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Effect of Sardine Oil and Tomato Powder with or without Addition of Clove Oil on Laying Duck Performances and Digestibility of Nutrients

E. Widodo, M.H. Natsir, I.H. Djunaidi , R. Pitono

Abstract: ***The use of sardine oil to replace soybean oil has been reported to increase omega-3 in egg, but the disadvantages for breeder are of smaller hatching egg weight and production of smaller progeny. This could be overcome by the use of antioxidant to protect the oil from oxidation. Tomato powder is one of a good antioxidant source. While clove oil is reported to exert antimicrobial factor which might be able to alter digestibility and or absorption of nutrients leading to improve egg production. Current research was carried out to evaluate effect of different types and levels of additive on laying duck performances and nutrient total tract digestibility. In the first experiment, ninety six female ducks were used, they were offered 160 g feed per day and water was provided ad libitum. The dietary treatments consisted of P0 : basal feed containing 2% soybean oil, P1: basal feed of which 1% of soybean oil was replaced with 1% sardine oil, P2: basal feed of which 1% of soybean oil was replaced with 1% sardine oil and added with 1% tomato powder and P3 : basal feed of which 1% soybean oil was replaced with 1% sardine oil and added with both 1% tomato powder and 100 ppm clove oil. Next, in the second experiment, 30 ducks were used to measure digestibility of duck feed added with similar additives to the first experiment. The dietary treatment consisted of P0: basal feed without antibiotics, P1 basal feed of which 1% soybean oil was replaced with 1% fish oil+1% tomato powder, and P2 basal feed of which 1% soybean oil was replaced with 1% fish oil+1% tomato powder + 200 ppm clove oil. Data were statistically analyzed for one way analysis of variance, different among treatments was tested by Duncan Multiple Range Test. The result of first experiment showed that highly significant improvements were reported for HDP and IOFC (P<0.01) and significantly improved (P<0.05) FCR. However, in the second experiment the treatments did not significantly influence essential amino acid digestibilities. It is concluded that improvement of laying performances of duck was due to the use of natural feed additive comprising of fish oil, tomato powder and clove oil, but the improvement was not attributed from digestibilities of nutrients.***

Keywords - natural additive, laying performances, digestibility, duck

I. INTRODUCTION

Fish oil is considered as one of omega-3 rich oil which can be used to make either a poultry functional egg or meat. Enrichment of egg rich in omega-3 has been successfully reported, particularly research involving the use of flaxseed. In broilers, it has been reported that supplementation of flaxseed and menhaden oil for 7 days before slaughter enhanced omega-3 fatty acid in meat (Gonzales-Esquerra and Leeson (2000). Scheideler and Froning (1996) reported that increasing flaxseed supplementation resulted an increase in omega-3 content in chicken egg. In contrast to previous experiment reported by Pappas et al., (2005) who reported egg and DOC weights decreased due to substitution of soybean oil with fish oil in broiler breeder, Andri et al., (2018) reported that substitution of soybean oil with sardine oil supplemented with tomato powder did not impair duck production performances, including egg weight. Burt and Reinders (2003) and Dorman and Deans (2000) reported that clove essential oil inhibited growth of *Escherichia coli*. Aware of banning in antibiotic growth promoter used, the antibiotic replacer is needed. Mukhtar (2011) reported that clove oil could act as effective as antibiotic when implemented in broiler feed. This research was intended to examine effect of sardine fish oil with or without addition of tomato powder when either supplemented with or without clove oil on digestibilities of amino acid and performances of Mojosari ducks.

II. MATERIAL AND METHOD

Experiment 1.

Ninety six female Mojosari ducks were used and allotted to 20 units of experiment. They were fed in accordance with designated treatment. The dietary treatments consisted of P0: basal feed containing 2% soybean oil, P1: basal feed of which 1% of soybean oil was replaced with 1% sardine oil, P2: basal feed of which 1% of soybean oil was replaced with 1% sardine oil and added with 1% tomato powder and P3 : basal feed of which 1% soybean oil was replaced with 1% sardine oil and added with both 1% tomato powder and 100 ppm clove oil. Everyday feed allowance was 160 g/duck and water was provided *ad libitum*. Basal feed was as shown in Table 1. Experiment was conducted for 6 weeks.

