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Evaluation of Metabolizable Energy and Crude Protein Balance on Productivity and Income on Male Kamang Ducks

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ABSTRACT

Male Kamang ducks are one of the local ducks in West Sumatran germplasm originating from Tilatang Kamang and Kamang Magek Districts, Agam Regency, West Sumatera. The balance of metabolizable energy and crude protein (EM/P) in preparing the ration for Kamang ducks must be considered because it is closely related to the efficiency and growth of the ducks. Preparing the feed formulation for Kamang ducks with the right energy and protein balance will support their productivity. The research used male Kamang ducks in the grower phase, which is 3 to 7 weeks of age. Feed Treatment was metabolizable energy of 2800 kcal/kg with 17%, 18%, and 19% crude protein levels. The design used was completely randomized, with 3 treatments and 6 replications. The research showed no significant effect of treatments on feed consumption, body weight gain, or conversion ratio of male Kamang ducks in the grower phase; however, from the treatments, the highest income based on the IOFC value was ration B. In male Kamang ducks, good performance in balance of ME/P are 147.37 to 164.71 with the highest Income Over Feed and Cost (IOFC) value and lower fat abdominal at ME/P 155.55.

Keywords: Kamang Ducks, Grower, Performance, IOFC, Metabolizable Energy

INTRODUCTION

Indonesia has a variety of livestock germplasm, including poultry, that has the potential to be developed to strengthen the community's economy. Ducks are one type of poultry farming that is currently developing as an economic business and as a source of animal food that produces meat and eggs; however, the development of the duck farming business is often faced with various problems, especially feed problems, which cause its potential not to develop optimally.

West Sumatra has several types of ducks, one of which is germplasm and one of which is Kamang ducks. Kamang ducks are one of the local livestock of West Sumatran germplasm originating from Tilatang Kamang and Kamang Magek subdistricts, Agam Regency, West Sumatra. Kamang ducks have dual functions that have potential. To develop, male Kamang ducks are meat producers, and female Kamang ducks are good egg layers (UPT Keswan, 2021).

Kamang ducks have an advantage over other local West Sumatran ducks, such as bayang ducks and pitalah ducks, because the growth of Kamang ducks is higher and feed conversion is lower. Female Kamang ducks have a particular characteristic: a white curved line above the eye to the beak, and the color of the feathers tends to be dark brown with a black beak (Suhaemi, 2015). Male Kamang ducks, as meat producers, have a blackish head and beak; some have a line above the eyes with feathers tending to be greyish, and the underside of the wings are black in stripes; however, the blue color of male ducks when they are young tends to be light brown (Triani, 2014). Kamang duck meat quality is better than other ducks in West Sumatera because it has the lowest bad cholesterol (Low-Density Lipoprotein, LDL) content, namely 6mg/100g) and the highest good cholesterol (High-Density Lipoprotein, HDL) content, namely 18mg/100g (Suhaemi, 2015).

The balance of metabolizable energy and crude protein (ME/P) in preparing the ration for Kamang ducks must be considered because it is closely related to the efficiency and growth of the ducks. Preparing the ration for Kamang ducks with the right energy and protein balance will support their productivity. Excess energy occurs when the ratio of energy to protein exceeds what is needed for average growth, production, activity, and maintenance, and this will cause decreased ration consumption and inadequate

demand for nutrition. On the other hand, if the ration lacks energy below basic living requirements, the poultry will lose body weight because protein is depleted and body fat is converted into energy (Sumiati, 2019).

Kamang ducks are local ducks that live in tropical areas in West Sumatra where there is no information on a balance of energy and protein, so research is needed on an appropriate balance of metabolic energy and crude protein needed in Kamang ducks to optimize the potential of local ducks as one of West Sumatra's germplasm for economic empowerment: society and the resources of animal food.

MATERIALS AND METHODS

The ingredients used are conventional feed consisting of corn, fish meal, soybean meal, rice bran and stone meal. There were 90 male Kamang ducks in the grower phase aged three weeks, placed in 18 cages; each cage contained five birds and cage equipment such as feeders, drinkers, and lights.

