Research Article

Level of the Use of Salvinia Molesta (Kiambang) as an Eco-Friendly Duck Feed in Indonesia

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Abstract | The study discusses how the Kiambang (Salvinia molesta) affects the productivity of duck feed. The purpose is to propose an alternative duck feed that is affordable and environmentally friendly. Aquatic plants belong to the duckweed family which can be found in swamps, lakes, and rice fields. This feed is classified as an unconventional feed that can be used as an alternative feed ingredient for fibrous protein sources. In addition, it contains several minerals, xanthophyll pigments and -carotene which are important nutrients for ducks. However, the practical use of this plant has not been fully studied. This experimental study used a Randomized Block Design with a Split Plot pattern. The ducks were divided into three groups. Each group is further classified into three weight classes. The variables observed were the number of erythrocytes, hemoglobin levels, hematocrit percentage, the number of lymphocytes, monocytes, heterophils, eosinophils, and basophils. Three treatments of 5%, 10%, and 15% levels of kiambang flour in feed were ready. The variables measured were also ration consumption, weight gain and conversion as well as carcass, and abdominal fat during growth. The experimental results showed that the average feed consumption ranged from 4034.89 to 4207.40 g/head, weight gain was 710.22–889.84 g/head, and conversion was 4.8–5.9. The highest carotid weight was 0.09 m2/head with an average weight of 561.67 g and the lowest carotid weight was 0.05 m2/head with an average weight of 392 g. In addition, the carcass ratio was 55.7%-67.96% with 0.3% belly fat.

Keywords | Duck performance, Salvania molesta (Kiambang), Eco-Friendly duck feed

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INTRODUCTION

Of the total quantity of eggs consumed in Indonesia, over 19% derives from duck eggs while the consumption of duck meat remains low at 0.94% of the total demand for meat in Indonesia (Kataren, 2002). Indonesian people now understand the need for animal protein intake, so the demand for duck meat and eggs is increasing. Consumption of duck eggs increased by 4,763,733 kg in 2008 to 4,782,335 kg in 2010 while, consumption of duck meat increased from 7,010,928 kg to 7,716,573 kg (BPS, 2010). The development of ducks is not only determined by the type of livestock, but also depends on seeds, feed, and maintenance management. One of the factors that need to be considered in maintenance management is the size of the cage because the area of the cage that is not in accordance with the needs of the duck will affect the comfort in the cage. If it is not in accordance with the needs of the ducks, it will also lead to an increase in the accumulation of carbon dioxide and high levels of ammonia in the cage. This condition will cause the slow growth of ducks and make them susceptible to deadly diseases. Under these conditions, it will cause stress to the ducks, if this continues it can lead to a decrease in the immune system in livestock. The decreased immune system function will result in the livestock being susceptible to disease, so livestock production will decrease.

Duck breeders have not paid attention to the size of the cage, thus affecting the growth of ducks due to feeding competition which in turn can affect consumption, weight gain, and costs. conversion. Each duck has its own needs for a suitable cage. If the cage is too small, the accumulation of carbon dioxide increases while the oxygen concentration decreases, resulting in slow growth and high susceptibility to disease. Another factor in intensive farming is the rising cost of feed (60-70%) compared to the total cost of production.

Plants found in nature as aquatic plants that can be added to duck feed are Kiambang (*Salvinia molesta*) in the form of flour which serves as a substitute for duck feed. Efforts to reduce feed prices are by promoting inexpensive and widely available non-conventional feed sources. Kiambang (*Salvinia molesta*) fulfills these requirements. It can be added to feed in the form of flour which is used as a substitute feed for ducks. According to Rosani (2002), Kiambang is a nutritious substitute containing crude protein (15.9%), crude fat (2.1%), crude fiber (16.0%), calcium (1.27%), and phosphorus (0.798%). Kiambang also contains important ingredients such as tannins, polyphenols, and flavonoids. Tannins are anti-nutritional substances, while polyphenols and flavonoids function as efficient anti-oxidants. One type of flavonoid in kiambang is beta carotene. These materials can increase carcass production. The use of cage size accompanied by the administration of kiambang concentration containing antioxidants can restore the blood picture of ducks to normal conditions, it is necessary to research the effect of cage area and administration of kiambang flour on the blood image of ducks.