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***** Correspondence Author (s)
E. Widodo, Department of Animal Nutrition, University of Brawijaya, Indonesia 65145. (E-mail: eko.widodo@ub.ac.id)
M.H. Natsir, Department of Animal Nutrition, University of Brawijaya, Indonesia 65145.
I.H. Djunaidi, Department of Animal Nutrition, University of Brawijaya, Indonesia 65145.
R. Pitono, Department of Animal Nutrition, University of Brawijaya, Indonesia 65145.

The variables measured included feed consumption, Hen day Production (HDP), Feed Conversion Ratio (FCR) and Income Over Feed Cost (IOFC). IOFC was calculated as the different of income from selling egg produced with cost of feed (IDR/bird/day). Costs of per kg feed were IDR 5,200, IDR 5,100, IDR 5,200 and IDR 5,240 for P0, P1, P2 and P3, respectively. In Addition, the price of 1 egg (duck egg usually is not sold per 1 kg) was IDR 2,000. At the time of experiment 1US $ = IDR 14,800.

Table 1. Composition of basal feed and its nutritional contents

Feed Ingredient	Proportion (%)
Yellow corn	47.50
Soybean meal	19.50
Rice bran	14.20
Meat bone meal	8.00
Limestone	4.80
DL-methionine	0.20
L-Lysine	0.20
Soybean oil	2.00
Salt	0.10
Vitamin Mix[1)]	0.50
Mineral Mix[2)]	3.00
Nutritional contents[3)]	
Metabolizable Energy, Kcal/kg	2,865
Crude Protein, %	19.36
Crude Fat, %	6.95
Crude Fiber, %	4.09
Calcium, %	3.24
Phosphor, %	0.92
Lysine, %	1.03
Methionine, %	0.53

Note:

1) Vitamin Mix per kg contains Vit A 12,000 IU, Vit D3 2,000 IU, Vit E 8 IU, Vit K3 2 mg, Vit B1 2 mg, Vit B2 5 mg, Vit B6 0.5 mg, Vit B12 0.012 mg and Vit C 25 mg
2) Mineral Mix per kg contains Ca D-Panthotenate 6 mg, Niacin 40 mg, Choline Chloride 10 mg, Methionine 30 mg, Lysine 30 mg, Mangan 120mg, Ferrum 20 mg, Iodium 0,2 mg, Zinc 100 mg, Cobalt 0.2 mg and Xanthoquinone 10 mg Zinc Bacitracin 2 mg

Experiment 2.

The second experiment, 12 4-months old ducks were used to measure digestibility of duck feed added with similar additives to the first experiment. Every female Mojosari duck was kept in an individual battery cage. The duck was in the preliminary period for 5 days, fed the basal diet (as shown in Table 1) of 160g/duck/day and water was provided *ad libitum*. In the next 4 days, each group of 3 ducks were subjected to be given dietary treatment as followed: P0: basal feed containing 2% soybean oil, P1 basal feed of which 1% soybean oil was replaced with 1% fish oil+1% tomato powder, and P2 basal feed of which 1% soybean oil was replaced with 1% fish oil+1% tomato powder + 200 ppm clove oil. During this period, the daily excreta voided by each duck was collected, dried in the oven for 2 days and ground. Each excreta sample was then subjected to analysis of particularly dry matter, crude protein and amino acid contents.

Statistical analysis

Data obtained from experiment 1 and 2 were statistically analyzed for one way analysis of variance, different among treatments was further tested by Duncan Multiple Range Test.

III. RESULT AND DISCUSSION

Experiment 1.

The results of experiment 1 were summarized in Table 2.

