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THE EFFECTS OF DIFFERENT FEEDING CONDITIONS ON PERFORMANCE AND CARCASS CHARACTERISTICS OF PEKIN, LOCAL, AND CROSSBRED DUCKS

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ABSTRACT: The objective of the study was to investigate performance and carcass quality of Pekin, local, and cross-breed ducks raised under different feeding (varied in protein and fiber levels). A total of 180 male ducks aged 14 days, consisting of 60 Pekin ducks, 60 local ducks (Mojosari), and 60 cross-breed (Mojosari + Alabio) ducks were used in the study. Each type of duck was randomly divided into 36 units of cages, each of which was filled with 5 ducks. The data obtained from the study were analyzed according to a completely randomized design with 2×3 factorial pattern. Initial body weight of local ducks at 14 days was significantly ($P<0.01$) lower than that of Pekin and cross-breed ducks, while, Pekin ducks were higher than the other two types of ducks. On the other hand, feed consumption was significantly ($P<0.01$) influenced by the type of diet and breed. While carcass percentage was significantly ($P<0.01$) influenced by breed and diet types. The percentage of Pekin duck carcasses that received diet A (low protein and fiber) was significantly different ($P<0.05$) from cross-breed ducks, in comparison to local ducks. In conclusion the feed conversion rate and final body weight for diet A showed better results than diet B (high protein and high fiber) on the Pekin duck. Meanwhile, the carcass characteristics like abdominal fat of diet B (for Pekin, local duck, and cross breed) were better than diet A (for Pekin and local duck). It's suggested to use Pekin ducks with low protein and low fiber diet to get the better performance, in compared with local ducks which needs high protein and high fiber content in diet.

Keywords: Carcass characteristics, Cross-bred birds, Nutrients, Pekin Duck, Performance.

INTRODUCTION

Duck meat is very liked by almost all levels of society because it has a distinctive taste, and a higher fat content than chicken meat (Ali et al., 2007; Qiao et al., 2017). Pekin ducks are good type of duck and have several advantages including large size, fast growth, weight, and good carcass quality (Bugiwati et al., 2021). One of the local duck origins in Indonesia is Mojosari Alabio ducks mostly originate from cross-breeding of male Mojosari (Anas javanica) and female Alabio (*Anas platyrhynchos Borneo*). Mojosari Alabio male duck is a local duck that has a good daily weight gain (Subhan et al., 2022).

In general, broiler ducks are kept intensively fed a complete commercial feed in the form of granules or pellets (Blair, 2008). This maintenance pattern is relatively expensive, so it can increase production costs and reduce profits. Therefore, producers constantly seek cheaper ways to feed the duck. On the other hand, the demand for world duck meat production tends to increase, therefore knowledge of nutrition is needed for feed formulation to enable better meat production (Fouad et al., 2018).

Parameters of duck meat and quality of carcass depend on performance factors, including sex of birds and age, genotype, a system of management, and type of feed (Rahman et al., 2014; Smith et al., 2015). Furthermore, Ali et al. (2008), Zdanowska-Sąsiadek et al. (2013), and Naveen et al. (2016) reported that the qualities of meat duck also depend on the handled before and rearing period, during, and post-slaughter including the condition of meat storage. Meanwhile, the nature of the meat depends on the feed during the rearing period, handling before and during slaughter, and the storage conditions of the meat (Nurkhoeriyati et al., 2012; Zdanowska-Sąsiadek et al., 2013; Naveen et al., 2016). Furthermore, feeding a balanced-diet is a key factor for the growth and development of local ducks, especially protein requirements (Kuzniacka et al., 2014; Udayana et al., 2020).

Determining the nutritional needs of different types of ducks is very important for the efficient use of feeds (Fouad et al., 2018; Liu et al., 2019). In addition, comparing the performance and characteristics of carcasses with various nutritional profiles can provide important information for the progress of duck farmers. However, this data is restricted to the duck (Fouad et al., 2018). The objective of the research was to evaluate of performance and carcass characteristics of Pekin Ducks, local ducks, and the cross between Pekin with local ducks raised under different feeding formulates.

