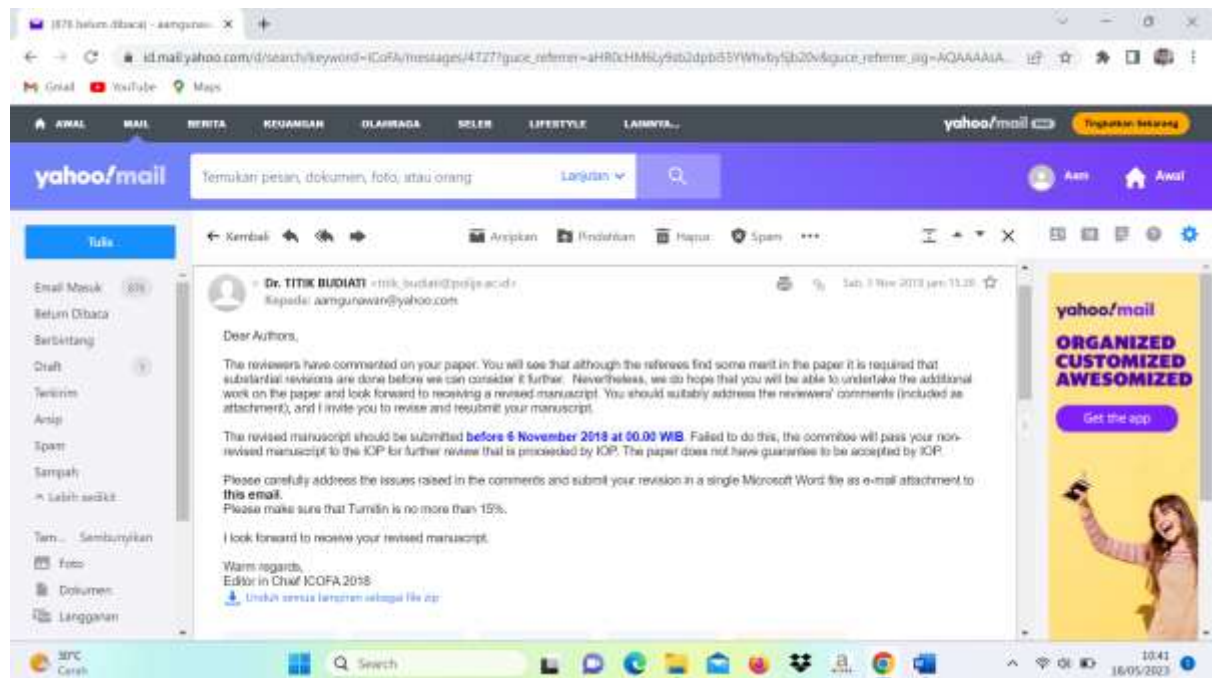
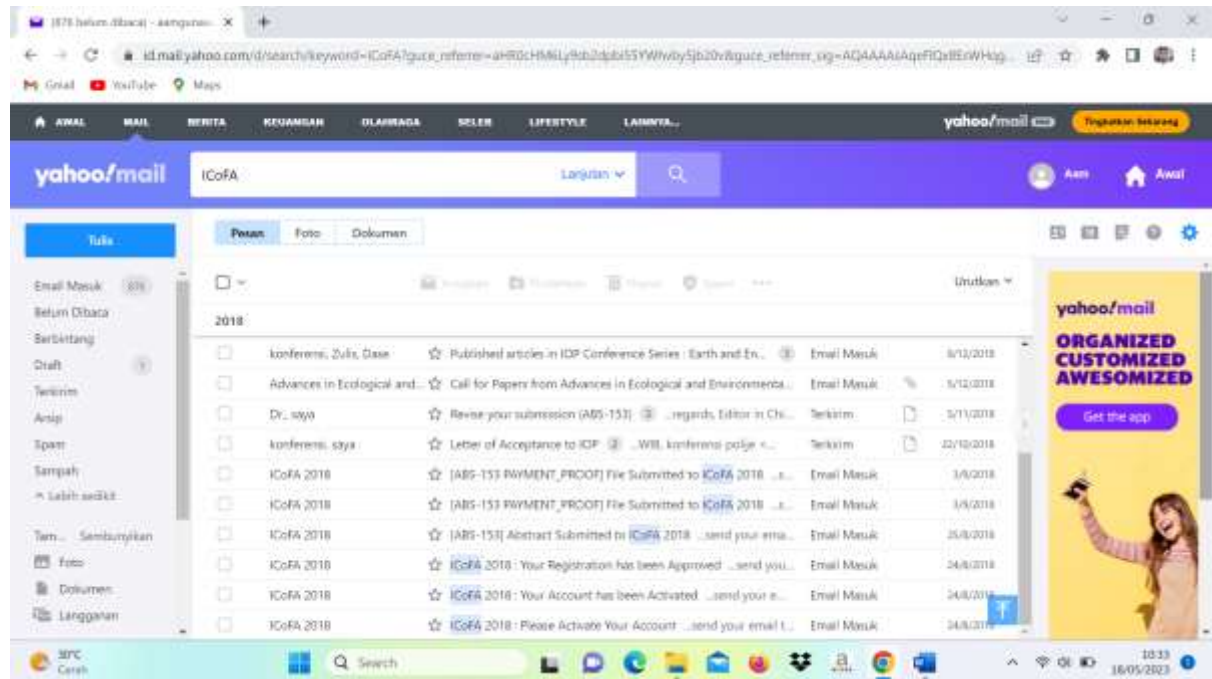


