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The growth performance of Peking ducks fed with rations containing probiotic agents and waste products of *leubiem* fish (*Chanthidermis maculatus*)

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Abstract: The purpose of this study was to evaluate the growth performance of Peking ducks fed with rations containing waste products of *leubiem* fish (*Chanthidermis maculatus*) and probiotic agents. The study was conducted experimentally using 96 Peking ducks, within an age range of about 1 to 8 weeks, and a Completely Randomized Design (CRD), which consisted of four treatment rations and four replications. The treatment rations used in this research included treatment R0, which was the basal diet, serving as the control ration, and also treatment R1, R2, and R3, which consisted of 10% concentration of *leubiem* fish skin, head, and bone, respectively, as well as 1% of a probiotic agent. The observed variables included the rate of feed consumption, body weight gain, final body weight, feed conversion ratio, and mortality were then analysed using Analysis of Variance (ANOVA). The results showed that the use of *leubiem* fish components and probiotic agents in rations at 10% and 1%, respectively, had a significant effect ($p < 0.05$) on the rate of feed consumption, body weight gain, feed conversion ratio and final body weight. However, there was no significant effect on the mortality of Peking ducks. Therefore, this study concluded that the use of rations containing *leubiem* fishbone and probiotic agents at 10% and 1%, respectively, were able to accelerate the growth performance of Peking ducks.

1. Introduction

Certain factors such as the nature of the feed, animal breed and proper management, can determine the sustainability of a livestock business. However, one of the major challenges experienced in duck farming is the high cost of feed, which amounts to 60-70% of the total production cost. Basically, the feed given to the animals must be of good quality, have a sufficient balance of nutrients including protein, energy, vitamins and minerals. It also must be capable to greatly affect the physical appearance and the general health status of the ducks [1].

Optimizing the use of local feed ingredients is one of the methods to reduce the costs of duck farming without hampering livestock productivity [2]. One of the local feed ingredients used in Peking duck rations is fish waste.



Fish waste is the product obtained by cutting fish and extracting the bone, head, skin, offal and other parts. *Leubiem* fish is rich in proteins and has a fairly good nutritional content, which includes crude protein, crude fat, calcium, and phosphorus at 66.20%, 2.78%, 8.51%, and 4.46%, respectively, accumulating in the fish skin. Subsequently, *leubiem* fish bone meal contains crude fat, crude protein, calcium, crude fibre, and phosphorus at 58.28%, 1.66%, 2.55%, 9.30%, and 4.62%, respectively, while *Leubiem* fish head meal contains the same components as the fishbone meal at 49.18%, 5.08%, 1.72%, 11.11%, and 5.70%, respectively [1].

Fish waste products can cause pollution if not managed properly due to the decay of the protein components [3]. Furthermore, it can be a source of infectious diseases in humans, which can be transmitted by flies as vectors. However, purposive fish waste processing can provide multiple benefits by utilizing fish waste as a source of protein ingredient in animal feed and also reducing the environmental pollution. Although fish waste is a good source of protein and amino acids, it can also serve as a source of minerals for the livestock, such as phosphorus, calcium, and vitamins. The nutritional content of *leubiem* fish waste products enables its use as one of the ingredients in formulating Peking duck rations since it can meet up the required protein needs.

Similarly, feed additives such as probiotics are needed to improve the productivity and performance of Peking ducks. Probiotics are a group of beneficial microbes used to influence the host through the repair of the microorganisms in the digestible tract [4]. The most commonly used probiotic microorganisms are the *Lactobacillus* and the *Bifidobacteria* strains [5]. Consequently, the use of *leubiem* fish waste and probiotics as feed ingredients is an effort to increase the productivity and growth of Peking ducks. Therefore, the study aimed to evaluate the performance of Peking duck fed with rations containing *leubiem* fish waste products (*Chanthidermis maculatus*) and probiotics.

2. Materials and methods

This study employed 96 peking ducks aged between 1 to 8 weeks, and rations consisting of *leubiem* fish waste products (skin, bone, and head), rice bran, soybean meal, corn, sago, coconut meal, coconut oil, premix, NaCl, DCP and probiotics, as feed additives. The study was conducted experimentally using a Completely Randomized Design (CRD) with four treatment rations and four replications (6 ducks/repetitions).

The treatment rations included treatment R0, which was the basal diet, serving as the control ration, and also treatment R1, R2, and R3, which consisted of 10% concentration of *leubiem* fish head, skin, and bone, respectively, as well as 1% of a probiotic agent.

2.1 Treatment rations

The rations used during the study were basal rations without antibiotics. All treatment rations contained the same amount of feed ingredients but differed in *leubiem* fish waste composition. The ration used was formulated to meet the nutritional requirements of Peking ducks, which contained 18% crude protein and 2700 Kcal/kg metabolizable energy. The composition of the feed ingredients and the nutrient content of each treatment ration is as shown in Table 1.