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MATERIALS AND METHODS

Experimental design

A total of 180 male ducks aged 14 days, consisting of 60 Pekin ducks, 60 local ducks called Mojosari, and 60 cross-breed ducks (Mojosari ducks with Alabio duck) were used in the study. Each group of breed were devided 12 cage. every cage consisted 5 ducks. Cages measuring 100 x 50 x 60 cm are equipped with a place to feed and drink. The cage floor was made from iron and designed using a slat system. Feed and water were offered ad-libitum throughout the experiment period of 28 days (14 to 42 days of age). The basal diet was formulated to the nutrient requirements of feed based on local plants as an energy source broiler according to NRC (1994). The design used was a completely randomized design with 6 replications. The treatments given were Diet A and Diet B which were given to three species of ducks, namely Pekin ducks, local ducks, and crossbred ducks. The composition and contain nutrients from experimental diets are shown in table 1.

Table 1 - Composition of feed for duck

Type of diet	Crude Protein (%)	Crude Fiber (%)	Crude fat (%)	Ca (%)	P (%)	ME (Kcal/kg)
Diet A	22.00	5.00	5.00	0.95	0.60	3,000
Diet B	23.05	13.67	5.01	3.41	0.79	2,327

Diet A: Feed composition consist of yellow corn, soybean meal, meat bone meal, corn gluten meal, palm oil, amino acid essential, mineral essential, premix and vitamin. Diet B: Feed composition consist of corn, rice bran, bran pollard, dried distillers grains with soluble (DDGS), soybean meal, palm kernel meal, flour binder, shrimp meal, sago, crude palm oil, limestone, amino acid essential, premix vitamin, premix mineral, mono-calcium phosphate (MCP), and enzyme.

Parameters of study

Ducks and feed were weighted based on parameters including initial and final body weight (BW), the gain of weight, feed intake (FI), and feed conversion ratio per kg of body weight gain, carcass qualities were measured. Recording of growth performance from the ducks was assessed by recording BW, weight gain, feed consumption, and feed conversion ratio (FCR) during the study. Body weight was measured weekly, and feed consumed on a per pen basis was recorded daily. After 28 days of rearing, 12 birds (2 from each group), with body weight close to the mean for the whole flock, were slaughtered for carcass and meat quality analysis. Then the carcass was removed manually and divided into pieces such as chest, legs, wings, neck, and belly fat for analysis. All processes parameters adopted from Wang et al. (2017) and Kokoszynski et al. (2020).

Statistical analysis

The data obtained from the study were analyzed for variance using the GLM procedure from SPSS version 24 according to a completely randomized design with 2x3 factorial pattern. The standard error of measurement (SEM) was also calculated. If the results of the F test show a significant or very significant difference, then the analysis is continued with the Tukey test at $P<0.01$ (Steel and Torrie, 1982).

Ethical approval

This study was approved by the Institutional Animal Care and Use Committee in Faculty of Agriculture, Islamic University of Kalimantan with number 003/U.CC/FP/IV/21.

RESULTS AND DISCUSSION

Performances

The growth performance of the Pekin ducks, local ducks, and cross-breed ducks fed diets A and B were presented in Table 2. The initial body weight of local ducks at 14 days was significantly different ($P<0.01$) lower than that of Pekin and cross-breed ducks, while, Pekin ducks were higher than the other two types of ducks. On the other hand, feed consumption was significantly ($P<0.01$) influenced by the type of diet and breed. Then, diet type and breed type were very significant ($P<0.01$) in influencing weight of gain and final body weight. The interaction was very significant ($P<0.01$) between diet type and breed type on body weight gain and final body weight. The Pekin ducks fed diet A significantly ($P<0.05$) had higher body weight gain than Pekin ducks fed diet B. Likewise, local and cross-breed ducks that received diet A significantly ($P<0.05$) had higher body weight gain than local and cross-breed ducks that received diet B. The final body weight of Pekin ducks fed diet A was significantly ($P<0.01$) higher than Pekin ducks fed diet B. While, local and cross-breed ducks fed diet A were significantly ($P<0.05$) higher in body weight than ducks local and cross-breeds on diet B. There was an interaction between breed and diet on weight gain and final body weight. Pekin duck was who received diet A produced the highest weight gain and final body weight. The pekins duck were broiler breeds, while local breeds and cross breeds are laying types.