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Effect of Giving Maggot Black Soldier Fly Live as a Protein supplement on The Percentage of Carcass and Weight of Carcass Cuts of Male Alabio Ducks

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Effect of Giving Maggot Black Soldier Fly Live as a Protein supplement on The Percentage of Carcass and Weight of Carcass Cuts of Male Alabio Ducks

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Abstract

Maggot black soldier fly (*Hermetia illucens*) contains complete nutrients and in a living condition is very favored by ducks. Therefore this study aims to study the giving of live maggots tried in ducks. The study used 60 male alabio ducks placed randomly into 20 cages. The design used is a completely randomized 2x2 factorial design with five replications. The treatment consisted of P1: 10% live maggot supplementation on 16% ration protein, P2: 10% live maggot supplementation on 21% protein ration, P3: 0% live maggot supplementation on 16% ration protein, and P4: 0% live maggot on protein ration 21%. The data obtained were analyzed of variance and Duncan's multiple range test. The results showed that the giving of live BSF maggot had a highly significant effect on the percentage of carcass and weight of carcass cuts, but did not effect the percentage of abdominal fat and the weight of the viscera parts. Ration protein levels of 16% and 21% did not effect the percentage of carcass, weight of abdominal fat, weight of carcass cuts, and weight percentage of viscera part of male alabio ducks (*Anas platyrhynchos borneo*).

Keywords: *Maggot BSF, Alabio ducks, carcass cuts, viscera part, abdominal fat.*

1. Introduction

Many Indonesians living in Kalimantan are working in the fields of animal husbandry and fisheries. The problem faced by these two business fields is the problem of feed, many people are classified as small and medium-sized businesses that go bankrupt due to soaring feed prices. Feed costs are very large in livestock or fisheries business, which is about 75% of the total production costs (Santoso, 2008). Therefore, there is a great need for the availability of cheap feed, so that the business carried out by the community can continue continuously.

Maggot can be used to feed various types of fish and livestock (Agunbiade et al., 2007; Teguaia et al., 2002; Awoniyi et al., 2003; Bodri and Cole., 2007; Bondari and Sheppard., 1981; Hem et al., 2008; Haryati 2011; Kardana et al., 2012; Torang 2013). Maggot can be given alive or meal, of course, this can be used as a new business for people in Kalimantan, where the population has a lot of fish and livestock, especially ducks. Especially at this time the price of feed continues to increase.

Maggot *Hermetia illucens* or better known as maggot black soldier fly (BSF) is very well used as a source of protein feed ingredients. Maggot BSF contains about 45% protein with 35% fat content (Olivier, 2000). According to NRC (1994) to ensure livestock grow well, the starter phase duck ration is prepared 21% protein, this protein content is enough as a growth promoter, which is supported by only 4% crude fiber and 2,900 kcal/kg of metabolizable energy. Unlike the finisher phase where the protein content is relatively low at 19% and the metabolizable energy of 3,000 kcal/kg can guarantee growth. Because finisher ducks need higher energy for meat growth and formation. Low protein ration (16%) certainly has a much cheaper price compared to high protein content (21%). Thus, live maggot supplementation on low protein content rations is expected to have the same quality as 21% protein ration. Protein supplements can come from animals or plants, and can be given as a protein source in rations, if the protein content is low. Great protein deficiency, cattle will experience an average growth loss of 6-7%, in laying hens can cause severe molting and egg production stop. On the basis of these considerations, the preparation of the ration requires additional protein that is rich in the content of essential amino acids.

