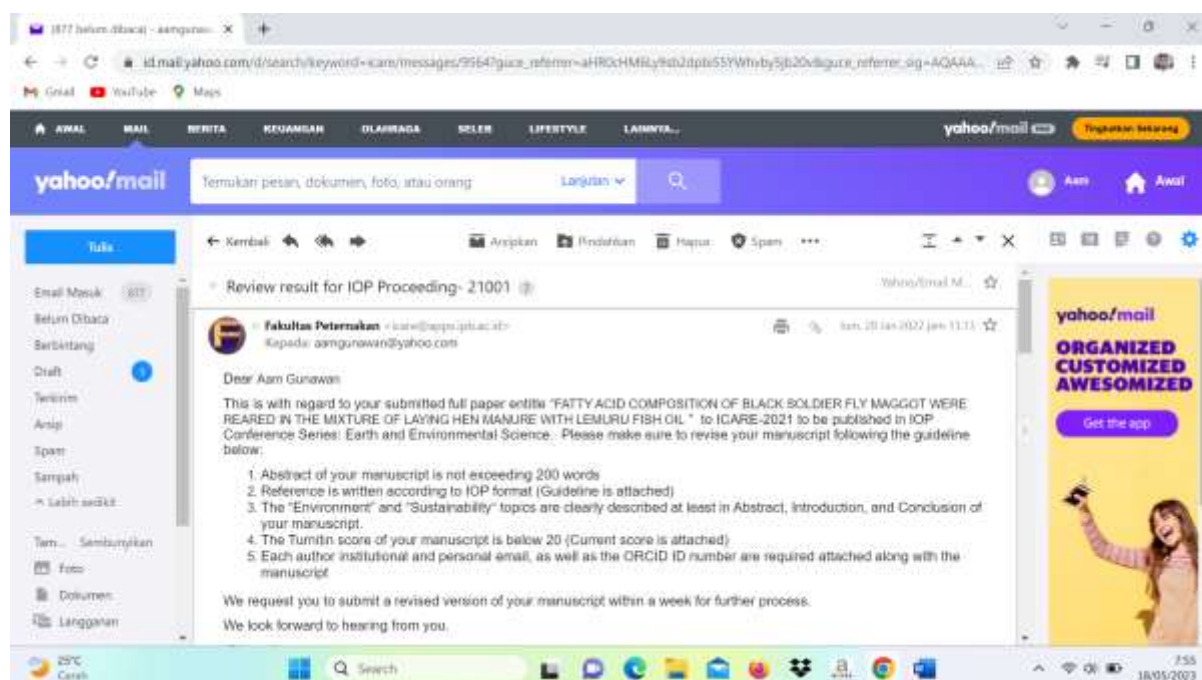
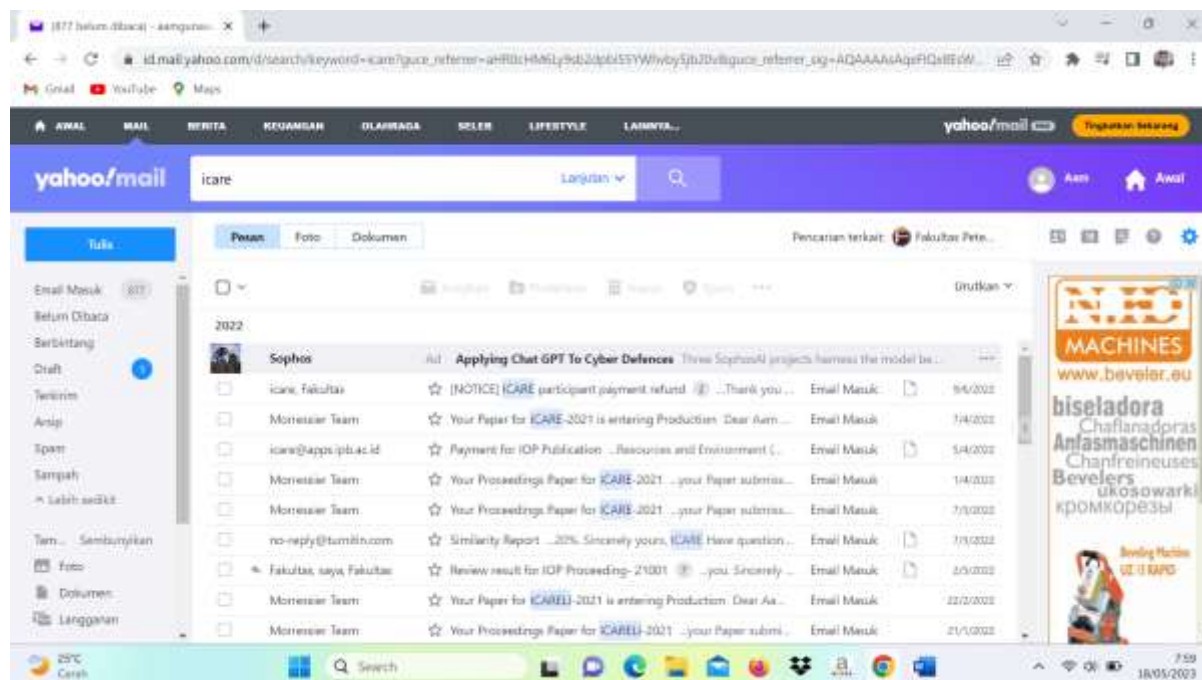


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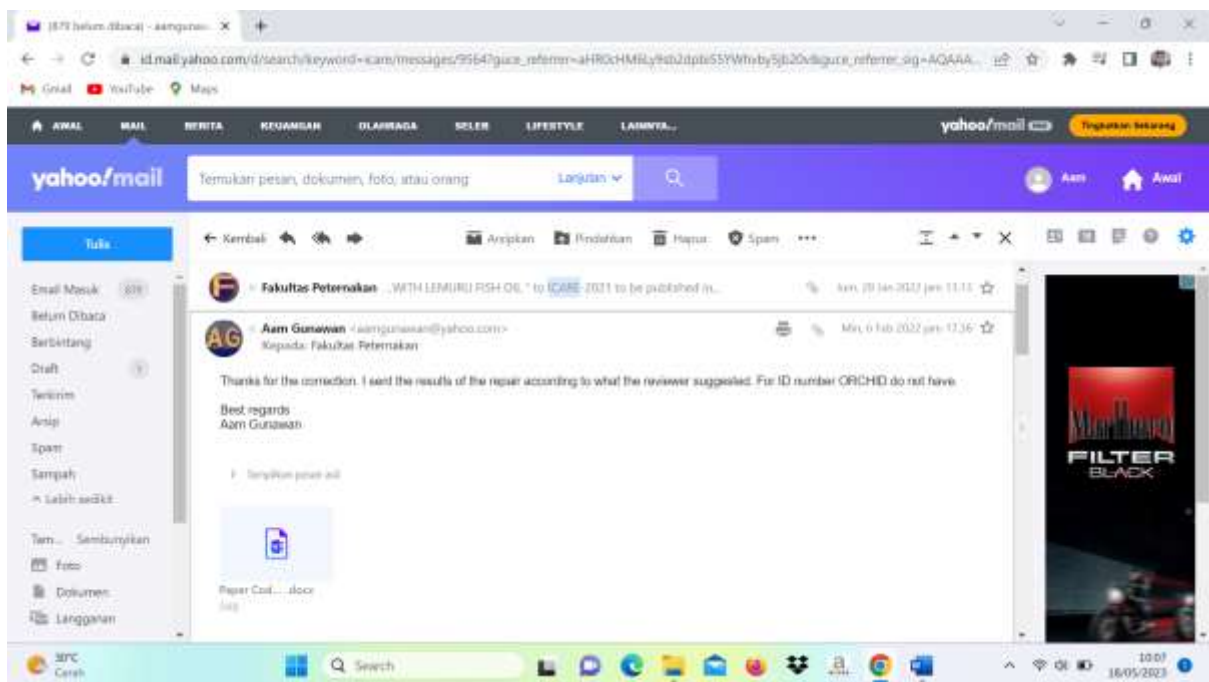
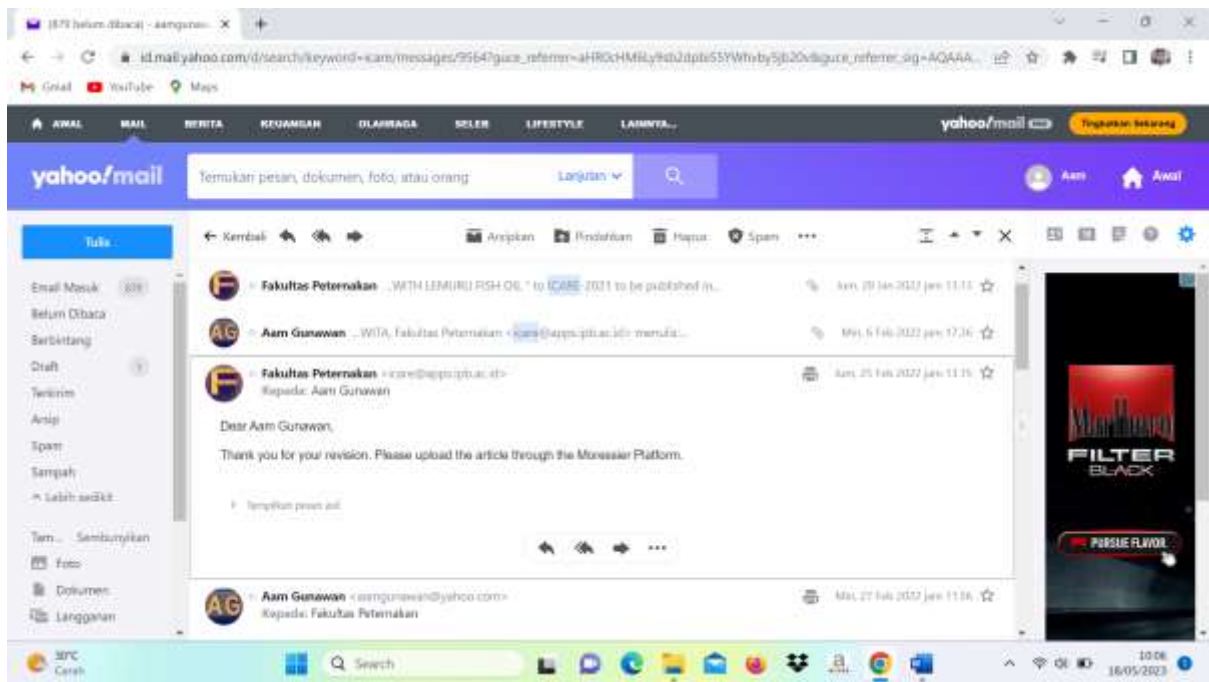
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"FATTY ACID COMPOSITION OF BLACK SOLDIER FLY MAGGOT WERE REARED IN THE MIXTURE OF LAYING HEN MANURE WITH LEMURU FISH OIL"