MATERIALS AND METHODS

Research location

This research was conducted in the stable the Animal Husbandry Technical Implementation Unit of the Faculty of Animal Husbandry, Andalas University, Padang. *Kiambang* leaves (*Silvinia molesta*) studied in this study were collected from *Kotobaru* Lake in the city of Bukittinggi, West Sumatra. This location was selected for the research because it is the only place where Silvinia Molesta grows the most in the region.

Materials and tools used

Materials used consist of 135 one-day-old ducks (DOD) were placed in a cage. In the first week of adaptation of the ducks to the new environment, they were introduced to the feed that would be given during the study. The treatment started at the beginning of the second week and lasted until the end of the tenth week. Equipment twenty-seven wire box enclosures (75 cm x 60 cm x 50 cm) were prepared. Five ducks were placed in each box. The ducks were weighed using a digital weighing device (CHQ) with a capacity of 2 kg. Each cage is equipped with eating and drinking utensils. The heat source is a 65-watt incandescent lamp/box which is used for two weeks as a 65-watt heater.

Experimental design, livestock and diet

Experimental rations were prepared according to the nutritional needs of local ducks according to Wahju (1997).

The materials used consist of yellow corn, bran, soybean meal, fishmeal, top mix, and palm oil. The content of food substances and metabolic energy of the ingredients of the ration are presented in Table 1, the consumption of the ingredients of the ration and the content of nutrients and metabolic energy are in Table 2.

Table 1: Content of feed substances and metabolic energy ingredients for ration.

Feed material	CP (%)	CL (%)	CF (%)	Ca (%)	Posfor	ME (Kkal/kg)
Corn	8.28	2.9	2.66	0.37	0.19	3300
Bran	12.9	4.09	16.15	0.69	0.26	1640
Fish flour	38.00	1.52	2.80	5.50	2.88	3080
Soybean meal	45.00	2.49	7.50	0.63	0.32	2240
Top mix	0.00	0.00	0.00	5.38	0.14	0.00
Palm oil	0.00	100	0.00	0.00	0.00	8600
Kiambang flour	18.32	1.58	21.76	1.72	0.20	2234

Note: (a) Nuraini, et al. (2013); (b) Batubara (2012); (c) Scott et al. (1982); (d) Hasil Analisa Laboratorium Gizi Non Ruminansia (2016).

This research was conducted using the experimental method, Randomized Block Design with Split Plot Design pattern with 3 levels of factor A and 3 levels of factor B with 3 groups. The level of factor A is the main plot, namely the area of the cage and the level of factor B is the sub-plot, namely the concentration of kiambang administration.

The treatment factors are: Main plot (Cage area) A1 = 0.05 m2/head; A2 = 0.07 m2/head; A3 = 0.09 m2/head; Sub-plots (Giving Kiambang Flour); B1 = 5%; B2 = 10%; B3 = 15%.

Data analysis

The data obtained were processed statistically with analysis of diversity according to the Randomized Block Design method with Split Plot Design pattern. The treatment showed a significant effect (F count > F table 0.05), further tests were carried out using DMRT.

Table 2: The composition of the ingredients for the ration and the content of nutrients and energy for the metabolism of ducks.

Food ingredient	P5	P10	P15
Corn	48.5	42.5	37
Bans	15	19	20.5
Soybeen meal	15	14	13
Kiambang flour	5	10	15
Fish flour	12	12	12
Top mix	0.5	0.5	0.5
Minyak	2	2	2
Total	100	100	100
Protein (%)	18.22	18.52	18.65
Fat (%)	3.56	2.70	2.67
Fiber (%)	6.44	7.67	8.82
Kalsium (%)	1.31	1.33	1.33
Fosfor (%)	0,62	0.59	0.55
Me (kkal)	2900	2800	2700

Note: The composition is arranged according to Table 1.