Research methods

Research is the balance of metabolizable energy (ME) and crude protein (CP) with EM 2800 Kcal/kg with three levels of crude protein (17%, 18% and 19%) with a balance of metabolizable energy and crude protein (EM/P) of 164.71; 155.55 and 147.37. The research method was a Completely randomized design 3 x 6 with 3 protein level treatments and six replications, each replication consisting of 5 male Kamang ducks in the grower phase (3 weeks old), which were reared for four weeks.

There are three types of treatment rations used, namely:

A. Ration with ME=2800 Kcal/kg and =CP 17%
B. Ration with ME=2800 Kcal/kg and CP=18%
C. Ration with ME=2800 Kcal/kg and CP=19%

Data analysis

The data was analyzed using variance to determine the effect of treatment. If there were significant differences in the parameters, it was continued with Duncan's Multiple Range Test (DMRT) further tests, according to Steel and Torrie (1991).

The parameters observed in this research are:

1. Body Weight Gain (g/duck).

Body weight gain was measured by subtracting the final body weight from the initial weight in each study period.

2. Feed consumption (g/duck)

Feed consumption was calculated by subtracting the rations given from the remaining rations for each research period.

3. Feed Conversion

Feed conversion is calculated by dividing the amount of ration consumed by the increase in body weight during the study.

4. Income Over Feed and Duck Cost IOFC (%)

IOFC income minus feed and duck costs

5. Carcass, gizzard, liver and Abdominal fat Percentage

Calculate by comparison the weight of each part with the live weight of the duck

RESULTS AND DISCUSSION

Kamang ducks are local ducks from West Sumatra that have not been studied much, so the nutritional requirements for Kamang ducks are not yet known. The balance of energy and crude protein is an important factor in determining the nutritional needs of Kamang ducks as meat producers so that the ration formulation for Kamang duck feed is more effective and efficient. The research results on determining the balance of metabolizable energy and crude protein in Male Kamang ducks can be seen in Table 1.

The metabolizable energy used in the study was 2800 kcal/kg with three different crude protein levels, there are 17%, 18% and 19%, so treatment A had a balance of metabolizable energy and crude protein of 164.71 and treatment B had a crude protein level of 18. % with a metabolizable energy balance of 155.55, and in treatment C, the crude protein level was 19% with a metabolizable energy and protein balance of 147.37.

Table 1. The feed consumption, body weight gain and feed conversion of male Kamang ducks (3-7 weeks).

Treatment	Feed Consumption (g/duck)	Body Weight Gain (g/duck)	Feed Conversion
A (CP=17%)	3443.33	591.75	5.84
B (CP=18%)	3401.66	582.92	5.85
C (CP=19%)	3410.00	616.75	5.55

Feed Consumption

Feed consumption is calculated by the amount of feed consumed during the research. Feed consumption is influenced by many factors, such as body size, genetics, bird activity, environmental temperature, quality and quantity of feed (NRC, 1994), and the smell and palatability of poultry feed will influence feed consumption. It is essential to know about feed consumption because it relates to the highest costs in the duck cultivation business; feed costs are 70-80 per cent of the cost component in raising ducks (Rohaeni et al., 2021).

In Table 1, statistically, from the analysis of variance, there was no significant effect (P>0.05) of ration treatment on the feed consumption of male Kamang ducks in the grower phase. This feed consumption, which was not significantly different, was due to the balance of metabolizable energy and crude protein in each treatment ration with a balance of metabolizable energy and crude protein (ME/P) of 164.71 (ration A), 155.55 (ration B) and 147 .37 (ration C) for male Kamang ducks in the grower phase.

The ME/P balance greatly influences feed consumption. Excess energy in the feed can cause feed consumption to decrease because ducks only consume a small amount of feed to meet their energy needs (Sumiati et al., 2019). The ME/P balance from 147.37 to 164.71 in the grower phase of Kamang ducks can be tolerated by Kamang ducks and reflects the same quality and palatability of the diet, resulting in feed consumption that is not significantly different.

The consumption rate for male Kamang ducks in the grower phase (3-7 weeks) is 3401g to 3443g. According to the research of Ekaprasetyo et al. (2022), the consumption of male Tegal ducks in the grower phase aged 2-7 weeks is 3458 g. Compared with the length of rearing time, the consumption of male Kamang ducks in the grower phase is higher than that of male Tegal ducks in the grower phase. Genetic factors greatly influence poultry ration consumption (Wahyu, 1997).