Carcasses with a larger weight will also affect the profit at the time of sale. The pieces of carcass are the body parts of poultry after being reduced by feathers, blood, head, feet and internal organs. Generally, restaurants cut duck carcasses into 4 parts, namely thighs, breast, back and wings. Ducks that are cut are young ducks because of the soft texture of the meat. The addition of live BSF maggots is expected to affect the growth of Alabio ducks. Carcass cuts that have a high percentage of weight will also produce high profits and reduce feed costs by BSF live maggots. Therefore the authors are interested in conducting a study on the effect of giving maggot live for the growth phase ducks on the percentage of carcass, abdominal fat, weight of carcass cuts, and percentage of viscera parts of Alabio ducks.

1.1 Materials and methods

1.1.1 Materials

1. Maggot BSF live, prepupa phase. Live BSF Maggot is obtained from cultivation using palm kernel meal media
2. Experimental duck. This study used as many as 60 Alabio ducks, 3 weeks old and randomly divided into 20 cages. Each cage is filled with three ducks.
3. Experimental ration. The ingredients of the ration consisted of: concentrated ducks, rice bran, corn, and fish meal. The composition of the experimental ration is presented in Table 1, while the composition and nutrient content of the experimental ration are presented in Table 2.

Table 1. Nutrients Composition of Ingredient (As-fed)

Ingredient	Crude Protein (%)	M.E Kcal/kg
Concentrated duck ¹	38.00	3,300
Rice bran ²	13.20	2,878
Corn ²	9.42	3,182
Fish meal ²	36.00	3,468

¹Production PT. Wonokoyo Jaya Corporindo Surabaya

²Yield of laboratory analyze

Table 2. Structure and Nutrient Content of Experimental Rations

Feed Ingredient	Treatment ration	
	Low Protein	High Protein
	----- (%) -----	
Concentrated duck	19.72	25
Rice bran	25	25
Corn	55.28	36.85
Fish meal	0	13.15
Total	100	100
Nutrient content		
Crude protein (%)	16	21
Metabolizable energy (kcal/kg)	3,129.27	3,173.11

1.1.2 Cages

The cage is made of materials such as boards, bamboo, zinc roofs with an area of 3 x 6 m. Inside the cage, there are 20 cages with a size of 100 x 90 x 50 cm. The base of the cage is made of bamboo with a slat system. The drinking place used is made of PVC longitudinal gutters and the place of feed used is a tub made of 20 wooden boards.

1.1.3 Equipment

1. Basin, with a diameter of 50 cm and a height of 30 cm as many as 50 pieces are used to place palm kernel cake.
2. Machine for making pellet feed
3. Digital scales of Oxone brand 5 kg with accuracy of 1 g, used to weigh feed, ducks, etc.
4. Equipment for cutting ducks and cutting carcass parts

1.2 Methods

1.2.1 Experimental design

The design used is a completely randomized design (CRD) 2x2 factorial pattern. The first factor was the give of live BSF Maggot with 2 levels, namely 0% and 10%. The second factor is protein ration with 2 levels, namely high protein ration (21%) and low protein ration (16%). Each treatment combination uses 5 replications. The combination of treatment is:

- P1 = Low Protein Ration (16%) + Live Maggot BSF (0%)
P2 = Low Protein Ration (16%) + Live Maggot BSF (10%)
P3 = High Protein Ration (21%) + Live Maggot BSF (0%)
P4 = High Protein Ration (21%) + Live Maggot BSF (10%)

If based on the results of the analysis of variance there is a significant effect, then the test was continued using Duncan's multiple range test (Steel and Torrie, 1982).

1.2.2 Research procedure

(1) Maggot production

The basin is 20 pieces each filled with 3 kg of palm kernel meal and 6 liters of water, covered with dried banana leaves. Left in the open for 3 weeks.

(2) Harvesting of Maggots

Maggots found in the basin were harvested, then weighed and given to ducks

(3) Placement of ducks

Newly arrived ducklings are inserted in each cage before weighing a uniform initial weight. Ducklings are placed in a cage compartment each filled with 3 ducks. After that, ducklings are given a research ration in accordance with the four types of treatment. Before being given, each treatment ration material was mixed with each other with the following procedure: each raw material was weighed according to requirements, each treatment was milled with a pellet machine until it was completely homogeneous.