Carcass characteristic

The carcass characteristics of Pekin ducks, local ducks, and cross-breed ducks were fed diets A and B and their interactions were presented in Table 3. Carcass percentage was significantly ($P<0.01$) influenced by breed type and diet

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type. The percentage of Pekin duck carcasses that received diet A was significantly different (P<0.05) from cross-breed ducks, but not significantly different from local ducks. Whereas, diet A produced a higher carcass percentage than diet B.

The percentage of meat was very significantly (P<0.01) influenced by the type of diet and significantly (P<0.05) was influenced by the type of breed. The percentage of thigh meat was significantly (P<0.01) influenced by the type of diet. The percentage of breast meat was very significant (P<0.01) influenced by diet type and significantly (P<0.05) influenced by breed type. Pekin ducks that received diet A produced a higher percentage of breast meat than Pekin ducks that received diet B.

The Pekin ducks were known as broiler ducks which have been genetically enhanced to obtain higher meat yields and lower levels of carcass fat deposition (Fouad et al., 2018). In our study, final body weight diet feeds a ranged from1.014 g to 1.500 g/bird. Similar results from the final body weight of duck by Kokoszynski et al. (2019a) and Starcvic et al. (2021). The variation in duck body weight can be influenced by several factors, including feed, genetic value, and the environment. On the other hand, the difference in final weight gain that occurs between types of diets is mostly due to the different nutrient content, especially protein and energy. This was supported by Wen et al. (2017) and Liu et al. (2019) stated that the level of metabolic energy and crude protein in the ration affected the growth performance of Pekin ducks. On the other hand, other researchers like Murawska (2012);, Kokoszynski et al. (2015), and Kokoszynski et al. (2019a) revealed that final body weight of ducks was influenced by many factors such as duck strain, sex, age, chemical composition of feed, and feeding including a total of feed intake.

The consumption of feed A was 2.30 - 3.01 g/bird while the consumption of feed B was higher at 3.11 - 3.16 gr/bird. Ducks can regulate the total consumption of feed according to the amount of energy needed by the body. Ducks also will consume more feed when receiving a low-energy diet compared to a high-energy diet. While diet A contains higher energy (Table 1) than diet B, so the ratio consumption is lowest. The results of this study were almost the same as those of Wen et al. (2017) who reported that increasing ration energy can reduce feed intake and feed/gain. Liu et al. (2019) stated that feed consumption and feed conversion of Pekin ducks decreased linearly with increasing metabolizable energy (ME) and crude protein. The average consumption of the Pekin duck ration in this study was 3.14 g or 112.18 g/day, slightly lower than the results of the study by Kokoszynski et al. (2019a) the consumption of ducks aged 1-49 days was 123.2 g/day.

The results of our study, carcass percentages ranged from 50-57% Diet A, and 49-52% Diet B. meanwhile other authors have found higher carcass percentages in commercial Pekin ducks (Kwon et al., 2014; Baltic et al., 2017; Kokoszynski et al., 2019a; Kokoszynski et al., 2019b; Kokoszynski et al., 2020). The results of our study showed that the abdominal fat content of feed A was 1.41% on average while in feed B was 0.39%, the difference was due to variations in different nutritional content, like protein dang fiber. Meanwhile, Wang et al. (2017) reported that the percentage of duck belly fat will decrease as the protein content in the feed increases. This illustrates that the level of protein content in the feed has an impact on the duck's abdominal fat. In addition, the increase in crude fiber content in the feed also resulted in a decrease in the length of the small intestine, along with an increase in the relative weight of the proventriculus and gizzard (Freitas et al., 2014; Yokhana et al., 2016).

