



Effect of Supplementation of Black Soldier Fly Maggot on Growth Performance, and Meat Chemical Properties of Kampung Unggul Balitnak Chicken

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ABSTRACT

Black Soldier Flies were cultivated at the Universitas Sumatera Utara waste disposal site and was fed organic waste. The resulting maggots were fed to Kampung Unggul Balitnak (KUB) chickens 6 until 12 weeks. This study aimed to determine the effect of maggot feed on the growth performance of KUB chickens, as well as its meat chemical properties (protein content, and fat content). A Completely Randomized Design (CRD) was employed, consisting of five treatments and four replicates. Each replicate utilized five chickens, resulting in a total of 100 KUB chickens used in the study. The treatments were as follows: P0 = feed without maggot larvae; P1 = feed with 2% maggot larvae; P2 = feed with 4% maggot larvae; P3 = feed with 6% maggot larvae; and P4 = feed with 8% maggot larvae. The results indicated that the treatments had a significant effect ($P < 0.01$) on growth performance, and protein of its meat. The highest weight gain (97.18 g/bird.week) and the highest protein content (23.81%) was observed in the 8% treatment group. Meanwhile there is a slight increase in meat fat, yet it remains well within the acceptable percentage limits for meat fat content. The increase in protein content corresponding to higher maggot inclusion levels demonstrates that maggots can serve as an effective supplementary protein source in KUB chicken feed.

Keyword: Duck Meat, Natural Biopreservatives, Celery Fermentation, Physical Quality, Total Plate Count, Shelf Life



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1. Introduction

One innovation resulting from the search for alternative chicken breeds for the general public to raise is the Kampung Unggul Balitbangtan (KUB) chicken. This is a local breed developed through selection and innovation by the Indonesian Research Institute for Animal Production (Balitbangtan) in Ciawi, Bogor. It outperforms other local breeds, boasting a hen-day egg production rate of 45–50% and superior meat quality characterized by rapid body weight gain. KUB chickens can reach an average weight of 1 kg by 12 weeks of age, whereas ordinary free-range chickens require up to 20 weeks to reach the same weight [1].

To make KUB chicken farming more efficient, it is necessary to identify feed sources that can be produced by the community itself. One such source is Black Soldier Fly (BSF) maggots. Animal-based protein feeds offer the advantage of a more complete essential amino acid profile [2,3].

BSF maggots can be cultivated by the community because they are reared on organic substrates. Vegetable waste from markets—such as lettuce, green beans, and carrots—is highly favored by the maggots. BSF maggot cultivation takes only 21 days, although younger maggots can also be used as chicken feed. BSF

maggots are an economical source of protein. Their protein content is quite high, ranging from 39.20% to 54.12% [4,5,6]. The protein level in the maggots depends on the rearing substrate used [7]. Protein derived from BSF maggots is easily digestible, thereby accelerating growth in poultry.

Based on the benefits of maggots, this study aims determine the effect of maggot feed on the growth performance of KUB chickens, as well as the characteristics chemical properties of KUB chicken meat (Protein and Fat).

2. Materials and Methods

2.1. Animals and Experimental Design

This study i.e. chicken rearing was conducted at Animal Production Laboratory of Universitas Sumatera Utara, while maggot was cultivated at the Universitas Sumatera Utara waste disposal site. The equipment used was 20 units of modified metabolic cages with a size of 25cm x 25cm x 30cm. In this study the feed consisted of commercial concentrate and BSF maggot. To feed the maggots, pour hot water over the fresh maggots, then provide them directly to the chickens.

The research design used in this study was a completely randomized design (CRD) consisting of 5 treatments and 4 replicates, using 5 chickens, with a total of 100 KUB chickens used.

The treatments applied in the study were as follows:

P0 = Diet without maggots

P1 = Diet with 2% maggot meal

P2 = Diet with 4% maggot meal

P3 = Diet with 6% maggot meal

P4 = Diet with 8% maggot meal

The mathematical model of the Completely Randomized Design (CRD) according to (Steel and Torrie, 1993) is as follows:

$$Y_{ij} = \mu + T_i + \epsilon_{ij}$$

Notes:

Y_{ij} = Observation results from treatment i and replicate

μ = Mean observation

T_i = Effect of treatment i

ϵ_{ij} = Treatment error effect of the i^{th} treatment and j^{th} replicate

i = Number of treatments: 1, 2, 3, 4, 5

j = Number of replicates in treatment: 1, 2, 3, 4

The observed parameters are protein digestion, nitrogen retention, apparent metabolic energy, growth performance, protein content, and fat content of KUB chicken meat.

The data obtained were analyzed using analysis of variance. If the results of the variance analysis show differences, further tests will be conducted with the Duncan method.