The ration is given 3 times a day or ad libitum, ie in the morning, afternoon and evening. The ration is given again if inside the food is completely gone while drinking water is given ad libitum.

All cages are equipped with feeder and drinker water to suit your needs, for lighting used 15 watt incandescent lamps. Male alabio ducks aged 8 weeks were fasted from feed about 6-12 hours then cut, just before being cut, the ducks were weighed, then the ducks were allowed to stand for \pm 2 minutes.

Cutting is done at the border of the neck and head, by cutting the jugular vein, carotide artery, trachea, and esophagus (Kosher method). After that, leave it for 1-3 minutes until the blood stops dripping. Furthermore, alabio ducks without blood are weighed, then dipped in hot water at a temperature of approximately 80 °C until the hair is easily revoked. Fur is pulled out manually, and ducks without fur are weighed. Carcass is obtained by separating the paws, neck, head and viscera. The carcass is weighed, then cut the breast, wings, rear, back and thighs. The viscera and giblets are cleaned and separate the parts of the viscera before being weighed.

1.2.3 Response Variable Measurement

1. Percentage of carcass, calculated using the formula:

$$\frac{\text{Carcass weight}}{\text{Slaughter weight}} \times 100\%$$

2. Percentage of abdominal fat, calculated using the formula: $\frac{\text{abdominal fat weight}}{\text{carcass weight}} \times 100\%$

3. Percentage of breast weight, calculated using the formula: $\frac{\text{Breast weight}}{\text{carcass weight}} \times 100\%$

4. Percentage of wing weight, calculated using the formula: $\frac{\text{Wing weight}}{\text{carcass weight}} \times 100\%$

5. Percentage of back weight, calculated using the formula: $\frac{\text{Back weight}}{\text{carcass weight}} \times 100\%$

6. Percentage of rear weight, calculated using the formula: $\frac{\text{Rear weight}}{\text{carcass weight}} \times 100\%$

7. Percentage of thigh weight, calculated using the formula: $\frac{\text{Thigh weight}}{\text{carcass weight}} \times 100\%$

8. Percentage of viscera parts weight, calculated using the formula: $\frac{\text{viscera parts weight}}{\text{viscera weight}} \times 100\%$

1.2.4 Data analysis

Observation data during the study was collected, then a analysis of variance was conducted to determine differences in the effect of treatment on the observed variables. Variance homogeneity test (Bartlett test) was carried out. If the results of the analysis of variance showed a significant or highly significant effect, the test was continued with the Duncan Multiple Range Test (Stell and Torrie, 1982).

1.3 Results and Discussion

1.3.1 Percentage of Carcass

Data from observation of carcass and abdominal fat percentage of each treatment are presented in Table 3.

Table 3. Average percentage of carcass and abdominal fat of Alabio ducks aged 8 weeks.

Variable	Protein (%)	Live maggot BSF (%)		Average (%) ± SEM
		0	10	
Carcass percentage	16 (Low)	56.00	68.96	62.48 ± 2.29
	21 (High)	56.75	66.83	61.79 ± 2.07
	Average (%) ± SEM	56.37^a ± 1.17	67.89^b ± 0.90	
% abdominal fat	16 (Low)	1.07	1.31	1.19 ± 0.11
	21 (High)	1.12	1.15	1.13 ± 0.12
	Average (%) ± SEM	1.09 ± 0.09	1.23 ± 0.13	

Description: The numbers followed by different superscript letters in the direction of the rows indicate a significant different

Based on the results of variance analysis it can be seen that the administration of live BSF maggots in rations had a highly significant effect ($P < 0.01$) on the percentage of male Alabio duck carcasses aged eight weeks, but no effect ($P > 0.05$) on the treatment of protein ration levels. The administration of maggot is very active in increasing the percentage of carcasses of Alabio ducks. Giving 10% of live maggot from feed given every day can increase the percentage of carcass from 56.37% to 67.83%. The percentage of carcass obtained from this

study is almost the same as Gunawan et. al. (2017) that the average percentage of Alabio duck carcasses ranged from 55.95 to 62.75%. Dewanti et. al (2013) further reported that the percentage of carcass was sent to the weight of the cut. In the opinion of Soeparno (2005) the percentage of carcass is influenced by the rate of growth and quality of feed. The growth rate shown by the existence of life weight gain will affect the cut weight produced and will affect the percentage of carcass produced.