by Aam Gunawan

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**FATTY ACID COMPOSITION OF BLACK SOLDIER FLY MAGGOT WERE
REARED IN THE MIXTURE OF LAYING HEN MANURE WITH
LEMURU FISH OIL**

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AND NENI WIDANINGSIH¹**

34

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ABSTRACT

Maggot black soldier fly can convert a mixture of layer chicken manure with lemuru fish oil into nutrient-rich biomass. The growth and nutrient composition of maggot is strongly influenced by the type of media used as food. Therefore, it is necessary to know whether the addition of lemuru fish oil into laying hens manure as a medium for maggot growth can affect the production of fresh maggot and the nutrient content of maggot meal, especially its fat content and fatty acid composition. In this study, the maggot black soldier fly was given six kinds of feed consisting of a mixture of laying hens manure with the addition of lemuru fish oil which varied 0%, 3%, 6%, 9%, 12%, and 15%. A total of 24 bioconverters containing 2 kg of a mixture of laying hens manure with lemuru fish oil were placed 0.1 g of black soldier fly eggs in each bioconverter. Every week, 2 kg of mixed feed were added to make a total of 8 kg of manure for each bioconverter. Three weeks old maggot black soldier fly was harvested and the total production was weighed. The weight of 100 maggots was also weighed. Maggot drying is done in an oven. Samples of maggot meal in each type of mixed feed were analyzed for dry matter content, ash, crude protein, crude fiber, crude fat, calcium, phosphorus, gross energy, nitrogen free extract, and fatty acid composition. The data was then analyzed for variance (ANOVA) followed by Duncan's multiple range test. The results showed that the treatment was highly significant effect on maggot production, weight of 100 maggots, and crude fat content. Supplementation of 12% lemuru fish oil resulted in the highest maggot production with an average weight of maggot which was almost the same as the addition of 15% lemuru fish oil. The fat content of maggot meal was higher with the increase in the use of lemuru fish oil. Lemuru fish oil supplementation was able to improve the nutritional quality of maggot meal, the fatty acid content of BSF maggot meal was quite complete and contained unsaturated fatty acids. Mixed feed of laying hens manure with 12% lemuru fish oil was the best mixture with the highest average fresh BSF maggot production of 1.139.25 g, average weight of maggot 0.19 g/maggot, crude fat content 33.87%, linoleic 6.483%, linolenic acid 0.388%, EPA 2.142 %, and DHA 0.049%. It was concluded that the addition of lemuru fish oil into the manure of laying hens could enrich the unsaturated fatty acid content of maggot black soldier fly.

Key words: BSF maggot, laying hens manure, fatty acid composition

INTRODUCTION

Fish meal is a feed ingredient that is widely used as a mixture of poultry rations. The availability of fish meal is feared to decrease so that it can cause price increases. Several researchers have tried to replace fish meal with maggot meal (Newton et al., 1977; Bondari and Sheppard 1981; Akpodiete et al., 1998; Teguija et al., 2002; Awoniyi et al., 2003; Agunbiade et al., 2007; Bodri and Cole 2007; St-Hilaire et al., 2007). When compared to its nutrient content, fish meal contains higher protein and quite high essential fatty acids, while BSF maggot meal contains high crude fat but low essential fatty acid content.

The larvae of *Hermetia illucens* or better known as the maggot black soldier fly (BSF) are very well used as feed ingredients for protein sources to replace fish meal which has recently been imported. Maggot BSF contains about 42% protein with 35% fat content

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(Sheppard et al. 1994). The nutrient content in BSF maggots depends on the substrate used for growth, which generally uses waste, such as food waste (Ewald et al. 2020), poultry manure (Sheppard et al., 1994; Awoniyi et al., 2003), dairy cow manure (Myers et al., 2008).

Although chicken manure is suitable for reared BSF maggots, chicken manure actually lacks fat, according to Ghaly and MacDonald (2012) laying hens manure contain 6.3% fat, 42.2% crude protein, 6.5% crude fiber and 33% carbohydrates. Slightly different from that reported by Shumo et al. (2019) Chicken manure contains 2.7% fat, 15.3% crude protein, 18.3% ADF, 35.5% NDF and 86.6% organic matter. In fact, BSF maggots need a medium with a high fat content to be deposited in the body. The addition of fat or oil may help the growth of BSF larvae. Moreover, when using lemuru fish oil, it can be estimated that the BSF maggot produced will contain fat with a higher poly unsaturated fatty acid composition. But the price per kg of maggot is also higher.

Unsaturated fatty acids are needed by the human body because they can increase intelligence in children and prevent coronary heart disease in adults. Therefore, livestock products such as meat and eggs should be cultivated to contain more unsaturated fatty acids such as omega-3 and omega-6. The content of unsaturated fatty acids in meat and eggs depends on the feed ingredients used for animal feed. Likewise, the fatty acid profile of BSF maggots is highly dependent on the substrate used. Ewald et al. (2020) concluded that the fatty acid composition of BSF larvae was influenced by substrate feed and larval weight.

The amino acid profile of BSF maggot meal is similar to the amino acid profile of fish meal (Atteh and Ologbenla, 1993), but its fatty acid profile is not widely known. Ewald et al. (2020) reported that BSF larvae contain high levels of saturated fatty acids up to 76%, monounsaturated fatty acids 32% and polyunsaturated fatty acids 23%. Previous studies have shown that it is possible to modify the fatty acid composition of BSF maggots. Knowledge of this fatty acid profile is very important so that the quality of BSF maggot is relatively the same as fish meal and can be used as animal feed ingredients. Thus, the aim of this study was to investigate how chicken manure mixed with various levels of lemuru fish oil affected the fatty acid composition of BSF biomass and BSF maggot production.

MATERIAL AND METHOD

Materials

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The materials used in this experiment included laying hens manure, lemuru fish oil and BSF fly eggs. The tools used include 24 bioconverters, scales, dryers, and equipment for nutrient content analysis.

Research procedure

(1) Egg Collection

The collection of BSF fly eggs is carried out in closed cages, so that BSF flies come to deposit their eggs using fermented palm kernel meal. BSF fly eggs obtained were collected in a petri dish.

(2) Implementation of bioconversion

There were 24 bioconverters each filled with 2 kg of chicken manure, then lemuru fish oil was added according to treatment (0, 3, 6, 9, 12, and 15% of the weight of chicken manure). Mix until homogeneous. 0.1 g of BSF fly eggs were placed on chicken manure. After hatching, 2 kg of chicken manure and lemuru fish oil were added, then repeated in the second and third weeks.

(3) Harvesting maggot

Harvesting of BSF maggots was carried out at the age of 3 weeks. The BSF maggots that have been collected are then weighed and dried at a temperature of 50 °C.

(4) Nutrient Content Analysis

Samples of laying hens manure and BSF maggot were analyzed proximately.

(5) Fat extraction and Fatty acid analysis

BSF maggots were mashed, then fat extraction was carried out using the Bligh and Dyer analysis (1959) method, while for fatty acid analysis using the analytical procedure of Christopher and Glass (1969) with slight modifications.

Variable Response

The independent variable in this study was the level of addition of lemuru fish oil in laying hens manure as a growth medium for BSF maggots. The dependent variables were maggot production, weight of 100 maggots, nutrient content (protein, carbohydrates, fat, crude fiber, calcium, phosphorus, fatty acids, and gross energy) and fatty acid composition.