Body Weight Gain

Body weight gain indicates the success of a duck farming business because it will influence the amount of income received. An increase in body weight is influenced by feed consumption. High feed consumption will increase weight gain in broiler ducks because nutrition is needed to grow and build body cells. Nutrition will be sufficient if good feed is consumed. From the results of this study, it can be seen that the body weight gain in Kamang ducks during the study ranged from 827 g to 915.8 g.

Based on the results of analysis of variance, it shows that there is no significant effect (P>0.05) in the influence of the balance of metabolizable energy and crude protein (ME/P) on the body weight gain of male Kamang ducks in the grower phase, this is due to the quality of the diet with ME/P 164.71 (ration A), 155.55 (ration B) and 147.37 (ration C) are balanced as duck feed. A balanced ration results in the consumption of the ration being the same and the nutrition needed by the ducks for growth being sufficient, resulting in the same body weight gain.

Body weight gain is closely related to consumption and quality of feed, and good consumption and quality of feed will result in higher body weight gain. Good feed consumption and feed quality will fulfil the nutritional needs of ducks, especially protein and energy, which will be used for maintenance and growth; conversely, if feed consumption and quality are low, then ducks will be deficient in energy and protein, hindering growth. Growth is closely related to consumption, and it is estimated that 63% of the decline in growth is due to a decrease in poultry feed (Daghir, 1998).

The average body weight gain of male Kamang ducks in the grower phase is 582.95 grams to 616.75 grams. The growth of male Kamang ducks in the grower phase as a result of this research is higher than the growth of Bayang male ducks, where in Bayang male ducks kept aged 3 to 8 weeks only resulted in a body weight gain of 521.86 grams (Rafian et al., 2023), as compared to the increase in body weight of male Tegal ducks in the grower phase kept from 2-8 weeks of age which only reached 480.83 (Ekaprasetyo et al (2022) Based on the results of this research, it indicates that genetically, male Kamang ducks are more productive as meat sources.

Feed Conversion

Feed conversion is the feed consumption ratio to body weight gain, the amount of feed consumed to produce one unit of weight gain in ducks. The feed conversion value reflects the efficiency of the ration. The lower the ration conversion, the more efficient the ration, which indicates that the smaller the amount of ration

consumed to produce an increase in the duck's body weight in one unit; conversely, the higher the feed conversion indicates that, the greater the amount of ration consumed to produce one unit of body weight gain in ducks.

Based on the results of the variance analysis, it was found that there was no significant effect (P>0.05) of the treatment ration with a balance of metabolizable energy and crude protein (ME/P) on the feed conversion of male Kamang ducks in the grower phase, this was due to the increase in body weight and consumption. The rations in the treatment rations with EM/P 164.71 (ration A), 155.55 (ration B) and 147.37 (ration C) were also the same.

The average feed conversion for male Kamang ducks in the grower phase ranged from 5.55 to 5.84. The results of this research are in line with research (Purba et al, 2017) where the conversion of PMp ducks reared for 6 weeks was 5.15-5.41, while the ration conversion of Pitalah ducks as local West Sumatran ducks with a metabolic energy of 2800 kcal/kg with 16%-18% crude protein given the probiotic *Bacillus amyloliquefaciens* was 4.44 to 5.52 (Zurmiati et al, 2017).

Based on the research results shown in Table 1, the metabolizable energy balance in the grower phase of Kamang ducks ranges from 147.37 to 164.71. The results of this study are in line with research by Zeng et al. (2015), which states that in grower phase ducks aged 2-6 weeks, the balance of metabolic energy and crude protein (ME/P) is 171.5 with metabolizable energy of 3087 Kcal/kg and crude protein of 18 %, while the balance of metabolic energy and crude protein in Peking ducks is lower, are 131.81. In Pitalah ducks that were given the probiotic *Bacillus amyloliquefaciens,* the EM/P balance was 155.55 with a metabolizable energy of 2800 kcal/kg and ME/P 158.82 with a metabolic energy of 2800 kcal/kg and 18% crude protein (Zurmiati et al., 2017).

The results of this study showed that the balance of metabolizable energy and crude protein for the three treatments was 147.37; 155.55 and 164.71 are ME/P balances and can be given to Kamang ducks in the grower phase because they result from the same feed consumption, body weight gain and feed conversion. A balanced metabolizable energy balance effectively produces optimal duck productivity because it fulfils nutritional needs, especially metabolic energy and crude protein, which are essential for growth.