The experimental design mathematical model used is as follows:

$$Yijk = \mu + \alpha i + \beta j + (\alpha\beta)ij + \Sigma ijk$$

Where; Yij= Response obtained from the effect of treatment between i, f, j and k-th test = general mean i = area of cage; j = Giving kiambang flour (5%, 10% and 15%); i = Effect of observation treatment to i (area of the cage); j = Effect of treatment on both levels to j (given kiambang); (αβ)ij = The interaction effect between the i-level factor A and the j-level factor B; ij = Effect of residual from experimental unit; K= Deuteronomy 1, 2, 3

RESULTS AND DISCUSSION

Effect of kiambang use on the number of erythrocytes (106/mm) at the age of 7 weeks

The average number of erythrocytes of Sikumbang janti ducks after being treated at week 7 is shown in Table 3.

Treatment with a concentration of kiambang at week 7 was significant (1.51–1.91) while the cage area at week 7 was not significant. There was no interaction between the width of the cage and the provision of weevils because the treatment that was given did not affect the percentage of erythrocytes in adult Kumbang janti ducks. Based on the analysis of variance, the interaction of cage area and the administration of kiambang concentration at week 7 did not affect the average percentage of erythrocytes in Sikumbang Janti ducks. Based on the results of the DMRT follow-up test, it was shown that the kiambang treatment at week 7 showed a significantly different effect (1.51–1.91) on the average percentage of erythrocytes in Sikumbang janti ducks.

The highest percentage of erythrocytes was found in kiambang 10%, this is presumably due to the influence of saponin active substances on kiambang plants mixed in the feed. Saponins which were deeper in the kiambang ranged from 0.12%, this level was limited to safe. According to Kumar et al. (2005), the recommended tolerance limit is 3.7 g/kg. If the amount given is too high, it will be detrimental to livestock, because it will cause the starch content to bind to saponins (Sent et al., 1998). Saponins can increase the surface tension of erythrocyte cells, over time erythrocytes rupture and eventually cell hemolysis occurs (Cheeke, 2000). Hemolysis is the breakdown of red blood cells so that erythrocytes are released into the plasma (Frandson, 1992). The occurrence of hemolysis will be responded to by the body to carry out homeostasis, then the spinal cord will compensate for the formation of excessive erythrocytes in the form of reticulocytes (pre-erythrocytes) so that the number of erythrocytes will increase. It had no effect indicating that the administration of kiambang up to 15% could still be tolerated by the ducks, this could be seen from the average percentage of duck erythrocytes obtained, which ranged from 1.51-2.07 x 106/mm, and this result was still within normal limits according to Smith et al. (1988) which is about 2.0–3.2 x 106/mm.

Effect of giving kiambang on blood hemoglobin levels (gram/100ml) at week 7

The average amount of hemoglobin in the blood of Sikumbang ducks in the 7th week of treatment is shown in Table 3. The average percentage of duck hemoglobin obtained was also within the normal range, which was

Table 3: The average number of erythrocytes, hemoglobin, hematocrit, lymphocytes, monocytes, heterophils, eosinophils, and basophils at week 7.

Kiambang consumption rate	Erythrocyte	Hemoglobin	Hematocrit	Lymphocytes	Monocytes	Heterophils	Eosinophils	Basophils
B1 (5%)	1.51^{a}	9.8^{b}	36.0	60.44	9.00	27.8	2.22	0.89
B2 (10%)	1.91^{b}	10^{b}	41.3	62.33	7.44	26,33	3.11	0.89
B3 (15%)	1.63^{a}	10.5^{a}	39.3	60.67	6.89	28,67	2.67	1.11

Note: The significant affect the eritrocy and haemoglobin.

