The effect of various vegetable oils in diets on the percentage of internal organ weights in local male ducks

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Abstract. This study aims to determine the effect of vegetable oils varieties in diets on the percentage of internal organ weights in 9 weeks old local male ducks. It was conducted using a completely randomized design (CRD) in a unidirectional pattern with 4 treatments and 6 replications, consisting of 6 ducks each. The treatments used include; P1: (96% basal ration + 4% palm oil); P2: (96% basal ration + 4% canola oil); P3: (96% basal ration + 4% coconut oil) and P4: (96% basal ration + 4% soybean oil). Furthermore, the data were analyzed using the one way analysis of variance (ANOVA) while the, Duncan's multiple range test (DMRT) was used to examine significant differences among treatments. The results showed that the percentage of intestinal weights indicated significant results (P<0.05), while the percentage of heart weights, gizzard weight, intestine length, and percentage of caecum weight were not significant (P>0.05). Based on the results, the addition of vegetable oils up to level 4% in the ration affect the percentage of intestinal weight. However, it had no effect on the percentage of internal organ weight and intestinal length.

1. Introduction

Duck meat is very popular and in great demand in many parts of the world. Compared to chicken, duck meat is distinctively characterized as a red meat [1]. Furthermore, the nutritional content of duck meat includes 20.04% protein, 8.2% fat, 1.2% ash and energy value of 15,900 kcal/kg. Meanwhile, the national consumption per capita per year in Indonesian is still low at 0.052 kg, compared to native chicken meat at 0.78 kg/year [2]. Chickens and ducks require high-energy foods to increase body weight and metabolic processes. In addition, about 2 to 5% oil is recommended in broiler diets for optimal growth performance [3] [4].

Lipids (fats and additionally oils) are frequently included to increase energy levels of poultry diets. Previous studies reported that dietary lipid quality is altered using distinctive lipid sources such as, soybean and palm oil, grease, as well as fat [5] [6]. This is because the estimates of vegetable oil are superior to animal fats [7]. Moreover, oils have generally been utilized as vitality sources in poultry's feed regimens. This resulted into a reduction in sustenance dust, increased ingestion and assimilation of
lipoproteins, significant amount of basic unsaturated fats, and the lowers heat generated by starches and proteins [8].

Various distinctive oils are available for poultry from vegetable sources. Normal oil sources in grill sustenance include sunflower, canola, and soybean oil [9]. Most vegetable oils are good sources of linoleic acid, but only few contain significant amounts of α-linolenic acid. Among others, perilla oil has the highest α-linolenic acid (omega-3) content, with a LDL component of 50% cholesterol and 25% protein while HDL consist of 20% cholesterol and 50% protein [10]. Vegetables oil acts as an energy source, meanwhile, in excess amount, it is converted into body fat, in form of fat deposits which increases heat conductivity in muscles and accelerates glycolysis process [11]. Therefore, there is need to examine the effect of various vegetable oils in the diets, on the percentage of internal organ weights.

2. Materials and methods

2.1. Research materials

The ducks were divided into 4 treatment groups, with 6 replicates consisting of 6 ducks each. The feeding treatments were as follows:
P1: 96% basal ration with 4% palm oil;
P2: 96% basal ration with 4% canola oil;
P3: 96% basal ration with 4% coconut oil and,
P4: 96% basal ration with 4% soybean oil.
The experiments were conducted for 9 weeks

2.2. Research methods

The study feed was manually formulated and then mixed until it became homogeneous. Meanwhile, the diets consisted of yellow corn, pollard, rice polish, soy bean meal, premix, NaCl, limestone, and vegetable oils. The basal diets contained 19-20% crude protein and energy between 3200-3300 kcal/kg. Feedstuffs composition and nutrient content of treatment diets are presented in Table 1.

2.3. Non-carcass collection

Data collection on slaughter and carcass weight were carried out when the ducks were nine weeks old, meanwhile, prior to slaughtering, two ducks were fasted for twelve hours. Thereafter, the ducks were slaughtered by cutting the carotid artery, jugular vein, trachea, and esophagus. Non carcass weight was obtained by weighing the life weight which is usually reduced by the total weight of the head, neck, blood, hair, skin, legs as well as internal organs (viscera) [12].

2.4. Percentage of internal organ weights

2.4.1. Percentage of Heart Weight (gram/head)
The heart weight percentage was obtained by dividing a weighed portion of the heart in grams, by the slaughter weight multiplied by 100%.

2.4.2. Percentage of Heart Weight (gram/head)
The liver weight percentage was obtained by dividing a weighed portion of the liver in grams by the slaughter weight multiplied by 100%.

2.4.3. Percentage of Weight and Length of Intestine

Intestinal weight was obtained by weighing the intestinal portion in grams and measuring its length and diameter in centimeters. Meanwhile, the percentage of intestinal weight was obtained by dividing the intestinal weight by the slaughter weight multiplied by 100%.
2.4.4. Percentage of Gizzard Weight (%)

The gizzard weight percentage was obtained by dividing a weighed portion of the gizzard in grams by the slaughter weight multiplied by 100%.