Table 1. Nutritional content (%) of feed

Feed	CP (%)	CF (%)	CFi (%)	Ca (%)	P (%)	Met (%)	Lisin (%)	EM (Kkal)
CP512 ^A	21.00	5.00	5.00	0.90	0.60	0.40	1.05	3,100
Fresh Maggot ^B	42.12	25.12	-	-	-	-	-	-

Notes : Nutrition laboratory test results, Animal Science Study Program, Faculty of Agriculture, Universitas Sumatera Utara

CP : Crude Protein; CF : Crude Fat; Cfi : Crude Fiber; Ca: Calcium; P : Phosphor; Met : Methionin; EM: Energy Metabolic

A : Commercial Feed of Charoen Pokphand No. 512

B : Fresh Maggot cultivated at the Universitas Sumatera Utara waste disposal site

3. Result and Discussion

3.1. Growth Performance

Growth performance is determined based on observations of body weight gain.

Table 2. Growth Performance of KUB due to maggot application

Treatments	Parameter	
	Consumption (g/bird/week) ^{ns}	Weighth Gain (g/bird/week)
P0 (0% maggot)	385.11	84.21 ^a
P1 (2% maggot)	390.18	90.32 ^b
P2 (4% maggot)	393.12	92.15 ^{bc}
P3 (6% maggot)	393.35	93.42 ^{bc}
P4 (8% maggot)	395.12	97.18 ^d

Note: Different superscripts in columns and rows indicate statistically significant differences ($P < 0.05$).

Body weight gain is closely correlated with consumption/feed intake. In this study, intake was influenced by the form, size, and method of feed presentation, all of which affect palatability and, consequently, the level of ration consumption. According to Natsir et al. (2020), the palatability of maggots is influenced by the form in which they are offered; chickens prefer fresh maggots over maggot meal. This study utilized fresh maggots—specifically, those that had just been harvested. The absence of differences in ration intake levels demonstrates that maggots remain palatable to KUB chickens at inclusion levels of up to 8%. However, significant differences in body weight gain were observed in this study.

The highest average body weight gain was observed in treatment P4 (97.18 g/bird/week), while the lowest was in treatment P0 (84.21 g/bird/week) for KUB chickens aged 6 to 12 weeks (Table 2). Analysis of variance indicated that the treatments had a significant effect ($P < 0.05$) on the body weight gain of KUB chickens aged 6 to 12 weeks. Significant differences in body weight gain among KUB chickens across treatments is attributed to the fact that the lysine and methionine content in each treatment ration met the chickens' nutritional requirements. This is because maggots contain 2.21% lysine and 0.83% methionine. According to [8], methionine and lysine are the amino acids that play a role in the growth of chicken body tissues. [9] also mentioned that lysine influences body weight gain in chickens.

3.2. Meat Quality Analysis

The chemical quality of meat is a key indicator determining the nutritional value, flavor, and shelf life of animal products. In general, chemical quality encompasses the primary composition of meat, consisting of protein, and fat content. These four components are interrelated and influenced by various factors, such as the species, age, sex, diet, and physiological condition of the livestock.

Table 3. Meat Quality of KUB due to maggot application

Treatments	PC(%)	FC(%)
P0	20.12 ^a	2.18
P1	21.31 ^b	2.41
P2	21.57 ^b	2.60
P3	23.01 ^c	2.71
P4	23.81 ^d	2.96

Notes : PC = Protein Content, FC= Fat Content

3.2.1. Protein Content (%)

Proteins are organic substances containing carbon, hydrogen, nitrogen, oxygen, sulfur, and phosphorus. They are essential for the survival of every organism, playing a crucial role in cellular metabolism and tissue formation. Consequently, protein can be considered the most important component for growth [10]. Chicken meat is a major source of protein for human survival; this is because it is of high quality, easily digested and absorbed, and contains a complete profile of essential amino acids.

The protein content of chicken meat is about 22% [11]. In this study, the protein concentration was higher than that in [11]. This is likely due to the high amino acid content resulting from the

maggot treatment, which was about 42.12% while [12] found [41.1%]. [13] found a protein concentration of approximately 24% in KUB meat fed.

3.2.2. Fat Content

This variation indicates that the differences in dietary treatments administered to the KUB chickens in this study had a significant effect on the fat content in their muscle tissue. According to [14], the normal fat content in chicken meat ranges from 1.2% to 12%.

The fat content observed in the treatments in this study is higher than control. This may be attributed to the fat content of the maggots, which in this study was approximately 25.12% while [15] found fat concentration of maggot was about 24%. However, the fat content in this study remains at a low concentration relative to the range established by [14].

4. Conclusion

Including 8% fresh Black Soldier Fly (BSF) maggot in the ration yields good performance in KUB chickens, with an average feed intake of 395.12 g/bird/week, body weight gain of 97.18 g/bird/week. Meanwhile, the protein and fat percentages in the meat were also improved, as 23.81 and fat percentages 2.96. The increase in protein content corresponding to higher maggot inclusion levels demonstrates that maggots can serve as an effective supplementary protein source in KUB chicken feed. Increased in meat fat percentage has no adverse effects as yet it remains within the acceptable percentage. This study demonstrates that fresh maggots not only enhance growth but also improve the chemical quality of KUB chicken meat.

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