Table 2. Effect of 6 weeks treatment on performances of Mojosari duck

Treatment	Feed consumed (g/bird/day)	Hen Day Production (HDP) (%)	Feed Conversion Rasio (FCR)	IOFC (IDR/bird/day)
P0	154.12 ± 2.51	57.56 ± 4.09^{A}	5.12 ± 0.93^{b}	362.05 ± 87.79^{A}
P1	155.52 ± 3.29	62.70 ± 4.91^{A}	4.58 ± 0.49^{b}	460.67 ± 110.51^{A}
P2	153.48 ± 1.61	59.03 ± 1.81^{A}	4.42 ± 0.29^{b}	398.51 ± 52.37^{A}
P3	153.36 ± 3.65	75.32 ± 6.41^{B}	3.50 ± 0.49^{a}	691.42 ± 132.69^{B}

Note:
A-B different superscript in the same column indicated high significantly (P<0.01) different effect
a-b different superscript in the same column indicated significantly (P<0.05) different effect

The results showed that since feed allowance was restricted to 160 g/duck/day, the statistical analysis indicated no significant different in feed consumption. In addition, HDP and IOFC significantly increased (P<0.01) and the best treatment obtained for P3. Significant FCR improvement (P<0.05) was also reported in this experiment, with the best FCR was obtained for P3. The results indicated that the combination of fish oil, tomato powder and clove oil enhanced duck performances. As compared with previous results reported by Andri et al., (2018) who reported no performance changes, current results found a better results. This was due to addition of clove oil which significantly improved HDP, FCR and IOFC. Essential oil in the clove oil or powder could replace the use of antibiotic without influencing productivity of broiler (Mukhtar, 2011) (Dalkiliç and Güler, 2009) or layer chicken (Gandomani et al., 2014) (Arpášová, Gálik, Fik and Pistová, 2017). Consequently, the laying performance and FCR in the research of Gandomani et al., (2014) was due to synergism between the sardine fish oil and clove essential oils.

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They also mentioned that mechanism of improvements were caused by development of intestinal microstructure leading to increase in absorptive area and immune status. Such changes might consequently improve both nutrient digestibility and absorption.

Experiment 2.

The results of experiment 2 were summarized in Table 3.

Table 3. Effect of treatment on nutrient digestibility values

Digestibility value	P0	P1	P2
Dry matter (%)	79.47±2.66	78.29±2.64	75.53±3.22
Crude Protein (%)	78.23±2.89	75.64±3.84	79.47±2.66
Methionine (%)	85.38±0.49	82.02±5.24	85.35±1.08
Lysine (%)	79.06±1.80	76.09±2.31	76.25±1.31
Cystine (%)	78.27±2.76	77.61±2.56	75.98±4.53
Histidine (%)	82.04±1.00	80.39±3.80	80.84±2.14
Threonine (%)	75.04±1.12	74.872.20	71.63±3.04
Valine (%)	76.99±1.28	75.56±2.26	74.36±1.91
Luecine (%)	79.50±0.88	77.20±2.01	76.48±1.60
Alanine (%)	76.99±1.28	75.56±2.26	74.36±1.91

On the basis of nutrient digestibilities, it was reported that the treatments were not significantly affected (P>0.05) digestibilities of dry matter, protein and all observed essential amino acids. This finding indicated that the mechanism of increasing duck laying performance might be not from increasing digestibility of nutrient. In contrast, Dalkiliç and Güler (2009) reported that broiler given only at 400 ppm of clove oil resulted a significantly better dry matter, crude protein and crude fat digestibilities. Brenes and Roura (2010) said that the different results might be due to composition of basal feed, level of feed intake, hygienic standard and environmental temperature. So, duck laying performance increase in this experiment might be explained by improvement of absorption of nutrient, immune status and decrease pathogenic microbial population as mentioned by Gondomani, et al, (2014), and it needs further works.

IV. CONCLUSION

From the results of 2 experiments, it then was concluded that the use of combination of natural feed additive, particularly combination of 1% fish oil, 1% tomato powder and 100 ppm clove oil, improves of laying performances of duck, but the improvement was not attributed from digestibilities of nutrients. It was then suggested to elaborate research on the aspect of intestinal development, immunology and microbial balance in the intestine.

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