Effect of supplementation of either powdered or encapsulated probiotic on carcass percentage, giblets and small intestinal morphometric of local duck

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Effect of supplementation of either powdered or encapsulated probiotic on carcass percentage, giblets and small intestinal morphometric of local duck

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Abstract. The purpose of this research was to evaluate the effect of supplementation of either powdered or encapsulated probiotic on carcass percentage, giblets and small intestinal morphometric of local duck. One hundred twenty male local day-old ducks (DOD) were distributed to 6 different dietary groups, included 2 probiotic forms of either powdered (T1) or encapsulated (T2) and 3 levels: 0% (L0), 0.2% (L1), 0.4%(L2). They were reared for 42 days (6 weeks). Variables observed were carcass percentage, giblets (gizzard, heart, liver) and small intestinal morphometric (villus height, villus width, crypt depth). Data were analyzed by Nested of Completely Randomized Design ANOVA and if there was significant effect followed by Duncan’s Multiple Range Test (DMRT). The result showed that there was no significant effect (p>0.05) of the form of either powdered or encapsulated probiotic on carcass percentage, giblets weight, and small intestinal morphometric. However, increasing level of probiotic have a significant effect (p<0.05) on carcass percentage, villus height, and villus width, but did not significantly affect giblets weight and crypt depth. It could be concluded that supplementation of either powdered or encapsulated probiotic have similar result. It is suggested to use 0.4% of encapsulated probiotic in local duck diet.

1. Introduction
Dietary synthetic feed additive has been used as an effective means to improve productivity, but it was forbidden by the government regulation Permentan No 14/2017 due to pathogenic contamination and developing resistant populations of bacteria [1]. Moreover, the use of antibiotics causes residual veterinary drugs in an animal product like meat, milk, eggs and among others [2]. Probiotics proposed as an alternative natural growth promoter due to probiotic is non-pathogenic live-microorganism which gives many health benefits to the host. Several studies have shown that the use of probiotics in the feed could improve the performances, population of microflora, white blood cells, cholesterol content [3,4,5]. However, several factors have been reported to affect the viability and stability of probiotics including pH, hydrogen peroxide, oxygen, storage temperature, etc [7]. To provide probiotics have survived through the stomach and reach in the intestine in large amounts, one of the efforts is using entrapment technology of matrix or encapsulation probiotics.

The encapsulation process of the core matrix within the microcapsule wall was expected to protect the probiotic substance. Several studies showed that the use of encapsulated probiotic was able to against pathogenic bacteria, enhance immune function and growth performances [5,7,8]. Furthermore, supplementation of either powdered or encapsulated probiotic are expected to improve performances...
were influenced the morphology of the small intestine in the mucosal layer, namely microvilli and epithelial cells in the absorption of nutrients [9]. According to the explanation above, the purpose of this research was to investigate the effect of either powdered or encapsulated probiotics on carcass percentage, giblets weight, and small intestinal morphometric.

2. Material and Methods
Materials which were used in this research were 120 male local day-old ducks (DOD). Feed that used was showed in Table 1. The encapsulated probiotic was prepared by mixing probiotic and BHT (Butylated Hydroxy Toluene) was added 0.075% Arabic gum and whey in the ratio (4:1) as an encapsulant, dried using a microwave-oven modification at a temperature of 37-40°C and equipped with a blower.

The local ducks were distributed into 2 main treatments, either powdered (T1) and encapsulated probiotic (T2) group. The sub-treatments consisted of 3 levels of probiotic: 0% (L0), 0.2% (L1), 0.4% (L2) with 5 replications and 4 bird each. The treatments were as followed: T1L0: basal feed + 0% powdered probiotic; T1L1: basal feed + 0.2% powdered probiotic; T1L2: basal feed + 0.4% powdered probiotic; T2L0: basal feed + 0% encapsulated probiotic; T2L1: basal feed + 0.2% encapsulated probiotic; T2L2: basal feed + 0.4% encapsulated probiotic.

Table 1. Composition of the basal feed

| Feedstuff            | Amount (%) (0-2 weeks) | Amount (%) (3-7 weeks) |
|-----------------------|------------------------|------------------------|
| Corn                  | 56,00                  | 59,00                  |
| Rice bran             | 13,00                  | 14,00                  |
| Soybean meal          | 18,80                  | 14,80                  |
| Corn Gluten Meal      | 1,10                   | 1,10                   |
| Grit                  | 6,40                   | 6,40                   |
| Salt                  | 0,10                   | 0,10                   |
| DL-methionine         | 0,10                   | 0,10                   |
| Lysine                | 0,10                   | 0,10                   |
| Dicalcium phosphate   | 0,20                   | 0,20                   |
| Premix                | 0,50                   | 0,50                   |
| Palm Oil              | 3,70                   | 3,70                   |
| Total                 | 100                    | 100                    |
| Nutrient Content*     |                        |                        |
| Metabolizable Energy (Kcal/kg) | 3.100 | 3.100 |
| Crude Protein (%)     | 20,60                  | 18,60                  |
| Crude Fat (%)         | 4,95                   | 4,95                   |
| Ca (%)                | 2,01                   | 2,01                   |
| P Available (%)       | 0,40                   | 0,40                   |
| Lysine (%)            | 0,88                   | 0,88                   |
| Methionine (%)        | 0,43                   | 0,43                   |