around 9.8-10.5g/100 ml, where the normal range of hemoglobin according to Ismoyowati (2012) is 10.81 g/100 ml. The results showed the highest average in B3 (15%) with hemoglobin of 10.5 g/100 ml. This is presumably due to the influence of protein content in kiambang which is around 15.9% (Rosani, 2002). Protein is the main nutrient needed in the formation of red blood cells and hemoglobin. In addition to protein, the content of flavonoid active substances can also increase blood hemoglobin levels. Sugiharto (2004) claims that the content of active ingredients such as flavonoids can increase hemoglobin. This is due to the activity of flavonoids that can increase the work of blood-producing organs so that blood production increases (Wahjuningrum et al., 2008). In addition, hemoglobin levels are also very dependent on the number of erythrocytes in the blood, the greater the number of erythrocytes in the blood, the hemoglobin levels will also increase. This is in accordance with the statement of Winarsih (2005), that hemoglobin levels are highly dependent on the number of erythrocytes because erythrocytes are the largest cell mass in the blood. It is worth noting that hemoglobin is the main protein component in the cytoplasm of mature erythrocytes and accounts for about 90% of the dry weight of erythrocytes (Guyton, 1996). Erythrocytes function to transport O2 and cause red blood (Frandson, 1992).

Effect of kiambang giving on hematocrit value (%) on week 7

In Table 3 the results of the analysis of variance showed the interaction between the area of the cage and the administration of kiambang concentration on the average percentage of duck hematocrit. Sikumbang Janti at week 7 was significantly different. This indicated that the interaction of cage area (5 head/m^2) with the provision of kiambang up to 15% was able to increase the average percentage of blood hematocrit of Sikumbang janti ducks because of the active substance content of flavonoids in the ration which functioned to increase growth hormone. Triyanto (2006) argues that flavonoids can increase growth hormone and enzyme inhibitors by forming complexes with protein and will increase nutritional value so that the formation of red blood cells can continue to increase the value of hematocrit. The results of the variance analysis show the interaction between the enclosure area and giving kiambang concentration to the percentage of duck blood hematocrit. Sikumbang Janti at week 7 was significantly different (36.0 – 41.3).

DMRT further test showed that the interaction of cage area and the provision of kiambang had a significant effect (36.0–41.3) on the average percentage of blood hematocrit of Sikumbang janti ducks. The results showed that the highest average hematocrit percentage was the interaction between B3 (15%) with a mean of 39.3%. The results showed that the interaction of the cage area of the administration of kiambang which was up to 15% increased the blood hematocrit percentage of Sikumbang janti ducks due to the content of flavonoid active substances in the ratio which functioned to increase growth hormone.

Effect of kiambang supplement on lymphocyte value at week 7

The percentage of lymphocytes in the blood of Sikumbang ducks during the 7th week of treatment is shown in Table 3. The results of the analysis of the variance study showed that there was an interaction between the cage area and the administration of kiambang concentration on the average percentage of blood lymphocytes of Sikumbang janti ducks at week 7 not significantly different (60.44 – 62.33). It was seen that the area of cage interaction and the administration of kiambang concentrations at 7 and 10 weeks did not affect the blood lymphocytes of the Sikumbang janti ducks, because the area of the cage used during the study was still tolerable by the ducks. This is because the area of the research cage can still be adjusted by the ducks so that the ducks do not experience a significant impact from the variation in the required cage size.

Likewise, giving kiambang does not affect the average lymphocyte because giving kiambang up to 15% can still be tolerated by ducks so that the process of forming lymphocytes is still running normally. This can be seen from the percentage of lymphocytes obtained ranging from 58.69-63.11%, this result is still within normal limits according to Smith and Mangkoewidjojo (1988) which is around 24-84%. In addition, these results indicate that the active substances of saponins and tannins in kiambang can reduce the stability of the body so that it does not interfere with the health of ducks due to stress. Not only that, but saponins are also able to stimulate anti-immune by forming antibodies (Francis et al., 2002) so that the ducks are still in normal condition. In Table 1 it can be seen that the average percentage of lymphocytes at week 7 gets a fluctuating value, this is because saponins act as immunomodulatory substances that suppress and reduce body resistance.

The effect of giving kiambang to the value of monosit at week 7

The percentage of monocytes, the blood of Sikumbang janti ducks on treatment at week 7 can be seen in Table 3. The results of the variance analysis show the interaction between the enclosure area and giving kiambang concentration to the average percentage of duck blood monocytes at 7th and 10th weeks was not significantly different (6.89–9.00), as well as the extensive treatment of the enclosure and the giving of each kiambang effect was not significant. Based on the analysis of these variations, the wide interaction of the enclosure and the giving the concentration of kiambang at the 7th week didn't significantly affect the percentage of monocyte blood average of Sikumbang Janti.

