Effect of Several AGP Replacers on Digestibilities of Amino Acid in Mojosari Duck

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Abstract. An attempt was made to search effect of several AGP replacers on digestibilities amino acid determined by using Acid Insoluble Ash Method in Mojosari ducks. This research used 40 ducks, raised at individual cage to facilitate 9 treatments and 4 replications. The treatments consisted of P1: basal feed + antibiotic ; P2: basal feed + 1% sardine oil + 0.5% tomato powder ; P3: basal feed + 2% sardine oil + 0.5% tomato powder ; P4: basal feed + 1% sardine oil + 1% tomato powder ; P5: basal feed + 2% sardine oil + 1% tomato powder ; P6: basal feed + 1% sardine oil + 0.5% tomato powder + 200 ppm clove oil ; P7: basal feed + 2% sardine oil + 0.5% tomato powder + 200 ppm clove oil ; P8: basal feed + 1% sardine oil + 1% tomato powder + 200 ppm clove oil ; P9: basal feed + 2% sardine oil + 1% tomato powder + 400 ppm clove oil. Digestibility coefficient was measured by Acid Insoluble Ash method. Data were analyzed by ANOVA, and the differences was tested by DMRT. The results showed that feed consumption and digestibilities of dry matter and crude protein were not significant, therefore, digestibility of several amino acids were highly significant (P<0.01), particularly for threonine, arginine, phenylalanine and tyrosine. It could be concluded that the use of sardine oil (2%) supplemented with 1% tomato powder and 400 ppm clove oil showed the best replacer of AGP.

1. Introduction

Soybean oil or fat product is often included in poultry diet to fulfil the energy requirement in feed, in particular broiler feed. Broiler needs higher energy content in feed as compared to other poultry to support rapid growth. Moreover, efforts have been done on the use of certain oil to not only enhanced egg production but also increased the omega-3 content in poultry egg. Previous research indicated that the use of omega-3 in sardine oil in poultry feed positively correlated with omega-3 content in egg. This would play an important role in society because make it possible to be used as functional food. Replacement of soybean oil with sardine oil has already been carried out in layer duck and increased egg omega-3. However, previous authors [1] and [2] reported that there was a decrease in egg production and egg weight in chicken fed feed containing plant oil was replaced by fish oil. On the other hand, it was reported that substitution of soybean oil with fish oil did not significantly affected egg weight and DOC weight in broiler breeder [3]. In case of flaxseed supplementation, it increased omega-3 in chicken egg [4]. Research in local chicken indicated that substitution of soybean oil with sardine oil added with tomato powder did not significantly influence egg production, including egg weight [5]. In other report, it was reported by that the use of clove oil could replace antibiotic used without affecting broiler performance [6]. This research was attempt to evaluate the effect of soybean oil with sardine oil supplemented with tomato powder and different levels of clove oil on amino acid digestibility in Mojosari duck.
2. Method of research

2.1. Location
This digestibility assay was carried out in David Duck Farm, Slorok Village Blitar Regency. Chemical analysis on dry matter and crude protein were carried out in the Laboratory of Nutrition and Feed Sciences, University of Brawijaya, while analysis of amino acids was done by sending sample to Laboratory of Analysis of PT Saraswati Indo Genetech, Bogor.

2.2. Materials
Materials used were 36 laying Mojosari duck of 5 months old, because of not able to produced egg yet. They were randomly allotted to 36 individual cages. Feed was provided restrictedly on 160 g/bird/day and given twice (morning and afternoon, at the same proportion), while water was provided \textit{ad libitum}. Each cage was equipped with feeding and water through, and a tray to collect excreta. Basal feed made from several ingredients as showed in Table 1.

Other materials used consisted of sardine oil, tomato powder and clove oil which were bought from Muncar Banyuwangi, Balai Materia Medika, Kota Batu and Sari Kimia Malang, respectively.

2.3. Method
Method of research was field experiment based on Completely Randomized Design having 9 treatments and 4 replications, 1 bird per replication. The treatments were as follow:

- P1: Basal feed + antibiotic (positive control)
- P2: Basal feed + 1% sardine oil + 0.5% tomato powder