2.4.5. Percentage of Cecum Weight (gram/head)

Poultry possess a pair of cecum or appendix which are located at the junction between the small intestine and the large intestine. The cecum weight was obtained by weighing its pair in grams. Meanwhile, the percentage of cecum weight was obtained by dividing the weight of the cecum by the slaughter weight multiplied by 100%.

Table 1. Feedstuffs composition (on dry matter basis) and nutrient content of experimental diets

| Ingredients | T1 (Palm oil) | T2 (Canola oil) | T3 (Coconut oil) | T4 (Soybean oil) |
|-------------|---------------|-----------------|------------------|------------------|
| Basal diet (96%) | 37 | 37 | 36.75 | 37.50 |
| Yellow corn (%) | 37 | 37 | 36.75 | 37.50 |
| Pollard (%) | 10.25 | 10.25 | 11.25 | 9.75 |
| Rich polish (%) | 24.5 | 23.25 | 23.75 | 23.50 |
| Soy Bean Meal (%) | 21.5 | 22.75 | 21.50 | 22.50 |
| Premix (%) | 2.35 | 2.35 | 2.35 | 2.35 |
| Limestone (%) | 0.30 | 0.30 | 0.30 | 0.30 |
| NaCl (%) | 0.10 | 0.10 | 0.10 | 0.10 |
| Vegetables Oils (4%) | | | | |
| Palm oil (%) | 4 | 0 | 0 | 0 |
| Canola oil (%) | 0 | 4 | 0 | 0 |
| Coconut oil (%) | 0 | 0 | 4 | 0 |
| Soybean oil (%) | 0 | 0 | 0 | 4 |
| Total (%) | 100 | 100 | 100 | 100 |
| ME, kcal/kg | 3258.97 | 3262.89 | 3241.44 | 3266.61 |
| Crude protein, % | 19.64 | 20.14 | 19.71 | 19.99 |
| Crude fiber, % | 6.09 | 6.02 | 6.11 | 6.00 |
| Extract ether, % | 5.64 | 5.56 | 5.61 | 5.56 |
| Ca, % | 0.97 | 0.98 | 0.98 | 0.98 |
| P av, % | 0.71 | 0.71 | 0.71 | 0.71 |

2.5. Data analysis

This study was conducted using a one-way randomized design. In addition, the data were analyzed using analysis of variance (ANOVA) while differences between treatment means were further analyzed using Duncan’s New Multiple Range Test (DMRT) with significance level of P<0.05.

3. Results and Discussion

The results on the percentage of organ weight in form of heart weight, gizzard, liver, intestines, caecum and intestinal length in 9 weeks old local male ducks with the addition of different vegetable oils in the ration are presented in Table 2.
### Table 2. Percentage of organ weight in local male ducks aged 9 weeks

| Variable                  | Treatment | P1       | P2       | P3       | P4       | P Value |
|---------------------------|-----------|----------|----------|----------|----------|---------|
| Percentage of heart weight (%) |           | 0.79±0.07 | 0.78±0.03 | 0.80±0.04 | 0.79±0.04 | 0.941   |
| Percentage of gizzard weight (%) |           | 4.23±0.47 | 4.96±0.47 | 4.43±0.56 | 4.59±0.20 | 0.062   |
| Percentage of liver weight (%) |           | 2.00±0.18 | 2.15±0.26 | 2.17±0.29 | 2.13±0.18 | 0.576   |
| Percentage of intestinal weight (%) |           | 3.36±0.35<sup>a,b</sup> | 2.92±0.17<sup>a</sup> | 3.20±0.54<sup>a,b</sup> | 3.79±0.73<sup>b</sup> | 0.046   |
| Intestinal length (cm)     |           | 163.5±13.91 | 167.25±2.54 | 164.5±7.07 | 164.17±5.82 | 0.874   |
| Percentage of caecum weight (%) |           | 0.46±0.15 | 0.46±0.08 | 0.45±0.11 | 0.47±0.07 | 0.984   |

<sup>a,b</sup> Different superscripts in the same row show significant differences (P<0.05)

P1: 96% basal ration + 4% palm oil; P2: 96% basal ration + 4% canola oil; P3: 96% basal ration + 4% coconut oil and P4: 96% basal ration + 4% soybean oil

#### 3.1. Percentage of heart weight

The poultry's heart consists of 4 chambers, namely 2 atria and 2 ventricles which pump blood. Meanwhile, the percentage of heart weight obtained in this study is presented in Table 2. The analysis showed that the treatments have no significant effects (P>0.05) on the percentage of heart weight as the four treatments showed no significant differences. These results were almost similar to [13] which stated that the addition of both fresh and oxidized soybean oil to broiler chicken feed had no significant effect on heart weight. This was supported by [14] which noted that the use of complete ration silage with a moisture content of 30%, 40%, 50%, and 60% had no effect on the heart weight (1.12-1.34%) in male abio Mojosari ducks. Similarly, the use of Solid, a byproduct of palm oil processing with a level of 0%, 12.5%, 25%, 37.5% had no significant effect on the percentage of heart weight of broiler chickens [15].