The percentage of monocyte blood monocytes ranged from 6.89% to -10.33% which is still within the normal range of about 0.0-30% (Smith, 1988). This is due to the role of tannin contained in kiambang. Francis et al. (2002) argue that tannins can stimulate the immune response by forming antibodies in the blood and will trigger producing the interleukin and interferon compounds to be used as communication media between defense cells, and play a role in the mobility of differentiation of leukocyte cells (Francis et al., 2002). Monocytes are a slow line of defense and they increase in the long term. The new monocytes will produce the spinal cord, here monocytes still cannot integrate the foreign body, but after entering the tissue after 8-12 hours the monocyte will swell and will move chemotaxically toward the damaged tissue and already can phytitize foreign objects (Guyton, 1996).

Effect of kiambang administration on heterophil values at week 7

The percentage of blood heterophile of Sikumbang ducks that were treated at week 7 can be seen in Table 3. Giving kiambang with different concentrations was also not significantly different (26.33–28.67) to the average percentage of blood heterophile of Sikumbang Janti ducks. This is presumably because the giving of kiambang up to 15% can still be tolerated by the ducks. However, the active ingredients contained in kiambang, namely flavonoids, can help increase immunity in poultry by increasing phagocytosis, increasing the number of macrophages, and stimulating antibody formation (Bagalkotkar et al., 2006). In this condition the ducks were still in normal condition, it could be seen that the percentage of blood heterophils in the ducks in the study ranged from 20.89% to 29.11%. This result is still in normal conditions according to Tizard (1982) which is around 20-30%.

Effect of kiambang administration on eosinophil value at week 7

The percentage of blood eosinophils in Sikumbang ducks in the 7th week of treatment is shown in Table 3. Based on the analysis of variation, the interaction area of the cage and the administration of kiambang concentrations at week 7 did not affect (2.22–3.11) the blood eosinophil percentage of Sikumbang Janti ducks. This is because the area studied is still able to make the ducks comfortable inside, even though the cage is smaller, but the ducks can still tolerate these conditions. The ducks gave a good response to the concentration of up to 15% kiambang, this can be seen from the percentage of eosinophils in the study which ranged from 2.22% to 3.11%. The results are still within normal limits according to Kresno (2001), which is around 2%-5%. Normal conditions in research ducks, can not be separated from the role of kiambang in feed, although in small amounts, the active substance of saponins can help the percentage of eosinophils return to a stable condition. Judging from the function of saponins as feed additives in the thickening system (Cheeke, 2000). Added by Francis et al. (2002) argue that saponins can stimulate immune cells to increase the formation of antibodies that can act as immunostimulators. According to Kumar (2005), the recommended tolerance limit is 3.7 g/kg. If the amount given is too high, it will be detrimental to poultry, because it will cause the starch content to bind to the saponins (Sent et al., 1998).

The effect of kiambang giving on basophil values at week 7

The percentage of blood basophils of Sikumbang janti ducks after being treated at week 7 can be seen in Table 3. The results of the analysis of variance showed that there was an interaction between the area of the cage and the administration of kiambang concentration on the percentage of blood levels of Sikumbang janti duck basophils at week 7 was not significant (0.89–1.11), it did not affect the interaction area of the cage and the concentration of kiambang. The study showed that the area of the cage did not affect the percentage of blood basophils in Sikumbang janti ducks. Kiambang treatment of up to 15% can still be tolerated by the ducks as it stabilizes them. This can be seen from the percentage of basophils in the study, which is around 0.78%-1.89%. According to Melvin and William (1993), the percentage of normal avian basophils is in the range.

Active substances in kiambang such as saponins can work actively as an immunostimulant to stimulate the non-specific immune system (Winarno, 1997). According to Ganong (1995), basophils function as histamine release in damaged tissue to increase blood flow which will attract heterophils and facilitate tissue repair. Basophils contain heparin, histamine, hyaluronic acid, chondroitin sulfate, serotonin, and several chemotherapeutic factors. Heparin works to prevent blood clotting, while histamine functions as a vasodilator so that basophils come out (Guyton, 1996). In poultry and poultry, basophils participate in hypersensitivity reactions, platelet mediators, and acute inflammatory activity.