Statistical Analysis

This research is a pure experiment using Completely Randomized Design (CRD) with six treatments and four repetitions. In detail the six treatments were: M1: lemuru fish oil (0%); M2: 3% lemuru fish oil; M3: 6% lemuru fish oil; M4: 9% lemuru fish oil; M5: lemuru fish oil 12%; and M6: 15% lemuru fish oil. To determine the effect of treatment, statistical analysis was carried out the F test, if there was significant effect, then to determine differences in the levels of lemuru fish oil used, Duncan's multiple range test was carried out (Steel and Torrie, 1982).

RESULTS AND DISCUSSION

Maggot Production

The highest average BSF maggot production of 1,139.25 g was obtained in the treatment using 12% lemuru fish oil mixing level (M5), and the lowest was 537.0 g in the treatment without using lemuru fish oil (M1) (Table 1). The results of the analysis of variance on the resulting maggot production data showed that the treatment had a highly significant effect ($P < 0.01$) on the fresh maggot production produced and the results of Duncan's multiple range test showed that the treatment of mixing lemuru fish oil was significantly different from the treatment without using lemuru fish oil, the use of Lemuru fish oil resulted in higher BSF maggot production, but the best mixing rate was 12%. Levels of mixing lemuru fish oil 3, 6, 9, and 15% gave relatively the same larval production.

Table 1. Average production of fresh BSF maggots (g) and weight of 100 fresh BSF maggots based on the level of treatment of mixing lemuru fish oil with laying hens manure

Treatment	Average production of larvae (g ± SEM)	Average weight of 100 fresh BSF larvae (g ± SEM)
M1 (0%)	537.00 ± 15.30 ^a	13.0150 ± 0.80 ^a
M2 (3%)	869.50 ± 36.34 ^b	15.4200 ± 0.19 ^{ab}
M3 (6%)	871.50 ± 44.08 ^b	14.4875 ± 0.71 ^a
M4 (9%)	852.75 ± 70.24 ^b	17.8400 ± 2.05 ^{bc}
M5 (12%)	1,139.25 ± 90.10 ^c	18.8625 ± 0.83 ^c
M6 (15%)	807.75 ± 57.99 ^b	19.3275 ± 0.79 ^c

Distinct superscript letters in the column indicate significant differences according to Duncan's test ($P \leq 0.05$).

The difference in the average BSF maggot production between the mixing level of 0% and 3-12%, is due to the maggot needing oil for growth and food reserves during the pupal and adult phases, by consuming lemuru fish oil and the protein contained in laying hens manure causes the maggot produced more. According to Sheppard et al. (1994) larvae of black soldier flies contain 35% fat and 42% protein, while the results of research by Ewald et al. (2020) black soldier fly larvae reared in food waste contain 40.7% fat and 36.6% protein so it needs to be provide in the media as a place of growth.

The mixing level of 15% lemuru fish oil gives lower yields compared to the mixing rate of 3-12%, this is thought to be less favored by the larvae because the media produced from this mixture is too sticky and smells fishy, which may interfere with the movement of the larvae.

The level of BSF maggot production in the media obtained in this study was relatively high, when converted it reached 7-14%. Almost the same as that reported by Lalander et al. (2019) the maggot black soldier fly was able to convert 13.9% of food waste and 7.1% of poultry manure. This high level of BSF maggot production is thought to be caused by the manure used for BSF maggot growth media is still fresh, so that the available nutrients are sufficient to support maggot growth. According to Morgan and Eby (1975) in Tomberlin et al. (2002) larvae of other diptera species such as house flies require fresh manure every day to support optimal growth. Manure that has been in the cage for a long time may have been eaten by house fly maggots and has been digested by anaerobic organisms, resulting in less available nutrients, thereby suppressing the growth of BSF larvae. Larrain and Salas (2008) in their study used fresh manure less than 5 hours after being excreted by livestock.

Weight of 100 Maggots

The highest average weight of 100 fresh BSF maggots (Table 1) was obtained in the treatment using 15% lemuru fish oil mixing (M6) which was 19.3275 g, and the lowest was in the treatment without lemuru fish oil mixing (M1) which was 13.0150 g. The results of the analysis of variance on the weight data of 100 BSF maggots showed that the treatment had an effect on the weight of 100 fresh maggots. The higher the level of mixing of lemuru fish oil tends to produce heavier maggots. This is easy to understand because maggot really needs fat/oil to support its life development.

Duncan's test results showed that between M1, M2, and M3 did not show a significant difference, as well as between M4, M5, and M6 each produced almost the same maggot weight, so it can be said that the mixing rate of 12% is the mixing level of lemuru fish oil with optimal laying hens manure.

The M6 treatment produced the largest BSF maggot weight, but in terms of total fresh maggot production it was still below the M5 treatment, this may be due to the high mortality rate of larvae at a young age, as a result of the media being too sticky from this mixing.

The BSF maggot weight obtained from the results of this study ranged from 0.1301 g/maggot on laying hens manure media without lemuru fish oil, up to 0.1933 g/maggot on 15% lemuru fish oil mixing media. The average weight of BSF maggots obtained from the results of this study is slightly different (the resulting weight range is 0.1301-0.1933 g wider) with the results of research conducted by Tomberlin et al. (2002) who got the weight range of black soldier larvae from 0.153-0.171 g/larvae. The difference in these results is due to the difference in the media used. While Nguyen et al. (2013) obtained a larval weight of 339 mg/3 larvae or 0.113 g/larvae cultured in pig manure and Ewald et al. (2020) obtained a larval weight of 0.191 g/larvae cultured in food waste.

Nutrient Content

The average nutrient content of BSF maggot meal based on the treatments is presented in Table 2. The nutrient content between treatments was quite varied, but statistically analyzed only crude fat content, because this nutrient was closely related to the treatment given.

Table 2 Nutrient Content of meal BSF larvae (% dry matter) based treatment

Nutrient	Treatment					
	M1	M2	M3	M4	M5	M6
Water (%)	3.60	2.34	3.49	3.41	3.46	3.95
Ash (%)	17.20	13.80	15.63	15.10	12.96	13.30
Crude protein (%)	36.82	40.66	41.63	42.46	43.17	44.26
Crude fiber (%)	2.69	2.90	2.56	2.50	2.75	2.50
Crude fat (%)	24.80	26.22	28.15	32.23	33.87	34.39
Calcium (%)	1.47	1.45	1.31	1.21	1.25	1.20
Phosphorus (%)	0.78	0.65	0.56	0.71	0.55	0.65
Gross energy (Kkal/kg)	4,214.75	4,595.00	5,265.75	5,409.50	5,585.00	5,931.75
nitrogen-free	18.47	16.47	12.02	7.70	7.24	3.70

extract (%)						
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The highest average crude fat content was obtained in the treatment using 15% lemuru fish oil mixing with laying hens manure (M6), which was 34.39%, and the lowest was in the treatment without using lemuru fish oil on laying hens manure medium (M1), which was 24.80% (Table 2). The results of the analysis of variance on the crude fat content data showed that the treatment had a highly significant effect on the crude fat content of BSF maggot meal.

Table 3. Average crude fat content of BSF larvae meal (g) produced by treatment of mixing lemuru fish oil with laying hens manure

Treatment	Average crude fat content of BSF larvae meal (g)
M1 (0%)	24.80 ± 0.31 ^a
M2 (3%)	26.22 ± 0.35 ^b
M3 (6%)	28.15 ± 0.22 ^c
M4 (9%)	32.23 ± 0.14 ^d
M5 (12%)	33.87 ± 0.23 ^e
M6 (15%)	34.39 ± 0.62 ^e

Distinct superscript letters in the column indicate significant differences according to Duncan's test ($P \leq 0.05$).

The difference in the average crude fat content of BSF maggot meal is thought to be due to differences in the size of BSF maggots. BSF maggots produced from M6 media are larger than M1 media. Larger maggots are generally able to store more fat in their bodies, so they contain higher crude fat than smaller BSF maggots.

The crude fat content of maggot BSF ranged from 24.80-34.39% (Table 3), almost the same as that reported by Shumo et al. (2019). The crude fat content of BSF maggot meal is on average 30.1% in chicken manure and 34.3% in kitchen waste. Thus, the crude fat content of BSF larvae meal is highly dependent on the media used for its growth.

Fatty Acid Profile

The fatty acid profile of BSF maggot meal based on the treatment is presented in Table 4. However, only the fatty acids that were considered essential were analyzed, namely linoleic, linolenic, eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA).