The balance of metabolizable energy and crude protein (EM/P) must be considered because poultry growth and production will be disrupted if it is not balanced. Excess energy occurs when the ratio of energy to protein exceeds what is needed for average growth, production, activity and maintenance, and this will cause ration consumption to decrease because ducks only need to consume a little feed to meet their energy needs. Still, protein consumption does not meet their needs, causing protein deficiency and impacting growth and production. On the other hand, if the feed below energy to basic living requirements, the poultry will lose body weight because protein is depleted and body fat is converted into energy (Sumiati et al., 2019).

Income Over Feed Cost (IOFC)

The balance of metabolizable energy and crude protein (ME/P) is very important to attention for feed efficiency and duck productivity, leading to significant income earned in the grower phase of the duck farm. One of the income indicators for duck farming can be reflected in the IOFC (Income Over Feed and Cost) value. The IOFC value is income after deducting the cost of duck and feed costs, so calculating the IOFC value of feed can determine the efficient ration in duck farming. The results of the IOFD values for male Kamang ducks in the grower phase that were kept from 3 to 7 weeks of age with various balances of metabolic energy and crude fibre can be seen in Table 2.

Table 2. The value of income over feed and duck cost (IOFD) of male Kamang ducks (3-7 weeks)

Description	CP 17%	CP 18%	CP 19%
Feed consumption (gr)	3443.33	3401.66	3410
Feed + duck costs (IDR)	44.751	45.245	46.106
Feed Price (IDR)	6870.5	7422.5	7656
Final body weight (g)	1168.5	1248.5	1253
Gross Income (IDR)	4675	4994	5012
Income (IDR)	1989	4.697	4.014

High income is the main goal of the duck farm business in the grower phase, which will increase profits. In Table 2 it can be seen that the highest income was obtained in treatment B with the balance of metabolizable energy and crude protein ME/P being 155.5 with metabolizable energy of 2800 kcal/kg and crude protein of 18%. Because treatment B produces a high final body weight with lower feed costs, the cultivation of male Kamang ducks in the grower phase as a source of meat equivalents of EM/P 155.5 is more efficient.

The higher the IOFC value, the better the maintenance will be carried out because a high IOFC means that the income obtained from sales is higher. IOFC is influenced by the income, feed, and seed costs incurred during the research (Ibrahim, 2019). The cheaper the feed price, the greater the gross income received because the gross income obtained from selling chickens is reduced by the price of feed and day-old chickens (DOC) (Ariana et al., 2018).

Percentage of Carcass and Internal Organs in Male Kamang Ducks

The influence of the balance of metabolic energy and crude protein (ME/P) on the percentage values of carcass, internal organs and abdominal fat in the growing phase of male Kamang ducks can be seen in Table 3.

Carcass Percentage

Carcass percentage is the final goal that influences the market and income of the duck farming business. Carcass weight is influenced by strain, sex, husbandry system and management, and age at slaughter, feed and rearing conditions (Baeza et al., 2022). The results of the analysis of variance showed that the carcass percentage values in treatment B (EM/P = 155.55) and treatment C (EM/P = 147.37) were significantly higher ($P<0.05$) compared to treatment A (EM/P = 164.71). This means that the best feed quality and efficiency for male Kamang ducks is at the EM/P balance of 147.37 and 155.55.

The balance of energy and protein influences nutrient adequacy; the carcass percentage indicates whether ducks' nutritional needs are met. High energy reduces feed consumption, and low-energy feed reduces protein deposition (Fang et al., 2019). The higher carcass production indicates that the feed provided is safe and meets the quality and quantity ducks require.

The average carcass percentage of male Kamang ducks in the grower phase as a result of this research was 59.76 – 63.52%; the carcass percentage of Kamang ducks was higher than the carcass percentage of male Tegal ducks, 52.96% (Ramadhan et al., 2019). The results of this research are in line with research by Saragih (2020), which shows that the carcass percentage for 6-week-old Bayang ducks is 58.99 – 61.50%. The results of this research indicate that the male Kamang duck, a local duck from West Sumatra, has potential as a meat producer.