The effect of kiambang giving on fee consumption at week 7

The effect of treatment on duck feed consumption during the study can be seen in Table 4.

Table 4: Average of performance (feed consumption (g/head), body weight (g/head), carcass percentage (%), conversion, and abdominal fat g/100g/bodyweight of duck at a week 7 ration.

Factor A (Size of the cage)	Factor B (The effect of level kiambang consumption to 15%)				
	Feed consumption (g/head)	Body weight (g/head)	Conversion	Carcass (g/head)	Abdomen fat (%)
A1 (0.05 m²/head)	799.60	799.60	5.8	47.3	0.2
A2 (0.07 m²/head)	683.93	799.60	5.9	71.2	0.3
A3 (0.09 m²/head)	916.87	916.87	4.8	63.04	0.3
Average	4089,61	750.69	5,5	481	0.27

Note: No significant effect on the performance of kumbang janti ducks.

The above Table 4 shows that kiambang feed substitution of up to 15% did not affect feed consumption of Sikumbang janti ducks because rations with kiambang levels provide the same energy and protein content. In this study, kiambang feed up to 15% had crude fiber content is 21.76 % based on the results of proximate analysis, Laboratory of Non-Ruminant Nutrition, Faculty of Animal Husbandry, Andalas University, Padang. This level of fiber consumption can be tolerated by ducks. Anggorodi (1979) showed that the higher the crude fiber in the feed, the thicker and more resistant the cell walls would be so that the digestibility of the feed decreased (Figure 1). The results showed that the size of the cage and the treatment of kiambang feeding had no effect on the live weight of the ducks and there was no interaction between the size of the cage and the kiambang feed on the average body weight (Figure 2). The average body weight in the cage size treatment was 750.69 g, this result is lower than that of Ricardo's (2014) study because the rearing system in this study was carried out intensively to determine the effect of differences in cage size on duck body weight.

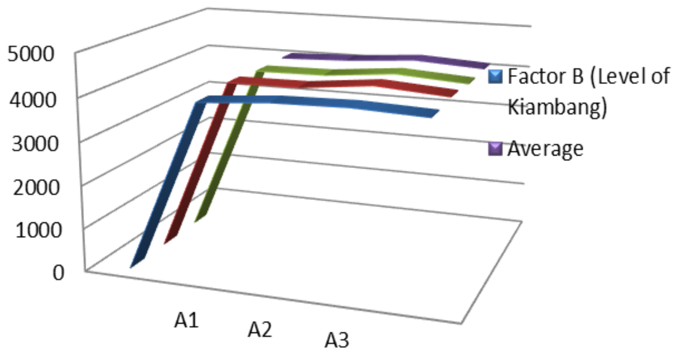

Figure 1: Substitution by kiambang up to 15% of feed did not affect feed consumption of Sikumbang Janti ducks A (raw size cage), B (Kiambang level).

Scott et al. (1982) stated that feed conversion was influenced by the amount of feed consumed and body weight gain. Kiambang turnover of up to 15% does not affect ration conversion. These results indicate that kiambang can be fed to ducks up to 15%. This study showed a feed conversion of 4.8–5.9 with a Kiambang level of up to 15% (Figure 3). Rahmayanti (2015) showed that feed conversion for female Kamang ducks aged 8 weeks ranged from 4.62-5.82 at 20% protein content, while Purba and Ketaren (2011) obtained feed conversions for local male ducks aged 8 weeks ranging from 5 weeks. The average carcass percentage in this study is 62.25%, which is higher than the 44.95% carcass percentage reported by Ricardo (2014) for three types of local ducks (Sikumbang Janti).