Table 4 fatty acid profile (%) of BSF larvae meal based treatment

Fatty acid	Treatment					
	M1	M2	M3	M4	M5	M6
Miristic	6.202	6.347	7.376	7.642	7.929	7.081
Palmitic	11.230	14.163	19.675	19.545	20.673	17.436
Palmitoleic	5.580	7.808	6.869	5.904	6.067	4.749
Stearic	1.417	1.400	2.024	2.457	2.116	2.104
Oleic	16.781	17.989	19.500	18.283	17.806	14.225
Linoleic	5.765	5.562	6.649	7.068	6.483	6.682
Linolenic	0.244	0.378	0.396	0.507	0.388	0.586
EPA	0	0	2.110	1.904	2.142	1.784
DHA	0	0	0.168	0.092	0.049	0

Keterangan: EPA = eicosapentaenoic acid (20:5n-3)
DHA = docosahexaenoic acid (22:6n-3)

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Table 5. Average fatty acid content of meal BSF larvae (%) produced by treatment of mixing lemuru fish oil with laying hens manure

Fatty acid	Treatment					
	M1	M2	M3	M4	M5	M6
Linoleic	5.765 ± 0.09 ^{ac}	5.562 ± 0.24 ^c	6.649 ± 0.45 ^{ab}	7.068 ± 0.02 ^b	6.483 ± 0.46 ^{ab}	6.682 ± 0.22 ^{ab}
Linolenic	0.244 ± 0.03	0.378 ± 0.04	0.396 ± 0.07	0.507 ± 0.11	0.388 ± 0.12	0.586 ± 0.05
EPA	0 ± 0.00 ^a	0 ± 0.00 ^a	2.110 ± 0.12 ^c	1.904 ± 0.07 ^{bc}	2.142 ± 0.09 ^c	1.784 ± 0.11 ^b
DHA	0 ± 0.00 ^a	0 ± 0.00 ^a	0.1685 ± 0.01 ^b	0.092 ± 0.05 ^{ab}	0.049 ± 0.05 ^a	0 ± 0.00 ^a

Distinct superscript letters in the column indicate significant differences according to Duncan's test ($P \leq 0.05$).

Linoleic, Linolenic Fatty Acids, EPA and DHA

Linoleic and linolenic fatty acids were found in all types of media, while eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) were found in media containing lemuru fish oil. Ewald et al. (2020) stated that there are great similarities between the fatty acid composition of larvae and substrates. Linoleic fatty acid content in this study ranged from 5.562-7.068% (Table 5), the percentage is less than the results of Barroso et al. (2017) and Liland et al. (2017), linoleic acid (C18:2) was found in high percentages of 12-24% in larvae fed fish and chicken feed, or wheat and brown algae. And almost the same as the research of Ewald et al. (2020) of 2.6-12.5% in larvae fed bread, leftovers, fish and shellfish.

The results of analysis of variance showed that the treatment level of mixing lemuru fish oil with laying hens manure had a highly significant effect ($P < 0.01$) on the linoleic fatty acid, EPA and DHA content of BSF maggot meal, but had no significant effect on the linolenic fatty acid content. This effect is the result of the addition of lemuru fish oil. The

results of the Agricultural Technology laboratory analysis at Gadjah Mada University Yogyakarta showed that lemuru fish oil contained linoleic, linolenic, EPA and DHA fatty acids, respectively 10.564%, 1.021%, 5.106%, and 2.966%. The addition of lemuru fish oil in laying hens manure was actually utilized by larvae and stored in the form of body fat, so that BSF maggots contained more linoleic, linolenic, EPA, and DHA fatty acids than without the addition of lemuru fish oil in laying hens manure media.

The content of linolenic fatty acid between treatments had no significant effect, this was due to the small amount of linolenic fatty acid in lemuru fish oil, namely 1.021%, so that a small amount of BSF maggot could be stockpiled. The fatty acid content of EPA and DHA began to be seen in the M3 treatment, and until the M5 treatment the EPA content was not significantly different. The DHA content was very high in the M3 treatment, but was not detected in the M6 treatment. DHA was not detected in the addition of 15% lemuru fish oil, it is possible that the larvae are no longer eating and store a lot of energy in the form of saturated fatty acids, according to the opinion of Ewald et al. (2020) more energy is stored in the form of unsaturated fatty acids because these fatty acids are less susceptible to oxidation than unsaturated fatty acids. Furthermore, it is said that when the larvae gain weight, the percentage of EPA and DHA decreases. Meanwhile Liu et al. (2017) found a decrease in unsaturated fatty acids over time as the black soldier fly larva (BSFL) got older. EPA and DHA were not found in the M1 and M2 treatments. This is easy to understand because the substrate contains little or no EPA and DHA according to the opinion of Liland et al. (2017) EPA (C20:5) and DHA (C22:6) were found in the larvae, most likely from the substrate.

CONCLUSIONS AND SUGGESTIONS

Conclusion

Lemuru fish oil is very well used for mixed BSF maggot growth media. The best mixture of lemuru fish oil is 12% of the weight of asfed laying hens manure, because it produces the most BSF maggot production with a fairly high average maggot weight and contains linoleic, linolenic, EPA and DHA fatty acids which are needed for Alabio duck feed supplements.

Suggestion

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For optimal maggot growth, it is necessary to pay attention to the fat and protein content of the media used. If the laying hens manure used contains low fat, it is better to add lemuru fish oil 12% of the weight of the laying hens manure. Laying hens manure used should be fresh manure so that the nutrients contained in it can be immediately consumed by BSF maggots, without being overhauled by microorganisms.

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Aam Gunawan, Abd. Malik, Deni Rusmana, Muh. Syarif Djaya & Neni Widaningsih

On behalf of the Scientific Committee of The 1st International Conference on Sustainable Animal Resources and Environment 2021, we are pleased to inform you that your abstract entitled **“Fatty Acid Composition Of Black Soldier Fly Maggot Were Reared In The Mixture Of Laying Hen Manure With Lemuru Fish Oil”** has been accepted for **Oral Presentation**.

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**FATTY ACID COMPOSITION OF BLACK SOLDIER FLY MAGGOT WERE
REARED IN THE MIXTURE OF LAYING HEN MANURE WITH
LEMURU FISH OIL**

**AAM GUNAWAN¹, ABD.MALIK¹, DENI RUSMANA², MUH. SYARIF DJAYA¹,
AND NENI WIDANINGSIH¹**

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ABSTRACT

Maggot black soldier fly can convert a mixture of layer chicken manure with lemuru fish oil into nutrient-rich biomass. The growth and nutrient composition of maggot is strongly influenced by the type of media used as food. Therefore, it is necessary to know whether the addition of lemuru fish oil into laying hens manure as a medium for maggot growth can affect the production of fresh maggot and the nutrient content of maggot meal, especially its fat content and fatty acid composition. In this study, the maggot black soldier fly was given six kinds of feed consisting of a mixture of laying hens manure with the addition of lemuru fish oil which varied 0%, 3%, 6%, 9%, 12%, and 15%. A total of 24 bioconverters containing 2 kg of a mixture of laying hens manure with lemuru fish oil were placed 0.1 g of black soldier fly eggs in each bioconverter. Every week, 2 kg of mixed feed were added to make a total of 8 kg of manure for each bioconverter. Three weeks old maggot black soldier fly was harvested and the total production was weighed. The weight of 100 maggots was also weighed. Maggot drying is done in an oven. Samples of maggot meal in each type of mixed feed were analyzed for dry matter content, ash, crude protein, crude fiber, crude fat, calcium, phosphorus, gross energy, nitrogen free extract, and fatty acid composition. The data was then analyzed for variance (ANOVA) followed by Duncan's multiple range test. The results showed that the treatment was highly significant effect on maggot production, weight of 100 maggots, and crude fat content. Supplementation of 12% lemuru fish oil resulted in the highest maggot production with an average weight of maggot which was almost the same as the addition of 15% lemuru fish oil. The fat content of maggot meal was higher with the increase in the use of lemuru fish oil. Lemuru fish oil supplementation was able to improve the nutritional quality of maggot meal, the fatty acid content of BSF maggot meal was quite complete and contained unsaturated fatty acids. Mixed feed of laying hens manure with 12% lemuru fish oil was the best mixture with the highest average fresh BSF maggot production of 1.139.25 g, average weight of maggot 0.19 g/maggot, crude fat content 33.87%, linoleic 6.483%, linolenic acid 0.388%, EPA 2.142 %, and DHA 0.049%. It was concluded that the addition of lemuru fish oil into the manure of laying hens could enrich the unsaturated fatty acid content of maggot black soldier fly.

Key words: BSF maggot, laying hens manure, fatty acid composition

INTRODUCTION

Fish meal is a feed ingredient that is widely used as a mixture of poultry rations. The availability of fish meal is feared to decrease so that it can cause price increases. Several researchers have tried to replace fish meal with maggot meal (Newton et al., 1977; Bondari and Sheppard 1981; Akpodiete et al., 1998; Tegua et al., 2002; Awoniyi et al., 2003; Agunbiade et al., 2007; Bodri and Cole 2007; St-Hilaire et al., 2007). When compared to its nutrient content, fish meal contains higher protein and quite high essential fatty acids, while BSF maggot meal contains high crude fat but low essential fatty acid content.

The larvae of *Hermetia illucens* or better known as the maggot black soldier fly (BSF) are very well used as feed ingredients for protein sources to replace fish meal which has recently been imported. Maggot BSF contains about 42% protein with 35% fat content

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(Sheppard et al. 1994). The nutrient content in BSF maggots depends on the substrate used for growth, which generally uses waste, such as food waste (Ewald et al. 2020), poultry manure (Sheppard et al., 1994; Awoniyi et al., 2003), dairy cow manure (Myers et al., 2008).

Although chicken manure is suitable for reared BSF maggots, chicken manure actually lacks fat, according to Ghaly and MacDonald (2012) laying hens manure contain 6.3% fat, 42.2% crude protein, 6.5% crude fiber and 33% carbohydrates. Slightly different from that reported by Shumo et al. (2019) Chicken manure contains 2.7% fat, 15.3% crude protein, 18.3% ADF, 35.5% NDF and 86.6% organic matter. In fact, BSF maggots need a medium with a high fat content to be deposited in the body. The addition of fat or oil may help the growth of BSF larvae. Moreover, when using lemuru fish oil, it can be estimated that the BSF maggot produced will contain fat with a higher poly unsaturated fatty acid composition. But the price per kg of maggot is also higher.