#### 3.2. Percentage of gizzard weight

Gizzard is part of the poultry's digestive organs used to mechanically digest feed. The percentage of gizzard weight obtained in this study is presented in Table 2. Based on the results, the addition of different vegetable oils in the ration had no significant effect (P>0.05) on the percentage of local duck gizzard weight as the four treatments showed no significant differences. These results were almost similar to [13] which reported that the addition of both fresh and oxidized soybean oil in broiler chicken feed had no significant effect on gizzard weight. Similar results were also obtained by [16] which stated that, the addition of crude palm oil (CPO) up to 0, 5, 10, 15, 210% had no significant effect on the percentage of ducks' gizzards. However, a study by [17] showed different results and noted that the use of mulberry leaves in broiler feed tends to affect the percentage of gizzard weight, the addition of 20% fermented mulberry leaves significantly increased the percentage of broiler gizzard weight compared to control. The percentage of local duck gizzard weight is between 4.55% - 5.75% [18]. Meanwhile, it was reported that shape and feed crude fiber were the main factors which affect gizzard weight [19].

#### 3.3. Percentage of liver weight

The liver is an internal organ that functions to secrete bile. Besides, the percentage of liver weight obtained in this study is presented in Table 2. Based on the analysis results, the addition of different vegetable oils to the ration have no significant effect (P>0.05) on the percentage of local duck liver
weight as the four treatments showed no significant differences. These results were different from [13] which reported that the addition of oxidized soybean oil to broiler chicken feed significantly increased liver weight compared to the addition of fresh soybean oil. This was supported by [16] which showed that, the addition of crude palm oil (CPO) at 0, 5, 10, 15, 20% had no significant effect on the percentage of ducks' internal organs (liver). Similarly, the addition of 10% and 20% mulberry leaves (fermented and non-fermented) had no significant effect (P>0.05) on the percentage of liver weight [17]. In addition, the inclusion of dietary Indian rapeseed meal at 0, 5, 10, 15, 20 and 25% had no significant effect on relative organ weight (liver) and percentages of breast and leg muscles of 42 days old ducks [20].

3.4. Percentage of intestinal weight and intestinal length

The percentage of intestinal weight and length, obtained in this study are presented in Table 2. Based on analysis results, the addition of different vegetable oils in the ration had a significant effect (P<0.05) on the percentage of intestinal weight but showed no significant effect on the intestinal length. Furthermore, the percentage of intestinal weight in treatment P1 was not significantly different from treatment P2, P3, and P4, while treatment P2 differed significantly from P4 but not significantly different from P1 and P3. Moreover, treatment P3 was not significantly different from the other three treatments. The highest percentage of intestinal weight was found in treatment P4. Therefore, the addition of different vegetable oils to the ration have no significant effect on the intestinal length of the ducks as the four treatments showed insignificant differences.

These results were almost similar to [17] which noted that the use of 10% and 20% mulberry leaves (fermented and non-fermented) significantly (P<0.05) increased the percentage of small intestine weight (duodenum, jejunum, ileum) compared to controls. Different results were reported by [14] which stated that the use of complete ration silage with a moisture content of 30%, 40%, 50%, and 60% resulted in an average jejunum (5.82-8.26 cm/100 grams), and ileum length (4.83-7.01 cm/100 grams) that were significantly higher (P<0.05) than the control, but had no effect on the duodenal (2.28-3.26 cm/100 grams) and colon length (1.01-1.31 cm/100 gram) of male alabio Mojosari duck. Besides, the poultry digestive system is highly dependent on enzymes, to ensure that the food given is easily absorbed [21]. Rations that contain lots of crude fiber tends to cause a change in the size of the digestive tract, making it become heavier, longer, and thicker [22].

3.5. Percentage of caecum weight

The caecum is part of the digestive tract which functions to digest feed microbiologically. Besides, the percentage of caecum weight obtained in this study is presented in Table 2. Based on the results, the addition of different vegetable oils to the ration have no significant effect (P>0.05) on the percentage of local duck caecum weight as the four treatments showed no significant differences. These results were different from [17] which stated that the use of 10% and 20% mulberry leaves (fermented and non-fermented) had a significant effect (P<0.05), and increased the percentage of caecum weight compared to controls. Furthermore, the use of complete ration silage with water content of 30%, 40%, 50%, and 60% resulted in a significantly higher average caecum length (1.48-1.99 cm/100 grams) (P<0.05) compared to the control [14]. Similarly, the use of high fiber feed in the ration significantly reduced performance, but increased the weight of the gizzard, caecum and small intestine [23].

4. Conclusion

Based on the results, the addition of 4% different vegetable oils in the ration affect the percentage of intestinal weight, but have no effect on the percentage of heart weight, gizzard, liver, caecum and intestinal length of 9 weeks old local male ducks.
Acknowledgements
This research was funded by the research project of Sebelas Maret University (PNBP UNS Nomor: 452/UN27.21/PN/2020).

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