The variables observed in this research are carcass percentage, giblets weight (gizzard, heart, liver) and small intestinal morphometric (villus height, villus width, crypt depth). The morphometric were performed using a Digital Imaging Mivroscope, Olympus BX-51 at an objective magnification of 4 times and 5 fields for each preparation. Data were analyzed by Analysis of Variance (Anova) Nested of Completely Randomized Design (CRD). If significant effect appeared followed by Duncan’s Multiple Range Test (DMRT).
3. Result and Discussion

| Variables                     | Treatments  |
|-------------------------------|-------------|
| Carcass percentage (%)       | Powder      | Encapsulated |
| Gizzard weight (g/100g)      | 3.970±0.29  | 3.977±0.21   |
| Heart weight (g/100g)        | 0.594±0.10  | 0.589±0.07   |
| Liver weight (g/100g)        | 3.593±0.22  | 3.575±0.34   |
| Villus height (µm)           | 497.33±31.7 | 514.52±19.2  |
| Villus width (µm)            | 119.41±4.1  | 122.11±5.8   |
| Crypt depth (µm)             | 74.72±5.4   | 76.30±3.2    |

3.1 The effect of probiotic supplementation either powdered or encapsulated (form) on carcass percentage

The effect of either powder or encapsulated probiotic forms on carcass percentage of local ducks were summarized in Table 2. The result of carcass percentage showed that there was no significant effect (p>0.05). This may due to affected by the similarly nutrient content in the basal diet. However, the comparative result between powder and encapsulated higher than reported that male ducks fed with *Salvinia molesta* resulted in carcass percentage of 52.70-56.58% [10].

The number of nutrients absorbed in the digestive tract for each treatment was relatively the same due to similarity metabolic energy, crude fiber and crude protein content in rations for each treatment. The rations that containing higher crude fiber decreased carcass weight than ration with a lower crude fiber [11]. The percentage of carcasses influenced by the quality of ration and growth rate of livestock. While the growth rate of livestock was indicated by the increase of body weight at slaughter will affect the percentage of carcass produced [12].

3.2 The effect of probiotic supplementation either powdered or encapsulated (form) on giblets weight

The effect of either powder or encapsulated probiotic forms on giblets weight of local ducks were summarized in Table 2. Statistical analysis of giblets weight showed there was no significant (p>0.05) difference between experimental groups. This indicated that different form of probiotic had no effect on giblets weight due to the same nutrient content in the ration of dietary and age of slaughter. That factors affect giblets weight are size, color, and consistency of liver such as breed, genetics, age, sex, individual status and feed intake [13]. Furthermore, either powdered or encapsulated probiotic was antinutrition-free reported that accumulation of toxins or anti-nutriments in the heart muscles will change the heart size [13]. Feeding poultry more than the requirement cause extra-digestion and it would affect the size of gizzard due to the thickening of the muscle type of feed particle size (mash, crumble or pellet) affected giblets weights, smaller particle size decrease gizzard activity [14].

3.3 The effect of probiotic supplementation either powdered or encapsulated (form) on small intestinal morphometric:

The effect of either powder or encapsulated probiotic forms on villus height (µm), villus width (µm) and crypt depth (µm) showed in Table 2. The effect of the use of either powdered or encapsulated probiotic showed that either powdered or encapsulated probiotic has no significant effect (p>0.05) on the morphometry of the small intestine (villus height, villus width, and the crypt depth). There was appropriate because either powdered or encapsulated probiotic has the same ability to repair the local duck's gut microvilli. that growth of microvilli affected by several factors such as age, sex, and type of
animal [15]. Moreover, feed nutrients, environmental conditions of the cage, humidity, temperature and natural factors such as weather and seasons. The difference villus height due to age phase, it also was reported that the height age villi 60 wks longer than the age of 30 wks [16]. The difference between a finisher stage turkey and a starter have different results [17].

3.4 The effect of levels of either powdered or encapsulated probiotic on carcass percentage

The effect of levels of either powder (Table 3) or encapsulated (Table 4) probiotics on carcass percentage showed there was significant effect (p<0.05). This may due to the level of addition improve body weight and greater carcass weight obtained. After that the 0.025% probiotic-supplemented birds had a significantly heavier body weight and weight gain [18]. As increasing the levels of probiotic used increased the carcass percentage due to the presence of probiotics in the ration could improve the digestibility of nutrients by producing *bacteriocin* as an antibacterial that altering the growth of pathogenic bacteria. In the gastrointestinal tract, probiotic would break down proteins and carbohydrates into amino acids, N, and the soluble carbon that require synthesizing of proteins. Increased protein digestibility affects the improvement of protein metabolism, thus directly increasing the protein synthesis of meat.