### Table 1. Ingredient and chemical composition of basal feed

| Ingredient                | Proportion (%) |
|---------------------------|----------------|
| Yellow corn               | 47.50          |
| Soybean meal              | 19.50          |
| Rice polishing            | 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           |

| Nutrient contents\(^3\)   |                |
|---------------------------|----------------|
| Metabolizable Energy, Kcal/kg | 2.865         |
| Crude Protein, %          | 19.36          |
| Crude Fat, %              | 6.95           |
| Crude Fibre, %            | 4.09           |
| Calcium, %                | 3.24           |
| Phosphorus, %             | 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-Pantothenic 6 mg, Niacin 40 mg, Choline Chloride 10 mg, Methionine 30 mg, Lysine 30 mg, Manganese 120mg, Ferrum 20 mg, Iodine 0.2 mg, Zink 100 mg, Cobalt 0.2 mg, Santhoquinone 10 mg and Zink Bacitracin 21 mg.
\(^3\) Calculation based on Table provided by [7]
P3: Basal feed + 2% sardine oil + 0.5% tomato powder
P4: Basal feed + 1% sardine oil + 1% tomato powder
P5: Basal feed + 2% sardine oil + 1% tomato powder
P6: Basal feed + 1% sardine oil + 0.5% tomato powder + 200 ppm clove oil
P7: Basal feed + 2% sardine oil + 0.5% tomato powder + 200 ppm clove oil
P8: Basal feed + 1% sardine oil + 1% tomato powder + 400 ppm clove oil
P9: Basal feed + 2% sardine oil + 1% tomato powder + 400 ppm clove oil

Adaptation period was for 4 days, while collection excreta period was for 3 consecutive days. Collected excreta was then dried, ground and sent to different laboratories for analysis.

2.4. Variables measured
Determination of digestibility of amino acid was done following the modification method developed by Sundu et al. [8].

2.5. Data analysis
Data were analyzed by Analysis of Variance (ANOVA) of Completely Randomized Design, if significant effect obtained then it was continued by Duncan Multiple Range Test.

3. Result and discussion
It is reported that from the current research the use of several combination of natural AGP did not affect essential amino acid digestibilities in laying duck, except for methionine and histidine as showed in Table 2 and 3.

| Treatment | Digestibility coefficient (%) |
|-----------|------------------------------|
|           | Methionine | Lysine | Isoluecine | Histidine | Threonine |
| P1        | 80.84 ± 3.36ab | 74.06 ± 5.34 | 62.04 ± 8.57 | 73.28 ± 5.13ab | 68.27 ± 4.00 |
| P2        | 85.79 ± 5.50b | 72.72 ± 8.43 | 66.62 ± 2.56 | 84.85 ± 4.39b | 54.16 ± 13.79 |
| P3        | 84.69 ± 4.31b | 81.82 ± 2.13 | 71.18 ± 4.95 | 88.82 ± 2.92bc | 66.86 ± 7.71 |
| P4        | 85.96 ± 5.28b | 79.39 ± 8.04 | 71.64 ± 11.66 | 88.35 ± 2.07bc | 68.73 ± 12.52 |
| P5        | 92.68 ± 4.76c | 85.57 ± 9.44 | 76.36 ± 15.82 | 91.17 ± 5.88c | 73.15 ± 17.48 |
| P6        | 92.83 ± 4.75c | 84.92 ± 6.44 | 75.23 ± 12.84 | 90.63 ± 5.94c | 71.12 ± 16.19 |
| P7        | 78.89 ± 3.07a | 71.32 ± 7.65 | 60.13 ± 16.13 | 77.16 ± 3.88a | 59.69 ± 3.09 |
| P8        | 79.95 ± 5.64ab | 73.04 ± 2.96 | 62.22 ± 10.10 | 77.37 ± 3.20a | 66.09 ± 3.97 |
| P9        | 88.34 ± 5.96bc | 81.93 ± 2.55 | 71.00 ± 7.74 | 91.29 ± 3.03c | 72.92 ± 8.01 |

Note: NS: not significant

Digestibility values of both methionine and histidine are highly significant and suggest that treatments of P5 (treatment of using basal feed + 2% sardine oil + 1% tomato powder) and P6 (treatment of using basal feed + 1% sardine oil + 0.5% tomato powder + 200 ppm clove oil) might be recommended as antibiotic replacer considering the results on amino acid digestibility in Mojossari duck. Digestibilities of methionine and histidine in this experiment are of particularly high, the reason remains unknown. However, similar result from previous research [9] reported that digestibility of methionine for SBM in broiler is also high (92%) and digestibility of histidine was not determined.
Table 3. Effect of treatments on digestibility of essential amino acid determined by acid insoluble ash method (continuation)