Unsaturated fatty acids are needed by the human body because they can increase intelligence in children and prevent coronary heart disease in adults. Therefore, livestock products such as meat and eggs should be cultivated to contain more unsaturated fatty acids such as omega-3 and omega-6. The content of unsaturated fatty acids in meat and eggs depends on the feed ingredients used for animal feed. Likewise, the fatty acid profile of BSF maggots is highly dependent on the substrate used. Ewald et al. (2020) concluded that the fatty acid composition of BSF larvae was influenced by substrate feed and larval weight.

The amino acid profile of BSF maggot meal is similar to the amino acid profile of fish meal (Atteh and Ologbenla, 1993), but its fatty acid profile is not widely known. Ewald et al. (2020) reported that BSF larvae contain high levels of saturated fatty acids up to 76%, monounsaturated fatty acids 32% and polyunsaturated fatty acids 23%. Previous studies have shown that it is possible to modify the fatty acid composition of BSF maggots. Knowledge of this fatty acid profile is very important so that the quality of BSF maggot is relatively the same as fish meal and can be used as animal feed ingredients. Thus, the aim of this study was to investigate how chicken manure mixed with various levels of lemuru fish oil affected the fatty acid composition of BSF biomass and BSF maggot production.

MATERIAL AND METHOD

Materials

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The materials used in this experiment included laying hens manure, lemuru fish oil and BSF fly eggs. The tools used include 24 bioconverters, scales, dryers, and equipment for nutrient content analysis.

Research procedure

(1) Egg Collection

The collection of BSF fly eggs is carried out in closed cages, so that BSF flies come to deposit their eggs using fermented palm kernel meal. BSF fly eggs obtained were collected in a petri dish.

(2) Implementation of bioconversion

There were 24 bioconverters each filled with 2 kg of chicken manure, then lemuru fish oil was added according to treatment (0, 3, 6, 9, 12, and 15% of the weight of chicken manure). Mix until homogeneous. 0.1 g of BSF fly eggs were placed on chicken manure. After hatching, 2 kg of chicken manure and lemuru fish oil were added, then repeated in the second and third weeks.

(3) Harvesting maggot

Harvesting of BSF maggots was carried out at the age of 3 weeks. The BSF maggots that have been collected are then weighed and dried at a temperature of 50 °C.

(4) Nutrient Content Analysis

Samples of laying hens manure and BSF maggot were analyzed proximately.

(5) Fat extraction and Fatty acid analysis

BSF maggots were mashed, then fat extraction was carried out using the Bligh and Dyer analysis (1959) method, while for fatty acid analysis using the analytical procedure of Christopher and Glass (1969) with slight modifications.

Variable Response

The independent variable in this study was the level of addition of lemuru fish oil in laying hens manure as a growth medium for BSF maggots. The dependent variables were maggot production, weight of 100 maggots, nutrient content (protein, carbohydrates, fat, crude fiber, calcium, phosphorus, fatty acids, and gross energy) and fatty acid composition.

Statistical Analysis

This research is a pure experiment using Completely Randomized Design (CRD) with six treatments and four repetitions. In detail the six treatments were: M1: lemuru fish oil (0%); M2: 3% lemuru fish oil; M3: 6% lemuru fish oil; M4: 9% lemuru fish oil; M5: lemuru fish oil 12%; and M6: 15% lemuru fish oil. To determine the effect of treatment, statistical analysis was carried out the F test, if there was a significant effect, then to determine differences in the levels of lemuru fish oil used, Duncan's multiple range test was carried out (Steel and Torrie, 1982).

RESULTS AND DISCUSSION

Maggot Production

The highest average BSF maggot production of 1,139.25 g was obtained in the treatment using 12% lemuru fish oil mixing level (M5), and the lowest was 537.0 g in the treatment without using lemuru fish oil (M1) (Table 1). The results of the analysis of variance on the resulting maggot production data showed that the treatment had a highly significant effect ($P < 0.01$) on the fresh maggot production produced and the results of Duncan's multiple range test showed that the treatment of mixing lemuru fish oil was significantly different from the treatment without using lemuru fish oil, the use of Lemuru fish oil resulted in higher BSF maggot production, but the best mixing rate was 12%. Levels of mixing lemuru fish oil 3, 6, 9, and 15% gave relatively the same larval production.

Table 1. Average production of fresh BSF maggots (g) and weight of 100 fresh BSF maggots based on the level of treatment of mixing lemuru fish oil with laying hens manure

Treatment	Average production of larvae (g \pm SEM)	Average weight of 100 fresh BSF larvae (g \pm SEM)
M1 (0%)	537.00 \pm 15.30 ^a	13.0150 \pm 0.80 ^a
M2 (3%)	869.50 \pm 36.34 ^b	15.4200 \pm 0.19 ^{ab}
M3 (6%)	871.50 \pm 44.08 ^b	14.4875 \pm 0.71 ^a
M4 (9%)	852.75 \pm 70.24 ^b	17.8400 \pm 2.05 ^{bc}
M5 (12%)	1,139.25 \pm 90.10 ^c	18.8625 \pm 0.83 ^c
M6 (15%)	807.75 \pm 57.99 ^b	19.3275 \pm 0.79 ^c

Distinct superscript letters in the column indicate significant differences according to Duncan's test ($P \leq 0.05$).

The difference in the average BSF maggot production between the mixing level of 0% and 3-12%, is due to the maggot needing oil for growth and food reserves during the pupal and adult phases, by consuming lemuru fish oil and the protein contained in laying hens manure causes the maggot produced more. According to Sheppard et al. (1994) larvae of black soldier flies contain 35% fat and 42% protein, while the results of research by Ewald et al. (2020) black soldier fly larvae reared in food waste contain 40.7% fat and 36.6% protein so it needs to be provide in the media as a place of growth.

The mixing level of 15% lemuru fish oil gives lower yields compared to the mixing rate of 3-12%, this is thought to be less favored by the larvae because the media produced from this mixture is too sticky and smells fishy, which may interfere with the movement of the larvae.

The level of BSF maggot production in the media obtained in this study was relatively high, when converted it reached 7-14%. Almost the same as that reported by Lalander et al. (2019) the maggot black soldier fly was able to convert 13.9% of food waste and 7.1% of poultry manure. This high level of BSF maggot production is thought to be caused by the manure used for BSF maggot growth media is still fresh, so that the available nutrients are sufficient to support maggot growth. According to Morgan and Eby (1975) in Tomberlin et al. (2002) larvae of other diptera species such as house flies require fresh manure every day to support optimal growth. Manure that has been in the cage for a long time may have been eaten by house fly maggots and has been digested by anaerobic organisms, resulting in less available nutrients, thereby suppressing the growth of BSF larvae. Larrain and Salas (2008) in their study used fresh manure less than 5 hours after being excreted by livestock.

Weight of 100 Maggots

The highest average weight of 100 fresh BSF maggots (Table 1) was obtained in the treatment using 15% lemuru fish oil mixing (M6) which was 19.3275 g, and the lowest was in the treatment without lemuru fish oil mixing (M1) which was 13.0150 g. The results of the analysis of variance on the weight data of 100 BSF maggots showed that the treatment had an effect on the weight of 100 fresh maggots. The higher the level of mixing of lemuru fish oil tends to produce heavier maggots. This is easy to understand because maggot really needs fat/oil to support its life development.

Duncan's test results showed that between M1, M2, and M3 did not show a significant difference, as well as between M4, M5, and M6 each produced almost the same maggot weight, so it can be said that the mixing rate of 12% is the mixing level of lemuru fish oil with optimal laying hens manure.

The M6 treatment produced the largest BSF maggot weight, but in terms of total fresh maggot production it was still below the M5 treatment, this may be due to the high mortality rate of larvae at a young age, as a result of the media being too sticky from this mixing.

The BSF maggot weight obtained from the results of this study ranged from 0.1301 g/maggot on laying hens manure media without lemuru fish oil, up to 0.1933 g/maggot on 15% lemuru fish oil mixing media. The average weight of BSF maggots obtained from the results of this study is slightly different (the resulting weight range is 0.1301-0.1933 g wider) with the results of research conducted by Tomberlin et al. (2002) who got the weight range of black soldier larvae from 0.153-0.171 g/larvae. The difference in these results is due to the difference in the media used. While Nguyen et al. (2013) obtained a larval weight of 339 mg/3 larvae or 0.113 g/larvae cultured in pig manure and Ewald et al. (2020) obtained a larval weight of 0.191 g/larvae cultured in food waste.

Nutrient Content

The average nutrient content of BSF maggot meal based on the treatments is presented in Table 2. The nutrient content between treatments was quite varied, but statistically analyzed only crude fat content, because this nutrient was closely related to the treatment given.