Table 3. Effect of levels of powder probiotics on carcass percentage, giblets weight, and small intestinal morphometric

| Variables             | Levels of powder in the diet (%) |      |      |      |
|-----------------------|----------------------------------|------|------|------|
|                       | 0                                | 0.2  | 0.4  |      |
| Carcass percentage (%)| 59.08±1.9<sup>a</sup>            | 60.16±2.3<sup>a</sup> | 61.40±0.8<sup>b</sup> |
| Gizzard weight (g/100g)| 3.976±0.21                      | 3.944±0.43 | 3.990±0.23 |
| Heart weight (g/100g)  | 0.572±0.04                       | 0.660±0.11 | 0.550±0.14 |
| Liver weight (g/100g)  | 3.420±0.19                       | 3.788±0.16 | 3.570±0.30 |
| Villus Height (µm)     | 489.7±41.35<sup>a</sup>         | 490.52±26.83<sup>a</sup> | 511.78±26.25<sup>b</sup> |
| Villus Width (µm)      | 118.71±4.99<sup>a</sup>         | 119.1±5.31<sup>a</sup> | 120.42±1.68<sup>a</sup> |
| Crypt Depth (µm)       | 74.01±5.88                       | 74.65±3.93 | 75.52±7.24 |

Table 4. Effect of levels of encapsulated probiotics on carcass percentage, giblets weight, and small intestinal morphometric

| Variables             | Levels of encapsulated in the diet (%) |      |      |      |
|-----------------------|----------------------------------------|------|------|------|
|                       | 0                                      | 0.2  | 0.4  |      |
| Carcass percentage (%)| 59.08±1.9<sup>a</sup>                  | 61.86±1.0<sup>b</sup> | 62.64±1.3<sup>b</sup> |
| Gizzard weight (g/100g)| 3.976±0.21                       | 3.942±0.25 | 4.012±0.18 |
| Heart weight (g/100g)  | 0.572±0.04                       | 0.606±0.70 | 0.588±0.10 |
| Liver weight (g/100g)  | 3.420±0.19                       | 3.602±0.51 | 3.704±0.30 |
| Villus Height (µm)     | 498.10±32.30<sup>a</sup>         | 522.21±12.88<sup>b</sup> | 523.26±0.27<sup>b</sup> |
| Villus Width (µm)      | 116.56±4.44<sup>a</sup>         | 123.07±4.63<sup>b</sup> | 126.7±3.51<sup>c</sup> |
| Crypt Depth (µm)       | 75.27±3.09                       | 76.67±4.30 | 76.96±2.41 |

The effect of levels of either powder (Table 3) or encapsulated (Table 4) probiotics on giblets weight showed there was no significant difference (p>0.05). Although increasing levels used tended to increase gizzard, heart, and weight liver relatively. This may due to to the addition different levels amount of different probiotic forms ranged between 0-0.4% did not significantly affect the weight of giblets. Moreover, indicated that the same nutrient content in the ration of dietary such as protein and fat content, age of slaughter, and anti-nutrition. Factors affect size, color, and consistency of liver such as
breed, genetics, age, sex, individual status and feed intake. Moreover, as increasing levels of probiotics use did not significantly affect heart weight also caused by similar housing conditions [13].

The effect of levels of either powder (Table 3) or encapsulated (Table 4) probiotics on the villus height, villus width and crypt depth showed were significant effect (p < 0.05) on the height and villus width, but did not significantly affect (p > 0.05) to the crypt depth. There was assumed that the level of feed supplemented contains more probiotics, thus optimizing the growth of the villi. because probiotics are more susceptible to deterioration of viabilities prior to entry into intestinal microvilli. In addition, the villus width is also determined by the basal feed content consumed. This is in contrast to research conducted Harimurti of probiotic supplementation could increase villi width. reported that a disruption of GIT epithelial cells causes micro-encapsulation of Enterococcus faecium does not work on the crypt. Another reason have reported that several aspects such as increased mRNA expression regulation of MUC2, then induced mucus protein secretion [19].

4. Conclusion
The result showed that there was no significant effect (p>0.05) of the form of either powdered or encapsulated probiotic on carcass percentage, giblets weight, and small intestinal morphometric. However, increasing level of probiotic have a significant effect (p<0.05) on carcass percentage, villus height, and villus width, but did not significantly affect giblets weight and crypt depth. It could be concluded that supplementation of either powdered or encapsulated probiotic have similar result. It is suggested to use 0.4% of encapsulated probiotic in local duck diet.

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