Table 2- Performances Pekin duck, Local duck, and Crossbred duck were given diets feed differences

Variable	Diet A			Diet B			SEM	P-value		
	Pekin	Local duck	Cross breed	Pekin	Local duck	Cross breed		D	B	D×B
Initial BW 14 days (g/bird)	363^{d}	210^{a}	299^{bcd}	338^{cd}	249^{ab}	277^{abc}	13.80	ns	**	ns
Feed Consumption/FC (g/bird)	3,077	2,399	2,918	3,164	3,118	3,161	78.90	**	*	ns
Weight Gain/WB (g/4 weeks)	1,136^{c}	803^{ba}	853^{b}	581^{a}	582^{a}	581^{a}	51.59	**	**	**
Feed conversation ratio (FCR)	2.75^{a}	3.02^{a}	3.41^{A}	5.44^{b}	5.36^{b}	5.45^{b}	0.29	**	ns	ns
Final body weight (g/bird)	1,500^{c}	1,014^{ab}	1,196^{b}	920^{a}	831^{a}	858^{a}	58.84	**	**	**

D = Diet factor; B = Duck breed factor; R×B = interaction between diet and duck breed factors. Within a row, means with a different superscript letter significantly differ a, b: P < 0.05; A, B: P<0.01); ns = no significance (P > 0.05); *: P < 0.05); **: P < 0.01.

Table 3- Carcass characteristics Pekin duck, Local duck, and Crossbred duck were given diets feed differences

Variable	Diet A			Diet B			SEM	P-value		
	Pekin	Local duck	Cross breed	Pekin	Local duck	Cross breed		D	B	D×B
Carcass (%)	57.41^{c}	54.96^{abc}	50.86^{ab}	52.76^{abc}	49.85^{a}	49.02^{a}	0.81	**	**	ns
Abdominal fat (%)	1.48	1.57	1.20	0.53	0.30	0.36	0.15	**	ns	ns
Meat:Slaughter weight (%)	30.88^{b}	28.66^{ab}	26.14^{ab}	25.83^{ab}	23.45^{a}	24.74^{a}	0.67	**	*	ns
Thigh meat in Carcass (%)	20.91^{a}	22.89^{ab}	22.14^{ab}	24.13^{ab}	24.30^{ab}	26.41^{b}	0.52	**	ns	ns
Breast meat in carcass (%)	19.17^{b}	14.70^{ab}	16.49^{ab}	12.04^{a}	10.55^{a}	12.63^{a}	0.79	**	*	ns

D = Diet factor; B = Duck breed factor; D×B = interaction between diet and duck breed factors. Within a row, means with a different superscript letter significantly differ (a, b: P < 0.05; A, B: P<0.01); ns = no significance (P > 0.05); *: P < 0.05); **: P < 0.01.

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CONCLUSION

Based on the description of the results and discussion, In conclusion it was showed the feed conversion rate and final body weight for Diet A were better than Diet B (high protein and high fiber) on the Pekin duck. Meanwhile, the carcass characteristics like abdominal fat of Diet B (for Pekin, local duck, and cross breed) were better than Diet A (for Pekin and local duck). It's suggested to use Pekin ducks with low protein and low fiber diet to get the better performance, in compared with local ducks which needs high protein and high fiber content in diet.

DECLARATIONS

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Authors' contributions

A. Gunawan designed of the research; A. Malik drafted the manuscript; Dharmawati, Kartika, Wulandari and Saprani collected of the data and done the statistical analysis.

Competing interest

All authors have no competing interest in the research.

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