Table 2 Nutrient Content of meal BSF larvae (% dry matter) based treatment

Nutrient	Treatment					
	M1	M2	M3	M4	M5	M6
Water (%)	3.60	2.34	3.49	3.41	3.46	3.95
Ash (%)	17.20	13.80	15.63	15.10	12.96	13.30
Crude protein (%)	36.82	40.66	41.63	42.46	43.17	44.26
Crude fiber (%)	2.69	2.90	2.56	2.50	2.75	2.50
Crude fat (%)	24.80	26.22	28.15	32.23	33.87	34.39
Calcium (%)	1.47	1.45	1.31	1.21	1.25	1.20
Phosphorus (%)	0.78	0.65	0.56	0.71	0.55	0.65
Gross energy (Kkal/kg)	4,214.75	4,595.00	5,265.75	5,409.50	5,585.00	5,931.75
nitrogen-free	18.47	16.47	12.02	7.70	7.24	3.70

extract (%)						
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The highest average crude fat content was obtained in the treatment using 15% lemuru fish oil mixing with laying hens manure (M6), which was 34.39%, and the lowest was in the treatment without using lemuru fish oil on laying hens manure medium (M1), which was 24.80 % (Table 2). The results of the analysis of variance on the crude fat content data showed that the treatment had a highly significant effect on the crude fat content of BSF maggot meal.

Table 3. Average crude fat content of BSF larvae meal (g) produced by treatment of mixing lemuru fish oil with laying hens manure

Treatment	Average crude fat content of BSF larvae meal (g)
M1 (0%)	24.80 ± 0.31 ^a
M2 (3%)	26.22 ± 0.35 ^b
M3 (6%)	28.15 ± 0.22 ^c
M4 (9%)	32.23 ± 0.14 ^d
M5 (12%)	33.87 ± 0.23 ^e
M6 (15%)	34.39 ± 0.62 ^e

Distinct superscript letters in the column indicate significant differences according to Duncan's test ($P \leq 0.05$).

The difference in the average crude fat content of BSF maggot meal is thought to be due to differences in the size of BSF maggots. BSF maggots produced from M6 media are larger than M1 media. Larger maggots are generally able to store more fat in their bodies, so they contain higher crude fat than smaller BSF maggots.

The crude fat content of maggot BSF ranged from 24.80-34.39% (Table 3), almost the same as that reported by Shumo et al. (2019) The crude fat content of BSF maggot meal is on average 30.1% in chicken manure and 34.3% in kitchen waste. Thus, the crude fat content of BSF larvae meal is highly dependent on the media used for its growth.

Fatty Acid Profile

The fatty acid profile of BSF maggot meal based on the treatment is presented in Table 4. However, only the fatty acids that were considered essential were analyzed, namely linoleic, linolenic, eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA).

Table 4 fatty acid profile (%) of BSF larvae meal based treatment

Fatty acid	Treatment					
	M1	M2	M3	M4	M5	M6
Miristic	6.202	6.347	7.376	7.642	7.929	7.081
Palmitic	11.230	14.163	19.675	19.545	20.673	17.436
Palmitoleic	5.580	7.808	6.869	5.904	6.067	4.749
Stearic	1.417	1.400	2.024	2.457	2.116	2.104
Oleic	16.781	17.989	19.500	18.283	17.806	14.225
Linoleic	5.765	5.562	6.649	7.068	6.483	6.682
Linolenic	0.244	0.378	0.396	0.507	0.388	0.586
EPA	0	0	2.110	1.904	2.142	1.784
DHA	0	0	0.168	0.092	0.049	0

Keterangan: EPA = eicosapentaenoic acid (20:5n-3)
DHA = docosahexaenoic acid (22:6n-3)

Commented [A6]: Lauric??

Commented [AG7R6]: Lauric is fatty acid of short chain, not detected because especially long chain fatty acid, it is needed for healthy.

Table 5. Average fatty acid content of meal BSF larvae (%) produced by treatment of mixing lemuru fish oil with laying hens manure

Fatty acid	Treatment					
	M1	M2	M3	M4	M5	M6
Linoleic	5.765 ± 0.09 ^{ac}	5.562 ± 0.24 ^c	6.649 ± 0.45 ^{ab}	7.068 ± 0.02 ^b	6.483 ± 0.46 ^{ab}	6.682 ± 0.22 ^{ab}
Linolenic	0.244 ± 0.03	0.378 ± 0.04	0.396 ± 0.07	0.507 ± 0.11	0.388 ± 0.12	0.586 ± 0.05
EPA	0 ± 0.00 ^a	0 ± 0.00 ^a	2.110 ± 0.12 ^c	1.904 ± 0.07 ^{bc}	2.142 ± 0.09 ^c	1.784 ± 0.11 ^b
DHA	0 ± 0.00 ^a	0 ± 0.00 ^a	0.1685 ± 0.01 ^b	0.092 ± 0.05 ^{ab}	0.049 ± 0.05 ^a	0 ± 0.00 ^a

Distinct superscript letters in the column indicate significant differences according to Duncan's test (P ≤ 0.05).

Linoleic, Linolenic Fatty Acids, EPA and DHA

Linoleic and linolenic fatty acids were found in all types of media, while eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) were found in media containing lemuru fish oil. Ewald et al. (2020) stated that there are great similarities between the fatty acid composition of larvae and substrates. Linoleic fatty acid content in this study ranged from 5.562-7.068% (Table 5), the percentage is less than the results of Barroso et al. (2017) and Liland et al. (2017), linoleic acid (C18:2) was found in high percentages of 12-24% in larvae fed fish and chicken feed, or wheat and brown algae. And almost the same as the research of Ewald et al. (2020) of 2.6-12.5% in larvae fed bread, leftovers, fish and shellfish.

The results of analysis of variance showed that the treatment level of mixing lemuru fish oil with laying hens manure had a highly significant effect (P<0.01) on the linoleic fatty acid, EPA and DHA content of BSF maggot meal, but had no significant effect on the linolenic fatty acid content. This effect is the result of the addition of lemuru fish oil. The

results of the Agricultural Technology laboratory analysis at Gadjah Mada University Yogyakarta showed that lemuru fish oil contained linoleic, linolenic, EPA and DHA fatty acids, respectively 10.564%, 1.021%, 5.106%, and 2.966%. The addition of lemuru fish oil in laying hens manure was actually utilized by larvae and stored in the form of body fat, so that BSF maggots contained more linoleic, linolenic, EPA, and DHA fatty acids than without the addition of lemuru fish oil in laying hens manure media.

The content of linolenic fatty acid between treatments had no significant effect, this was due to the small amount of linolenic fatty acid in lemuru fish oil, namely 1.021%, so that a small amount of BSF maggot could be stockpiled. The fatty acid content of EPA and DHA began to be seen in the M3 treatment, and until the M5 treatment the EPA content was not significantly different. The DHA content was very high in the M3 treatment, but was not detected in the M6 treatment. DHA was not detected in the addition of 15% lemuru fish oil, it is possible that the larvae are no longer eating and store a lot of energy in the form of saturated fatty acids, according to the opinion of Ewald et al. (2020) more energy is stored in the form of unsaturated fatty acids because these fatty acids are less susceptible to oxidation than unsaturated fatty acids. Furthermore, it is said that when the larvae gain weight, the percentage of EPA and DHA decreases. Meanwhile Liu et al. (2017) found a decrease in unsaturated fatty acids over time as the black soldier fly larva (BSFL) got older. EPA and DHA were not found in the M1 and M2 treatments. This is easy to understand because the substrate contains little or no EPA and DHA according to the opinion of Liland et al. (2017) EPA (C20:5) and DHA (C22:6) were found in the larvae, most likely from the substrate.

CONCLUSIONS AND SUGGESTIONS

Conclusion

Lemuru fish oil is very well used for mixed BSF maggot growth media. The best mixture of lemuru fish oil is 12% of the weight of asfed laying hens manure, because it produces the most BSF maggot production with a fairly high average maggot weight and contains linoleic, linolenic, EPA and DHA fatty acids which are needed for Alabio duck feed supplements.

Suggestion

Commented [A8]: How the feed cost/feed price?

Commented [AG9R8]: The price of maggot certainly increasing. In this research it has not been calculated.

For optimal maggot growth, it is necessary to pay attention to the fat and protein content of the media used. If the laying hens manure used contains low fat, it is better to add lemuru fish oil 12% of the weight of the laying hens manure. Laying hens manure used should be fresh manure so that the nutrients contained in it can be immediately consumed by BSF maggots, without being overhauled by microorganisms.

Commented [A10]: How about C/N ratio?

