of variance, the live BSF maggot treatment significantly ( $P < 0.05$ ) affected the boiled eggs' flavor, indicating that the administration of up to 40 g/bird/day live maggots can increase flavor score. However, the 15% and 21% diet protein level treatments did not change the taste of the boiled eggs, implying that no interaction occurred between them and the live maggots.

Generally, 40 g/bird/day live maggot addition can increase the flavor score to be adequately delicious, possibly because the high glutamic acid content in maggot meal is deposited in duck eggs. The sensory enhancement of eggs is presumably due to the high glutamic acid content in BSF larvae, which is close to 65.81 g/kg [18], while Zotte *et al.* [11] explained that the quail egg flavor score increased from control (0%) to 15% for fat-reduced maggot meal. Substitution of 10% dry maggot in quail diets did not negatively influence the flavor of breast meat [19]. In addition, no difference in the sensory profile of quail broiler meat was found [20].

### 3.3. Odor

The odor scores ranged from 3.07-3.94 and were classified as fishy to adequately fishy. The highest pick was obtained with the combination of low protein diet treatment and 40 g/bird/day maggot, while the lowest was realized with high protein diet treatment and the 40 g/bird/day maggot combination. Based on the analysis, the administration of live BSF maggot did not affect the odor of boiled eggs, while the treatment of diet protein level has a very significant effect ( $P < 0.01$ ). However, there is no relation between the protein level of the diet, maggot administration, and the odor of boiled eggs.

The observation of live maggots not affecting the odor score of boiled eggs is consistent with Zotte *et al.* [11], which stated that the sensory traits of BSF larvae-fed quail eggs are comparable to those fed with conventional feeds. Giving BSF larvae to layers did not affect egg odor, showing that the diet's

protein content determines the odor score variations [18]. Generally, high protein diets tend to make the odor score fishier, which is easy to understand because the conditions can be fulfilled using more fish meals. The previous study stated that adding fish meals to diets can cause the eggs to have a musty, stale, rancid, and fishy taste [21] .

### 3.4. Color

The color scores ranged from 8.50-8.69 and were classified as yellow, the highest pick namely 8.69 was obtained from the combination treatment with 40 g/bird/day maggot and a 21% protein level, while the lowest of 8.50 stemmed from the treatment without maggot addition (0 g/bird/day) with 15% and 21% protein levels. Based on the analysis, the administration of live BSF maggots has no effect ( $P > 0.05$ ) on the yolk color score and the protein level of the diet. The color intensity of quail egg yolks increases when the fat levels of BSF maggot meal are reduced [11]. This is also consistent with Secci *et al.* [22] which established that the eggs of chickens fed with a substituted feed of 100% soybean with defatted BSF larvae meal had a higher yolk color intensity. However, in this study, it was observed that the yolk color tends to increase when 40 g of live BSF maggots were given to the layers, presumably due to the high total carotenoid content. Furthermore, previous studies reported that the administration of BSF larvae with 2.00-2.15 mg carotenoids/kg and natural feed ingredients produced a reddish yolk color, which modern consumers appreciate more than the synthetic materials [22-24].

## 4. Conclusion

Based on the results, the administration of 40 g/bird/day live BSF maggot can alter the organoleptic quality of duck egg, giving a softer texture and quite delicious taste, but not the odor and the color, which remain the same. A high protein diet of 21% tends to change the organoleptic properties of eggs, making their texture softer and odor fishier, while the flavor and the yolk's color remain the same compared to the 15% diet. The use of live maggot as a duck feed supplement indirectly produces environmentally friendly eggs, because BSF maggot plays a role in overcoming organic waste problems in the form of waste accumulation, odors, and greenhouse gas emissions.

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## References

- [1] Kuang H, F Yang, Yan Z, T Wang and G Chen 2018 *Cholesterol* **2018** 1-23
- [2] Krawczyk M, Marcin P and Dariusz M 2015 *Poult.Sci.* **94** 1360–1367
- [3] Damaziak K, J Riedel, D Gozdowski, J Niemiec, A Siennicka, and D Rog 2017 *J. Appl. Poult. Res.* **26** 337–349
- [4] Abbas K A, Q H A Al-Jabary and A R Kareem 2020 *Plant Arch.* **20** 1500-1505
- [5] Donohue M and D L Cunningham 2009 *J. Appl. Poult. Res.* **18** 325–337
- [6] Makkar H P S, Tran G, Heuzé V and Ankers P 2014 *Anim. Feed Sci. Technol.* **197** 1–33
- [7] Diener S, C Zurbrugg and K Tockner 2009 *Waste Manaj. Res.* **27** 603-610
- [8] Despines J L and Axtell R C 1995 *Poult. Sci.* **74** 331-336
- [9] Akpodiete O J, A D Ologhobo and A A Onifade 1998 *Ghana J. Agr. Sci.* **31** 137-142
- [10] Awoniyi T A M, V A Aletor and J M Aina 2003 *Int. J.Poult. Sci.* **2** 271-274
- [11] Zotte A D, Y Singh, J Michiels and M Cullere 2019 *Animal* **9** 1-20
- [12] Gunawan A, S Erlina, R Samudera, M Syarif D, M Y Noor, and A X Lantu 2019 *IOP Conf. Seri. Earth Environ. Sci.* **207** 012021
- [13] Cullere M, A Schiavone, S Dabbou, L Gasco and A D Zotte 2019 *Animal* **9** 140
- [14] Kim Y B, Da-Hye K, Su-Been J, Jeong-Woo L, Tae-Hoon K, Hong-Gu L and Kyung-Woo L 2020

- Poult. Sci.* **99** 3133–3143
- [15] Świątkiewicz S, A Arczewska-Włosek, W Szczurek, J Calik, D Bederska-Lojewska, S Orczewska-Dudek, S Muszyński, E Tomaszewska and D Józefiak 2020 *Ann. Anim. Sci.* **20** 961–973
- [16] Lim J 2011 *Food Qual. Prefer.* **22** 733–747
- [17] Steel, R G D and J H Torrie 1982 *Principle and Procedure of Statistics: A Biometrical Approach* Second Edition Mc. Graw – hill International Book Co. Tokyo
- [18] Al-Qazzaz M F A, Ismail D, Akit H and Idris L H 2016 *R. Bras. Zootec.* **45** 518–523
- [19] Cullere M, M J Woods, L van Emmenes, E Pieterse, L C Hoffman, and A D Zotte 2019 *Animal* **9** 525 1-17
- [20] Cullere M, Tasoniero G, Giaccone V, Acuti G, Marangon A and Dalle Zotte A 2018 *Animal* **12** 640–647
- [21] Koehler H H and G E Bearse 1975 *Poult. Sci.* **54** 881-889
- [22] Secci G, Bovera F, Nizza S, Baronti N, Gasco L, Conte G, Serra A, Bonelli A and Parisi G 2018 *Animal* **12** 2191–2197
- [23] Finke M D 2013 *Zoo Biol.* **32** 27–36
- [24] Karadas F, Grammenidis E, Surai P F, Acamovic T and Sparks N H C 2006 *Brit. Poult. Sci.* **47** 561–566



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