Tegua et al., (2002) states that replacing fishmeal with maggot or maggot flour living as much as 10% of the feed given each day will result in better weight gain with the same carcass production. This is also supported by Bamgbose (1999) which states that a usage rate of more than 10% results in low consumption and performance which is likely due to the low palatability due to the black color of the maggot. Furthermore, it was stated that rations containing unbalanced energy and protein could affect the percentage of carcasses.

The percentage of carcass is related to gender, age and body weight. Carcass weight will increase with increasing age and increasing body weight of ducks that are affected by nutrient intake during maintenance. It is suspected that the addition of live BSF maggots in feeding Alabio ducks will improve the quality of the ration, so that the ration nutrients can be digested properly in the body to produce meat. This is consistent with the opinion of Supriyati and Kompiani (2002) that supplementary feed can increase final body weight and a better percentage of carcass. According to Rizal (2000) the percentage of carcass is influenced by body weight and body fat when it reaches market conditions. The level of protein in the ration that does not affect the percentage of carcass caused by ducks used in this study has entered the grower period 3-8 weeks. According to NRC (1994) the duck period of grower aged 2-7 weeks is sufficiently given 16% protein ration, while metabolic energy is 3,000 kcal/kg.

1.3.2 Percentage of Abdominal Fat

Data from the observation of the percentage of abdominal fat of each treatment are presented in Table 3. Based on the results of variance analysis it can be seen that the administration of black soldier fly 0% and 10% had no significant effect on the percentage of abdominal fat in male Alabio ducks aged eight weeks, also with the treatment of protein levels in rations 16% and 21%, both of which give relatively the same results. The average percentage of abdominal fat from Alabio ducks from each treatment ranged between 1.07 - 1.31%. This small percentage of abdominal fat is thought to be closely related to the age of young cattle, which is eight weeks, so that fat accumulation during growth is still small. Sulaiman (1998) states that abdominal fat is clearly visible when the ducks reach 9 weeks. It is suspected that the presence of abdominal fat is more influenced by slaughter age.

The results of this study were relatively low compared to the results of the study by Tugiyanti (2000) who reported that the average abdominal fat of local ducks ranged from 3.08 to 4.12%. This is due to the balance between protein and energy from all treatments given. So that it allows consuming the same amount of protein and energy. The same protein and energy balance will produce relatively the same abdominal fat.

Based on the results of variance analysis it can be seen that the treatment of protein levels in this study did not significantly affect the percentage of abdominal fat. This is because the 16% low protein ration has fulfilled the needs of ducks in accordance with the standards provided by the Indonesian National Standard (SNI) which is 15%, while the 21% high protein ration is too excessive resulting in smelly and watery excreta. As for which affects the low consumption of additional feed in this study allegedly due to the low palatability due to the black color of the living maggot. The results of this study are in line with Kurnia (1994) body fat accumulation is influenced by the quality of the ration, the method of feeding and maintenance management. Abdominal fat results from accumulation during life and ration consumption.

1.3.3 Percentage of Carcass Cuts

Data from the observation of the percentage of carcass cuts of each treatment are presented in Table 4. The average weight percentage of carcass pieces consisting of: breast, wings, back, rear, and thighs is presented in Table 4. The results of variance analysis showed that the administration of live BSF maggots had a highly significant effect ($P < 0.01$) on weight percentage carcass parts. The level of protein in ration 16% and 21% does not affect the weight percentage of carcass cuts.

The average percentage of breast, wing, back, rear, and thigh in a row at the treatment rate of 10% live maggot administration was 19.9%; 14.18%; 15.41%; 14.33%; 21.84%, and without maggot 23.64%; 16.48%; 18.30%; 16.29%; 25.31%. The results of the analysis of variance showed that the treatment of live maggot supplementation showed a highly significant effect on the percentage of weight of the breast, wings, back, rear, and thighs. Provision of live maggots results in a lower percentage of carcass pieces than without the

administration of live maggot. This is easy to understand because giving live maggots results in a higher percentage of carcass, the carcass weight obtained is also greater, so that the weight percentage of the carcass pieces becomes smaller. Based on the observations in this study, it turned out that ducks preferred to consume maggot live first, after being exhausted, then consuming rations, resulting in better absorption of nutrients, especially protein and fat, which resulted in the formation of muscle tissue and fat. Gunawan et al. (2012) high nitrogen retention value of maggot flour ranged from 63.96 to 75.84%. In addition, the fat-containing maggots are quite high at around 35% (Olivier, 2000) which is able to be absorbed by the body even though it can reduce the level of feed consumption. Saputra (2018) states that giving maggot 10% of the amount of ration consumed causes consumption to fall.