Commented [AG11R10]: C/N ratio has not yet been measured

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ICARE 2021

SEMINAR PROGRAM FIRST DAY

Wednesday, November 10, 2021

<https://ipb.link/icareday1>

Meeting ID: 971 8864 4353; Passcode: 350596

Time	Event
08.00-08.30	Registration
08.30-08.40	Report from OC
08.40-08.55	Welcome Address from Dean Faculty of Animal Science
08.55-09.15	Opening speech from Rector of IPB University
09.15-09.25	Photo session
09.25-09.30	Traditional performance
	Keynote Session Moderator : Prof. Dr. Ir. Muladno, MSA
09.30-09.50	Keynote speaker 1: Ministry of Agriculture
09.50-10.10	Keynote speaker 2: Head of National Research and Innovation Agency
10.10-10.30	Keynote speaker 3: Vice Governor West Sumatra
10.30-11.00	Discussion
11.00-11.20	Keynote Speakers and moderator appreciation
11.20-12.00	Seminar Program Information by OC
12.00-13.00	Break
	Plenary Session I Moderator : Prof. Dr. Ir. Asnath M Fuah, MS
13.00 -13.20	Invited speaker 1 : Prof. Graham Gardner (Australia)
13.25-13.45	Invited speaker 2 : Prof. Masahiro Ogawa (Japan)
13.50-14.10	Invited speaker 3 : Prof. Jo Cheorun (South Korea)
14.15-14.35	Invited speaker 4: Prof. Yusuf Konca (Turkey)
14.35-15.05	Discussion
15.05-15.15	Invited Speakers and moderator appreciation
15.15-15.30	Break
	Parallel Session
15.30-17.00	Parallel Session 1
	Animal Product's Technology
	Animal Feed and Nutrition
	Animal Breeding, Genetic and Environment



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SEMINAR PROGRAM SECOND DAY

Thursday, November 11, 2021

<https://ipb.link/icareday2>

Meeting ID: 925 7029 7064; Passcode: 946474

Time	Event
08.30-09.00	Registration
09.00-11.30	Parallel Session 2
	Animal Product's Technology
	Animal Nutrition, Forage and Feed Technology
	Animal Nutrition, Forage and Feed Technology
	Animal Management, Production, Logistic and Welfare
	Animal Breeding, Genetic and Environment
12.00-13.00	Break
	Plenary Session II Moderator : Prof. Dr.sc.ETH Anuraga Jayanegara, M.Sc
13.00-13.20	Invited speaker 5: Prof. Cece Sumantri (Indonesia)
13.25-13.45	Invited speaker 6: Assoc. Prof. Longyu Zheng (China)
13.50-14.10	Invited speaker 7: Assoc. Prof. Hasliza Hassim (Malaysia)
14.10-14.40	Discussion
14.40-14.50	Invited Speakers and moderator appreciation
14.50-15.00	Sponsor Video/performance
	Plenary Session III Moderator : Prof. Dr. Ir. Nahrowi, M.Sc
15.00-15.20	Invited speaker 8: Prof. Luki Abdullah (Indonesia)
15.25-15.45	Invited speaker 9: Prof. Steffen Weigend (Germany)
15.50-16.10	Invited speaker 10: Marion De Vries, Ph.D (Netherland)
16.10-16.40	Discussion
16.40-16.50	Invited Speakers and moderator appreciation
	Closing ceremony
16.50-17.05	Awarding
17.05-17.15	OC report



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ROOM A (Animal Product's Technology)	
Moderator : Dr. Cahyo Budiman SPT., MSc	
15.30-15.40	Veronica Wanniatie, Arif Qisthon, Ali Husni, Dedy Yuliawan, Panca Apriky, Yufi Diana Safitri Arlintia Widiawati, Mauly Aulia Putri Borneo
	"Physicochemical And Microbiological Quality Of Goat's Milk Yogurt With The Added Of Red Ginger (<i>Zingiber officinale</i> Var. Rubrum) Extract"
15.40-15.50	M Fiqri Erzhad, Marwah Hasan, Zakiah Wulandari, M.Sriduresta Soenarno, M.Arifin, Devi Murtini, Irma Isnafia Arief
	Physicochemical properties, total lactic acid bacteria and panelists preference for goat's milk kefir with fortification of red fruit liquid extract
15.50-16.00	Andrean Wangsa, Haryadi Raharjo
	A Narrative Review on Technological and Nutritional Aspects of Milk Phospholipids
16.00-16.10	Dyah Nurul Afiyah, Riska Nurtantyo Sarbini, Irma Isnafia Arief, Tuti Suryati
	β -Carotene Content and Quality Properties of Probiotic Yoghurt Supplemented with Podang Urang Mango Extract
16.10-16.20	Rifa Rafi'atu Sya'bani Wihansah, Debby Fadhilah, Pazra Wahyuningsih, Kusuma Sri Handayani
	Assesment of the Antidiabetic Activity and Quality Attributes of Yogurt Enhanced with Herbs Extracts
16.20-16.45	Discussion



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ROOM B (Animal Nutrition, Forage and Feed Technology)	
Moderator : Dr. Dilla M. Maeisthia Fassah SPt, MSi, Student 2	
15.30-15.40	Rani Winardi Wulan Sari, Novirman Jamarun, Suyitman, Khasrad, Gusri Yanti, Zaitul Ikhlas
	Nutritional Analysis of Mangrove Leaves (<i>Rhizophora apiculata</i>) Soaking with Lime Water for Ruminants Feed
15.40-15.50	Modawy Abdelgader, Ismoyowati, Eka Aris Rimbawanto
	Supplementing Diet with Safflower Oil (<i>Carthamus Tinctorius. L</i>) and Inositol for Male Sentul Chicken of Performance, Blood Hematological, Immunity and Organs Lymphoid
15.50-16.00	Isnaini Dafri, Salsa Bela Nur Izah, M. Firman Abdullah, Nahrowi, Anuraga Jayanegara
	High, Moderate, and Low Protein Feed Preparation Technology and Its Feeding Strategy to Increase Maggot Productivity
16.00-16.10	Syafwan, Yatno, Agus Budiansyah, Kristoper Simanungkalit, Lusiana Agustina BR Sembiring, Intan Lestari BR Aritonang
	Effect of Different Calcium Sources Given Free Choice on Calcium Consumption and Egg Production of Arabic Chickens in the Early Laying Period.
16.10-16.20	Listya Purnamasari, Hari Purnomo
	Detection of biological and aflatoxin B1 contaminants in broiler feed at the poultry shop Summersari District, Jember
16.20-16.45	Discussion



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ROOM E (Animal Breeding and Genetic and Environment)	
Moderator : Dr. M Sriduresta SPt., MSi	
15.30-15.40	Titis Apdini, Windi Al Zahra, Simon J. Oosting, Corina van E. Middelaar
	Coupling livestock to land: a scenario study for smallholder dairy farms in Indonesia
15.40-15.50	Windi Alzahra, Ahmad Ari Aldino, Titis Apdini
	Understanding the relationship between milk production and greenhouse gas emissions intensity at smallholder dairy farms
15.50-16.00	Muhammad Bagas Tama, Ardian Maulana, Septiana Widayanti, Rebecca Vanessa, Galih Pambuko, Rahyu Eka Puji Lestari, Novita Herowati, Taufiq Gunawan
	The Association of Lactoferrin (LTF) Gene with Milk Production Traits in Indonesian Friesian Holstein Dairy Cattle
16.00-16.10	Windi Al Zahra, Mohammad Ikhsan Shiddieqy, Simon J Oosting
	Comparing N ₂ O Emissions of Different Organic Fertilisers and N Application Rates on the Elephant Grass
16.10-16.20	Mariyam Al Haddar, Jakaria, Ronny Rachman Noor
	SNP g.1117G>A HSP70 Gene Polymorphism in Domestic Beef Cattle using PCR-RFLP Method
16.20-16.45	Discussion



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ICARE 2021

PARALEL SESSION

DAY 2

Thursday, November 11, 2021

<https://ipb.link/icareday2>

Meeting ID: 925 7029 7064; Passcode: 946474

ROOM A (Animal Product's Technology)	
Moderator : Dr. Epi Taufik SPt., MVPH, MSi, Student 1	
09.00-09.10	Zakiah Wulandari, Iman Rahayu Hidayati, Risha Andriani
	Egg Quality And Chemical Components Of Arabic And Commercial Chicken Enriched With Omega 3 During Storage
09.10-09.20	Azmi Mangalisu, Irma Isnafia Arief, Andi Kurnia Armayanti, Zakiah Wulandari
	Antimicrobial Activity Of Fermented Chicken Eggs Incubated On The Different Temperature And Time
09.20-09.30	Anis Usfah Prastujati, Mustofa Hilmi, Asmaul Khusnam Irma Isnafia Arief, Sukron
	Isolation And Identification Of Lactic Acid Bacteria Of Bekamal (Banyuwangi Traditional Fermented Meat)
09.30-09.40	Mochammad Sriduresta Soenarno, Cece Sumantri, Irma Isnafia Arief, Lilis Nuraida
	The Effectiveness Of Plantaricin Iia-1a5 Powder Application To Extend The Storage Of Fresh Cow's Milk
09.40-10.00	Discussion
10.00-10.10	Dedes Amertaningtyas, Herly Evanuarini, Mulia Winirsya Apriliyani
	Chemical Quality and Amino Acid Profile of Liver Nuggets Using Different Flours
10.10-10.20	Nujjiya Faza Nur Azizah, Herly Evanuarini
	Physicochemical Characteristics Egg White Powder Using Lactobacillus bulgaricus
10.20-10.30	Yuliana Mega Leony Simbolon, Herly Evanuarini
	The Physicochemical Characteristics Of Pasteurized Liquid Whole Egg With Different Percentages Of Acetic Acid
10.30-10.40	Cahyo Budiman, Muhammad Silmi Kaafah, Muhammad Rizkiawan Pratama, Mochamad Sriduresta Soenarno, Rukmiasih, Irma Isnafia Arief
	Characterization of protease producing bacteria Isolated from Broiler Litter Waste
10.40-11.00	Discussion