Gizzard

The gizzard, or gizzard in ducks, is oval and has thick muscles. It is located between the proventriculus and the boundary of the small intestine, also called the stomach. This muscle functions in the digestive process to grind food until the food becomes soft. Gizzards have several important functions, such as assisting digestion by reducing particle size, chemical degradation of nutrients, regulating feed flow, and responding quickly to changes in food roughness (Shihus, 2011).

This research shows that based on the results of the variance analysis, there is no significant difference ($P>0.05$) in the influence of EM/P balance on the gizzard weight percentage. This means the EM/P balance is 147.37; 164.71 and 155.55 do not burden the work of the gizzard, so it does not increase the size of the gizzard in Kamang ducks. The size and strength of the gizzard are influenced by the size of the feed particles, the quality and quantity of the ration (Kusmayadi et al., 2019)

Table 3. Percentage of carcass, gizzard, liver, and abdominal fat of male kamang ducks (3-7 weeks)

Treatment	Carcass (%)	Gizzard (%)	Liver (%)	Abdominal Fat (%)
A (CP=17%)	59.76[a]	5.65	2.53	0.83
B (CP=18%)	61.51[b]	5.03	2.42	0.87
C (CP=19%)	63.52[b]	5.43	2.54	0.91

Note: Different superscripts in the same column indicate significantly different ($P<0.05$)

The percentage of gizzard in male Kamang ducks ranges from 5.03-5.65; this result aligns with research by Rohmah et al. (2016), which shows that the percentage of male Tegal ducks reaches 5.45%. The gizzard size of male Kamang ducks is more significant than that of male Magelang ducks 10 weeks old, which is 4.36-4.64% (Hartati et al., 2024).

Liver

The liver is an internal organ in ducks that detoxifies toxins. The liver size in ducks is influenced by feed, breed, sex and liver performance. In Table 4 it can be seen that the balance of metabolic energy and crude protein has no significant effect (P>0.05) on the percentage of liver weight in male Kamang ducks. This means that the energy balance in male Kamang ducks in each treatment A (EM/P = 164.71), B (EM/P = 155.55), and C (EM/P = 147.37) can be used by male Kamang ducks so that it doesn't burden the heart's work. Too high energy content in poultry can increase liver performance and cause fat deposits in the liver (Cui et al. 2022).

The average percentage of liver weight in male Kamang ducks ranged from 2.42-2.54%, and the liver weight in the research results was the standard. Kusmayadi et al. (2019) reported that the liver weight in Ciateup ducks ranged from 1.08-3.09%, while Sandi (2010) stated that the percentage of liver weight in ducks was 2.8-3.8, liver weight increased with increasing giving cassava waste to ducks' rations because of the toxic content in cassava.

Abdominal Fat

Abdominal fat is the layer found around the gizzard and intestines and the layer between the abdominal muscles. The percentage of abdominal fat determines the quality of the carcass. Good carcass quality is low in abdominal fat. The weight of abdominal fat in ducks reflects excessive fat accumulation in poultry, resulting in poor carcass quality.

In Table 3, statistically, there is no significant effect (P>0.05) of the balance of metabolic energy and crude protein on the percentage of abdominal fat in male Kamang ducks. This means that the quality and efficiency of feed, combined with the balance of metabolic energy and crude protein (EM/P) in the male Kamang duck's diet, with a balance of 147.37-164.71, are the same. Feed composition, including metabolic energy and appropriate protein, is a practical and efficient solution to reduce body fat deposits in modern poultry strains (Fouad et al., 2014).

Due to this research, the average abdominal fat of male Kamang ducks is 0.83-0.91%. The results of this study are almost the same as those of Ramadhan's research (2019), with the percentage of abdominal fat in male Tegal ducks being 0.72%. Meanwhile, compared to the percentage of hybrid ducks, the percentage of abdominal fat in Kamang ducks is much lower; the research results by Susanto et al. (2020) show that the percentage of abdominal fat in hybrid ducks aged 45 days is 5.41%.

CONCLUSION

In Farm Kamang ducks as meat sources, good performance in male Kamang ducks in the grower phase is with a balance of metabolizable energy and crude protein (ME/P) of 147.37 to 164.71 with the highest Income Feed and Cost (IOFC) value and the higher of carcass percentage with ME/P 155.55.

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