| Treatment | Arginine (Digestibility coefficient, %) | Phenylalanine (Digestibility coefficient, %) | Valine (Digestibility coefficient, %) | Alanine (Digestibility coefficient, %) |
|-----------|----------------------------------------|---------------------------------------------|---------------------------------------|----------------------------------------|
| P1        | 63.27 ± 1.41                           | 60.28 ± 0.80                               | 60.51 ± 2.06                          | 59.65 ± 3.47                           |
| P2        | 52.85 ± 19.68                          | 58.84 ± 11.20                              | 62.45 ± 5.41                          | 58.35 ± 5.52                           |
| P3        | 68.46 ± 7.48                           | 66.73 ± 10.48                              | 62.45 ± 5.41                          | 58.35 ± 5.52                           |
| P4        | 68.65 ± 5.25                           | 69.87 ± 8.51                               | 64.20 ± 13.95                         | 60.21 ± 15.79                          |
| P5        | 76.57 ± 16.08                          | 74.68 ± 15.53                              | 71.52 ± 18.75                         | 69.03 ± 20.48                          |
| P6        | 75.33 ± 15.03                          | 70.50 ± 20.45                              | 69.96 ± 15.94                         | 67.51 ± 16.54                          |
| P7        | 57.06 ± 3.83                           | 56.40 ± 0.91                               | 57.80 ± 10.17                         | 57.70 ± 10.66                          |
| P8        | 55.72 ± 11.30                          | 54.35 ± 3.64                               | 59.69 ± 8.90                          | 55.48 ± 9.17                           |
| P9        | 74.03 ± 6.10                           | 75.04 ± 8.44                               | 67.06 ± 8.40                          | 63.05 ± 7.23                           |

Note: NS: not significant

Table 4. Effect of treatments on digestibility of non-essential amino acid determined by Acid Insoluble Ash Method

| Treatment | Cystine (Digestibility coefficient, %) | Proline (Digestibility coefficient, %) | Tyrosine (Digestibility coefficient, %) | Leusine (Digestibility coefficient, %) | Glycine (Digestibility coefficient, %) |
|-----------|----------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|
| P1        | 59.65 ± 12.73ab                        | 60.00 ± 2.34                           | 58.04 ± 7.12ab                         | 68.79 ± 3.94                          | 57.43 ± 8.20                           |
| P2        | 77.49 ± 11.14b                         | 57.96 ± 5.02                           | 71.89 ± 6.46                           | 51.98 ± 16.63                         | 52.20 ± 13.19                          |
| P3        | 83.99 ± 7.33bc                         | 63.66 ± 3.55                           | 80.35 ± 6.38                          | 49.39 ± 8.10                          | 50.59 ± 9.89                           |
| P4        | 88.31 ± 4.06c                         | 62.89 ± 13.81                          | 80.13 ± 6.32b                          | 45.59 ± 17.61                         | 53.20 ± 15.49                          |
| P5        | 91.73 ± 5.40c                         | 73.89 ± 15.86                          | 83.88 ± 9.78                           | 57.91 ± 28.41                         | 62.97 ± 23.83                          |
| P6        | 89.12 ± 8.29c                         | 69.82 ± 18.02                          | 82.07 ± 13.31b                         | 55.70 ± 23.22                         | 58.71 ± 23.38                          |
| P7        | 78.39 ± 9.63bc                         | 60.42 ± 2.77                           | 57.28 ± 6.88a                          | 57.79 ± 15.44                         | 51.72 ± 6.20                           |
| P8        | 67.38 ± 3.93a                         | 56.41 ± 8.35                           | 64.41 ± 12.08ab                        | 57.58 ± 25.58                         | 51.71 ± 23.44                          |
| P9        | 88.85 ± 3.92c                         | 67.62 ± 6.54                           | 83.22 ± 3.99b                         | 55.17 ± 12.52                         | 56.91 ± 11.37                          |

Note: NS: not significant

On the basis of non-essential amino acid, significantly better result was obtained for cysteine in P5 and P6. However, significantly lower result was reported for digestibility of tyrosine in P7. In the previous report [10] indicated no significant amino acid digestibilities were found if replacement of soybean oil with sardine oil, both added with tomato powder and with and without supplementation with clove oil. Another research done by [11] showed that thymol dan cinnamaldehide 50 ppm as well as 100 CRINA did not significantly influence ileal digestibilities of starch and crude protein, though amylase secretion was increased.

This current result might suggest that the use of sardine oil, tomato powder and clove oil might influence replace the use of antibiotic in feed and even improve digestibilities of some amino acids. Such an effect might improve productivity of Mojosari duck. Research from Jamroz et al., [12] showed that supplementation of plant extract as antibiotic replacer could improve digestibilities of lysine, methionine, asparagine, threonine, serine, glutamic acid, proline, phenylalanine, arginine and tryptophan. Bozkurt et al., [13] reported that egg production improved when layer chicken was fed feed containing blended essential oil combined with mannanoligosaccharide.

4. Conclusion

It was concluded that the use of sardine oil 2%, tomato powder 1% and combined with clove oil 400 ppm is the best non AGP additive to replace antibiotic and enable to improve some amino acid digestibilities.
Acknowledgement
The authors would like to acknowledge Ministry of Research, Technology and Higher Education for providing financial support through Basic Research Grant 2018.

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