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ROOM B (Animal Nutrition, Forage and Feed Technology) Moderator : Prof.Dr.Ir. Asep Sudarman, MSc, Student 2	
09.00-09.10	Megat Muhammad Nadzrin Bin Norizan, Hasliza Abu Hassim, Lokman Hakim Idris, Ismail-Fitry Mohammad Rashedi
	The Effect Of Different Soy Waste Level As Protein Supplementation In Goat Diets To The Carcass Characteristics, Nutritional Composition And Meat Quality Of Boer Goats
09.10-09.20	Andi Yekti Widodo, Sumiati, Ronald Tarigan
	Level Of Avian Pathogenic Eschericia Coli (Apec), Clostridium Perfringens, And Lactic Acid Bacteria In Commercial Broilers With Agp Replacers In Indonesia
09.20-09.30	Annisa Rosmalia, Nurul Asmaa Dewi, Idat Galih Permana, Despal
	Reformulation of Dairy Cattle Concentrate Based on Rumen Degradable Protein to Undegradable Protein Ratio at Different Energy Levels: In Vitro Study
09.30-09.40	Nanik Setiyaningsih, Sumiati, Anuraga Jayanegara, Wira Wisnu Wardani
	The Effect of 25OHD3 in Combination with Vitamin C (HyC) on Hatchability of Broiler Breeders
09.40-09.50	Aeni Nurlatifah, L Khotijah, R I Arifiantini, M S Maidin, D A Astuti
	Change in Hematology Prepartum and Postpartum of Ewe fed Flushing Diet Contain Lemuru Oil
09.50-10.15	Discussion
10.15-10.25	Ahmad Fariz Bin Nicholas, Hasliza Abu Hassim, Zunita Zakaria, Mohd Termizi Yusuf, Nazri Nayan
	The Filamentous Fungi Selection For Pre-Treatment Of Oil Palm Frond As Animal Feed
10.25-10.35	Idat Galih Permana, Despal, A Rosmalia, M D Rahayu
	In Vitro Evaluation of Dairy Ration Based on Rumen Degradable Protein and Undegradable Protein Ratio with Leucaena Addition
10.35-10.45	Agustin Nazillatun Nikmah, Nahrowi, I Komang Gede Wiryawan, Anuraga Jayanegara
	Optimization of Isoamylase Addition in Cassava Root Meal as an Alternative of Corn



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10.45-10.55	Azib Ernawati, Luki Abdullah, Idat Galih Permana
	Ruminal Macro Mineral Solubility of Indigofera zollingeriana Top-Leaves from Plants with Different Density Using In Vitro Technique
10.55-11.15	Discussion



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ROOM C (Animal Nutrition, Forage and Feed Technology) Moderator : Dr. Wulansih Astuti SPt., MSi	
09.00-09.10	Fajrin Sidiq, Amir E Ghane, Muhammad Ridla, Widya Hermana
	Supplementation of phytase and its combination with xylanase, amylase and protease (XAP) on performance andb one mineralization of broiler chicken
09.10-09.20	Djoni Prawira Rahardja, Muhammad Yusuf, V.SriLestari, Kusumandari Indah Prahesti
	Efficacy of In ovo Glutamine and Glucose, and Neonatal Nutrition of Mixed PreProbiotic and Lysine on Hatching, Post-hatching Performance and Intestine Histo-morphometry of Local Chicken
09.20-09.30	Dilla Mareistia Fassah, Nanda Nadhifa Nuraini, Lilis Khotijah, Kokom Komalasari, Sri Suharti, Dewi Apri Astuti, Komang Gede Wiryawan, Asep Sudarman, Didid Diapari
	Utilization of Vinasse-Molasses in the Finishing Ration on Growth Performance of Peranakan Ongole Cattle
09.30-09.40	Aulia Nurul Saputri, Dewi Apri Astuti, Dilla Mareistia Fassah
	Nutrient Digestibility of Late Pregnancy Local Ewes Fed Flushing Ration with Different Frequency (Kecernaan Nutrien Domba Fase Akhir Kebuntingan yang Diberi Ransum Flushing dengan Frekuensi Pemberian yang Berbeda)
09.40-10.00	Discussion
10.00-10.10	Nur Rochmah Kumalasari, Erlangga Satria Mulyadi Putra, Asep Tata Permana
	Correlation Analysis of Environment Factors on Kudzu (Pueraria javanica) Growth and Productivity.
10.10-10.20	Ariyani Tanti, Yuli Retnani, Iman Rahayu H S
	Effect of Supplementation Garlic (Allium sativum) by Various Processing on Performances of Broiler
10.20-10.30	Aam Gunawan, Abd. Malik, Deni Rusmana, Muh. Syarif Djaya, Neni Widaningsih
	Fatty Acid Composition Of Black Soldier Fly Maggot Were Reared In The Mixture Of Laying Hen Manure With Lemuru Fish Oil



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10.30-10.40	Rachmat Somanjaya, Oki Imanudin, Saleh Maulana Turohman, Asnath Maria Fuah, Sri Rahayu, Luki Abdullah, Mohamad Agus Setiadi
	In vitro Gas Production of Sorghum-Indigofera Forage-Based Complete Feed for Ruminants
10.40-10.50	Rita Mutia, Laily Rinda Ardani, Widya Hermana
	Evaluation of Probiotics as an Alternative a Substitute for Antibiotic Growth Promoters (AGP) on Carcass Percentage and Physical Quality of Broiler Meat
10.50-11.15	Discussion



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ROOM D (Animal Management, Production, Logistic and Welfare) Moderator : Dr. Rudi Afnan SPt., MSc	
09.00-09.10	Himmatul Khasanah G Syaikhullah, M Adhyatma
	Comparative Study of Amino Acid and Fatty Acid Profile between Sapudi and Cross Merino Sheep Meat
09.10-09.20	Harini Nurcahya, MIA Faisal, Sri Darwati
	Morfometric of Merawangarab Chicken with Different Genetic Composition at 2 to 12 Weeks Age Growth Phase
09.20-09.30	Harry Dhika, Agus Buono, Shelvie Nidya Neyman, Dewi Apri Astuti
	Entropy Implementation of Ongole Cattle Transportation Data
09.30-09.40	Zasmeli Suhaemi, Febriani, Sabrina, N Yessirita
	Production Potential of the First Generation of Pitalah and Bayang Ducks After Selection As a Community Economic Resource in West Sumatra
09.40-10.00	Discussion
10.00-10.10	Mohammad Ikhsan Shiddieqy, Priyono
	Sheep Production Management System to Harness Genetic Resources: A case in Bangun Karso Farm, Bogor, Indonesia
10.10-10.20	Hearty Salatny, Asnath M Fuah, Cece Sumantri, Sih Kahono, Widiatmaka
	Perception and Economic Prospect of Stingless Bee (Hymenoptera: Apidae: Meliponini) Development in West Halmahera
10.20-10.30	Edit Lesa Aditia, Rudy Priyanto, Luki Abdullah, Panca Dewi MHKS, Wasmen Manalu
	Performance Of Local Beef Cattle During Short Fattening Period After Short Distance Transportation With Sorinfer Feed
10.30-10.40	K Komarudin, T Sartika, N Pratiwi, N Azizah, S Sopiya
	Laying Performance of 6th Generation Selected Gaok Chicken
10.40-11.00	Discussion



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ROOM E (Animal Breeding, Genetic and Environment) Moderator : Dr. Isyana Khaerunisa SPT., MSi	
09.00-09.10	Aulia Evi Susanti, Rudy Priyanto, Muladno, Dewi Apri Astuti, Lucia Cyrilla Eko Nugrohowati Supriyadi Dekrityana
	Potential and Productivity of Natural Forage in Oil Palm Plantations in Musi Banyuasin Regency, South Sumatra Province
09.10-09.20	Jajam Haerul Jaman, Agus Bueno, Dewi Apri Astuti, Sony Hartono Wijaya, Burhanuddin
	Classification Of Large Ruminant Cattle Carrier Drivers With Naïve Bayes Algorithm
09.20-09.30	Adefia Fahira, Ronny Rachman Noor, Jakaria
	PLAG1 Gene Polymorphism of SNP c.795A>G in Bali, PO, and Madura Cattle Breeds Using PCR-RFLP Technique
09.30-09.40	Asep Gunawan, Kasita Listyarini, Ratna Sholatia Harahap, Katrin Roosita, Cece Sumantri
	Identification of TP53INP1 Gene and Its Association with Mineral Content in Sheep
09.40-10.00	Discussion
10.00-10.10	Ananda Putri, Nahrowi, Luki Abdullah
	Potential Availability of Forage in Oil Palm Plantations in West Pasaman Regency
10.10-10.20	Rohmad Setiaji, Muhammad Rohadi, Nuzul Widias, Sigit Prastowo
	The influence of non-genetic factors on Bali Cattle (<i>Bos javanicus</i>) growth traits
10.20-10.30	Retno Widyani, Mus Nilamcaya
	The Benefits Of Indonesian Spices For Livestock Health As A Legacy Of Our Ancestors' Local Wisdom
10.30-10.40	Burhanuddin Masy'ud, Lin Nuriah Ginoga, Mariana Takandjandji, Sutopo
	The effectiveness of aphrodisiac plants to stimulate sexual behavior of Timor deer in captivity: A case study of sanrego, pasak bumi, and tabat barito
10.40-11.00	Discussion



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