Table 4. Average Weight Percentage of Pieces of Alabio Duck Age 8 Weeks

Variable	Protein (%)	Live maggot BSF (%)		Average (%) ± SEM
		0	10	
Breast percentage	16 (Low)	23.08	19.63	21.36 ± 0.85
	21 (High)	24.19	20.20	22.20 ± 0.83
	Average (%) ± SEM	23.64^b ± 0.53	19.92^a ± 0.63	
Wing percentase	16 (Low)	16.28	14.15	15.21 ± 0.44
	21 (High)	16.68	14.20	15.44 ± 0.47
	Average (%) ± SEM	16.48^a ± 0.24	14.18^b ± 0.26	
Back percentage	16 (Low)	18.22	15.28	16.75 ± 0.63
	21 (High)	18.37	15.54	16.95 ± 0.57
	Average (%) ± SEM	18.30^b ± 0.34	15.41^a ± 0.38	
Rear percentage	16 (Low)	16.85	14.34	15.60 ± 0.48
	21 (High)	15.42	14.32	14.87 ± 0.27
	Average (%) ± SEM	16.14^b ± 0.33	14.33^a ± 0.21	
Thigh percentage	16 (Low)	25.57	22.26	23.91 ± 0.72
	21 (High)	25.04	21.41	23.22 ± 0.67
	Average (%) ± SEM	25.30^b ± 0.34	21.83^a ± 0.47	

The average percentage of breast, wing, back, rear, and thighs respectively in the treatment rate of 16% protein ration giving was 21.36%; 15.22%; 16.75%; 15.60%; 23.92%, whereas in the treatment of protein level 21% was 22.20%, 15.44%; 16.96%; 14.87%; 23.23%. The level of protein ration that has no effect, this is because the 16% low protein ration has fulfilled the needs of ducks in accordance with the standards provided by the Indonesian National Standard (SNI) which is 15%, while the 21% high protein ration is too excessive resulting in smelly and watery excreta. Breast weight percentage obtained from the results of this study is greater than the study of Armissaputri et al. (2013) which obtained a percentage of the mojosari duck's breast section of 11.13%. This is easy to understand because of differences in measurement methods. The results of the percentage of breast weight in this study were also greater than the results of Tommy's (2017) study which obtained a percentage of alabio ducks' breast weight of 13.25-15.60% at the age of 8 weeks. This is more due to differences in rations given. The weight percentage of carcass pieces is illustrated in Figure 1.

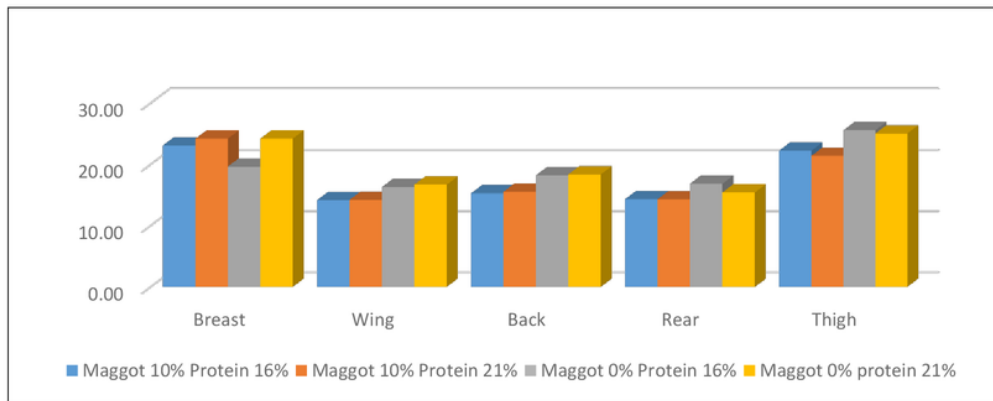


Figure 1. Weight Percentage of Pieces of Male Alabio Ducks Age 8 Weeks

1.3.4 Weight Percentage of Viscera Parts

The results of observations of percentages of viscera parts are presented in Table 5. The average percentage of liver weight, gizzard, heart and intestine at 10% of live maggots was 28.475%; 36.775%; 6.435%; and 28.32% respectively. The results of variance analysis showed that the treatment of live maggot administration as well as the provision of protein ration levels both expressed no significant effect ($P > 0.05$) on the percentage of viscera.