Table 1. The composition and nutrient contents of the treatment rations.

Feed ingredients	Treatment			
	R0	R1	R2	R3
Corn (%)	38.5	40	37	37
Rice bran (%)	17	18	18	18
Coconut meal (%)	10	13.5	13	13
Soybean meal (%)	24.3	7.5	12	10
Sago (%)	7.2	8.0	7.0	9.0
Fish skin flour <i>leubiem</i> (%)	0	10	0	0
Fish head flour <i>leubiem</i> (%)	0	0	10	0
Fish bone flour <i>leubiem</i> (%)	0	0	0	10
Coconut oil (%)	1.5	1.5	1.5	1.5
Premix (%)	0.5	0.5	0.5	0.5
NaCL (%)	0.5	0.5	0.5	0.5
DCP (%)	0.5	0.5	0.5	0.5
Total	100	100	100	100
Nutrient content				
Metabolizable energy (Kcal/kg)	2702	2767	2706	2719
Crude proteins (%)	18.02	18.12	18.08	18.15
Crude fiber (%)	5.92	6.66	6.55	6.95
Crude fat (%)	4.57	4.99	5.1	4.77
Calcium (%)	0.28	1.09	1.36	1.07
Phosphor (%)	0.58	0.95	1.09	0.91

Note: R0 (basal diet/control ration), R1 (ration containing 10% *leubiem* fish skin and probiotic 1%), R2 (ration containing 10% *leubiem* fish head and probiotic 1%), and R3 (ration containing 10% *leubiem* fish bone and probiotic 1%).

2.2. Research procedures

This study used peking ducks that were kept in a litter cage system until they were 8 weeks old. The experiment was conducted for eight weeks, where the feed and drinking water were provided ad libitum. The feed consumption and weight gain were measured weekly, while the measurement of final body weight, feed conversion, and the mortality rate of the Peking ducks were carried out at the end of the study.

2.3. Research variables and data analysis

The variables observed included the feed consumption, body weight gain, final body weight, feed conversion, and the mortality rate. Meanwhile, the data were analysed using one-way Anova followed up with Duncan's Multiple Range Test.

3. Results and discussion

3.1. Feed consumption

The average feed consumption of the Peking ducks during the study ranged between 5.132 to 5.516 kg/duck, as shown in Table 2. Also, the highest ration consumption was seen in treatment R0, which

served as the basal diet and control ration. The lowest ration consumption was seen in treatment R1, which contained *leubiem* fish skin and probiotics at 10% and 1%, respectively. The 8 weeks old Peking ducks performance are as shown in Table 2.

Table 2. The 8-weeks old Peking duck performances.

Variables	Treatment			
	R0	R1	R2	R3
Feed consumption (g)	5516 ± 10.04 ^b	5132 ± 12.52 ^a	5326 ± 16.53 ^{ab}	5361 ± 12,95 ^b
Body weight gain (g/weeks)	191.59 ± 6.41 ^b	157.02 ± 11.39 ^a	147.41 ± 3.26 ^a	180.36 ± 3,76 ^b
Final body weight (g)	1567 ± 40.70 ^b	1327 ± 81.34 ^a	1256 ± 21.18 ^a	1492 ± 21.94 ^b
Feed conversion ratio	3.52 ± 0.05 ^a	3.87 ± 0.18 ^b	4.24 ± 0.03 ^c	3.59 ± 0.02 ^a
Mortality (%)	0	0	0	0

Note: Different superscript in the same line means significantly different ($p < 0.05$); R0 (basal diet/control ration), R1 (ration containing 10% *leubiem* fish skin and probiotic 1%), R2 (ration containing 10% *leubiem* fish head and probiotic 1%), and R3 (ration containing 10% *leubiem* fish bone and probiotic 1%).

The results indicates that the use of rations containing *leubiem* fish waste and probiotic supplementation significantly affected ($p < 0.05$) the feed consumption of Peking duck. The lowest feed consumption was observed in the R1 feed treatment containing *leubiem* fish skin and probiotics at 10% and 1%, respectively. Furthermore, this was significantly different ($p < 0.05$) compared to the control treatment (R0) and the R3 treatment containing *leubiem* fishbone and probiotics at 10% and 1%, respectively, as seen in Table 2. The feed consumption in livestock can be influenced by numerous factors, such as the quality of the feed based on its nutritional content [6], as well as the protein and energy content in the ration [7]. Meanwhile, dietary consumption is also strongly influenced by the delicacy of the ration, as well as the type and composition of the feed ingredients used in the formulation of feed rations [8]. Another factor that affects feed consumption in livestock is the palatability of the feed regarding the colour, taste, smell and texture [9].