Table 5. Average Weight Percentage of Parts Viscera of Alabio Ducks Age 8 Weeks

Variabel	Protein (%)	Live Maggot BSF (%)		Average (%) \pm SEM
		0	10	
Liver percentage	16 (Low)	28.69	28.69	28.69 \pm 1.16
	21 (High)	25.52	28.26	
	Average (%) \pm SEM	27.10 \pm 1.14	28.475 \pm 0.89	
Gizzard percentage	16 (Low)	35.28	35.58	35.43 \pm 1.34
	21 (High)	37.63	37.97	
	Average (%) \pm SEM	36.45 \pm 1.44	36.77 \pm 1.11	
Heart percentage	16 (Low)	6.53	6.56	6.54 \pm 0.35
	21 (High)	6.47	6.31	
	Average (%) \pm SEM	6.50 \pm 0.32	6.43 \pm 0.23	
Intestine percentage	16 (Low)	29.51	29.17	29.34 \pm 1.12
	21 (High)	30.39	27.47	
	Average (%) \pm SEM	29.95 \pm 1.34	28.32 \pm 0.66	

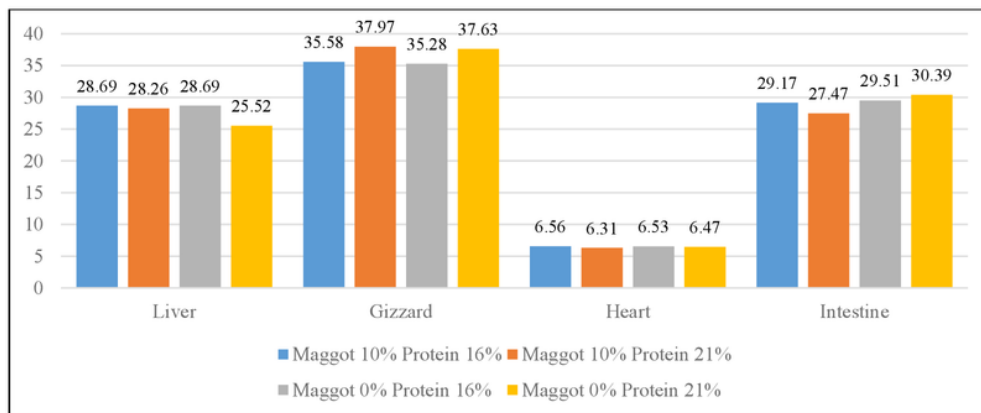


Figure 2. Percentage of Percentage of Male Viscera of Alabio Ducks Age 8 Weeks

The weight percentage of innards from the results of this study is higher than that of Armissaputri et al. (2003), where for Mojosari ducks the percentage of intestines was 3.15% and Tegal ducks were 2.81%, and according to Dewanti's (2013) research results on male local ducks aged 8 weeks the percentage of liver 2.21%, heart 0.72%, and bile 4.74%. The difference in the results of this study is caused more by differences in measurement methods. In the study of Armissaputri et al. (2003) and Dewanti et al. (2013) all non carcass weight is divided by cutting weight, while in this study the divider is the weight of viscera.

Maggot (*Hermetia ilucens*) life BSF used in this study is thought to have calcium (Ca) which has a better biological value than calcium (Ca) in fish meal, conditions of dietary calcium intake meet the achievement of the most active calcium absorption level in the mechanism transport in the small intestine (upper duodenum and jejunum), which was expressed in an increase in dietary calcium digestibility using live Maggot BSF, Finke (2012) reported that the calcium content in Maggot was quite high, had a digestibility rate of 88%. The increasing digestibility of calcium (Ca) with the increasing addition of maggot (*hermetia illucens*) of BSF life in the ration indicated that calcium (Ca) contained in the living maggot BSF had better biological value (Adedokun and Adeola, 2013).

Conclusion

The provision of live BSF maggots at 10% of the amount of ration given can result in a higher percentage of carcass, but produce a lower percentage of carcass pieces than 0% BSF maggot (without maggot). The level of protein ration of 16-21% resulted in the percentage of carcass, abdominal fat, carcass pieces and the percentage of parts of the innards that were relatively the same in male alabio ducks aged 8 weeks.

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