3.2. Body weight gain

The average weight gain of the Peking ducks during the study ranged from 147.41 to 191.59 g/weeks, as seen in Table 2. Statistical analysis showed that the use of *leubiem* fish waste products and probiotic supplementation in Peking duck rations had a significant effect ($p < 0.05$) on body weight gain. The consumption rate of the rations correlates with the body weight gain of the Peking ducks. The highest body weight gain ranging between 191.59 and 180.36 g/week was obtained in the control treatment, which was not significantly different from the R3 treatment containing *leubiem* fishbone and probiotics at 10% and 1%, respectively, as seen in Table 2.

The consumption of rations has a strong influence on the increase in animal weight, which indicates the growth rate of the livestock. Bodyweight gain is closely related to ration consumption since the latter determines the input of nutrients into the body, which is utilised for growth and other purposes. [13]. The results of this study are consistent with a previous study [14], which found that using liquid waste from steaming fish as a feed ingredient can increase the weight gain of peking x mojosari hybrid ducks. Furthermore, the use of phyto-genic products and probiotics as feed additives in rations has been shown to increase the growth of local ducks [10].

3.3. Final body weight

The results shows that the final body weights of the final Peking ducks ranged between 1256 to 1567 g/bird, as seen in Table 2. Also, the rations containing *leubiem* fish waste products and probiotic supplementation had a significant effect ($p < 0.05$) on the final bodyweight of the Peking ducks. The highest final body weight ranging between 1567 and 1492 g/bird, was observed in the control (R0) and R3 treatment containing *leubiem* fishbone and probiotics at 10% and 1%, respectively. Conversely, the lowest final bodyweight of 1256 g/bird was observed in treatment R2. Feeding of rations containing *leubiem* fish waste products and probiotic supplementation in R3 resulted in relatively higher final body weight of Peking ducks ($p < 0.05$) compared to treatments R1 and R2, but not significantly different from the control treatment R0, as seen in Table 2.

The use of rations containing *leubiem* fish waste products (head, skin flour, and bone) can improve the performance of the Peking ducks. More so, the final body weight of the ducks is influenced by the weight gain and age of the animals. Meanwhile, the growth of the animals is influenced by nutrient intake and the rate of digestion in the body of the animal, where proper absorption and digestion of nutrients play a role in the growth of ducks [11].

3.4. Feed Conversion Ratio (FCR)

The results shows that the use of *leubiem* fish waste and probiotic supplementation in rations had a significant ($p < 0.05$) effect on the feed conversion of Peking ducks, as seen in Table 2. The lowest feed conversion rates of 3.52 and 3.59 were found in the control treatment (R0) and the R3 treatment containing *leubiem* fishbone and probiotics at 10% and 1%, respectively. The statistical analysis revealed no significant difference, as seen in Table 2, which indicates that feeding a ration containing *leubiem* fishbone and probiotics at 10% and 1%, respectively, produces FCR comparable to the control ration.

Subsequently, the results showed that a ration containing *leubiem* fishbone and probiotics at 10% and 1%, respectively, can provide a level of delicacy, quantity, and nutritional balance to the feed, as well as being effective in increasing the growth of Peking ducks. Therefore, the lower the feed conversion rate, the more efficiently the livestock can utilise the rations [12]. The value of feed conversion is determined by the quality of feed used by livestock since a higher nutritional content implies a better feed conversion. Additionally, this occurs since livestock requires a lesser quantity of good quality feed to produce the same bodyweight as a poor-quality feed. High growth reflects the efficiency of feed consumption, as observed by the decrease in feed conversion rates [11].

3.5. Mortality

The results shows that the usage of rations containing *leubiem* fish waste and probiotic supplementation did not affect the mortality of Peking ducks. Additionally, this shows that *leubiem* fish waste can serve as a reliable feed ingredient and also a source of adequate nutrition in formulating duck rations. Similarly, probiotic supplementation serves as an antibacterial to maintain the health status of ducks [2].

Furthermore, regular rations and drinking water greatly affected the immune system of ducks. The cleanliness of the cage also has a significant impact on duck mortality since a dirty and untreated cage will easily harbour germs that can lead to death. Poor maintenance management and the presence of disease sources are two main causes of livestock mortality. Good maintenance management can control and prevent the spread of diseases in ducks, as well as inhibiting the spread of infections, which lowers the mortality rate in ducks [13]. The results showed that the use of 0.5% multi-strain probiotic preparations in commercial broiler chicken rations, as well as the combination of minerals and vitamins, have the potential to improve digestive function and the physiological status of broiler chickens [14].

Moreover, [11] reported that using water hyacinth feed and different prebiotics resulted in roughly the same digestive tract profile performance in male Tegal ducks.

4. Conclusions

It was concluded that the use of rations containing *leubiem* fishbone and probiotics at 10% and 1%, respectively, increased the body weight gain and the final weight of Peking ducks aged eight weeks.

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