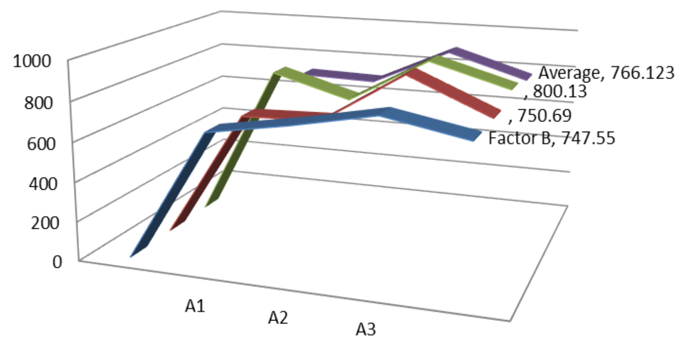

Figure 2: The average body weight in the cage size treatment was 766.123 g.

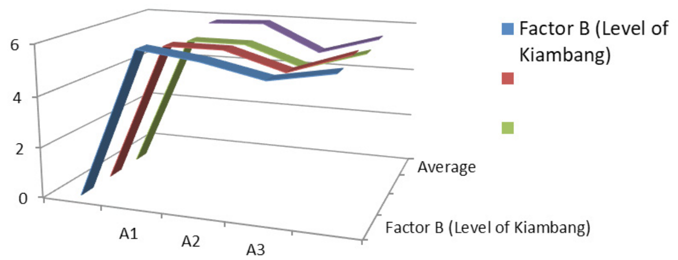

Figure 3: Feed conversion of 4.8 – 5.9 with a Kiambang level of up to 15%.

The result of this study is higher because the intensive maintenance system increased the percentage of carcass production compared to the semi-intensive maintenance system carried out by Ricardo (2014) (Figure 4). Table 1 shows that the percentage of abdominal fat obtained is 0.3% which is lower than that of Setiyanto (2005), where the percentage of local male belly fat is 0.5%. Soeharsono (1977) explained that the accumulation of abdominal fat reduces carcass weight because the fat is removed in the processing process. The substitution of kinambang flour in the feed up to a level of 15% can reduce the percentage of abdominal fat. Kiambang plant contains beta carotene and omega 3 which inhibits the growth of cholesterol in carcasses. The crude fat content of the feed with kiambang flour was not much different from the feed without kiambang flour. Belly fat increases in poultry feed with lower protein content (Thamrin, 1984). According to Sundari (1986), the percentage of abdominal fat will increase with decreasing crude fiber content in the feed.

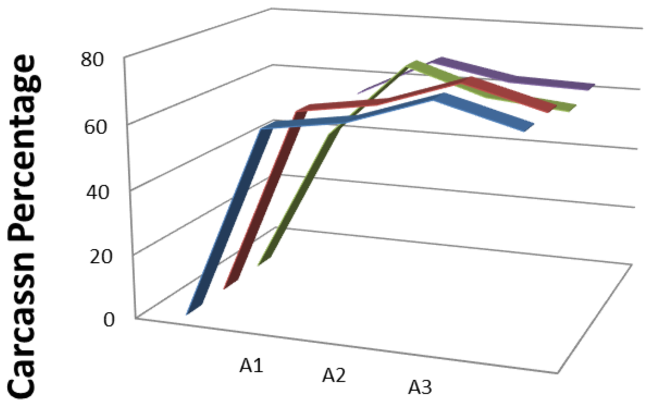

Figure 4: Average percentage of the carcass (62.25%).

CONCLUSIONS AND RECOMMENDATIONS

The study showed that the average feed consumption is 4034.89-4207.40 g/head, and the average weight gain was 710.22-889.84 g/head. Our results also showed that the feed conversion was 4.8-5.9, and the highest carotid weight was obtained in treatment A3 with a box of 0.09 m2/head with an average of 561.67 grams. The lowest carotid weight was obtained in treatment A1 with a box of 0.05 m2/head with an average of 392 grams. The percentage of carcass range is 55.7%-67.96%. The percentage of belly fat of Sikumbang Janti duck is 0.3%. This study has shown the interaction between cage size, feed consumption, body weight conversion, and the percentage of carcass and belly fat of ducks. This study also showed that there was no effect on the development of Sikumbang Janti ducks with a mixture of kiambang flour up to 15% in the feed. More studies are needed to evaluate the effect of Salvinia Molesta (kiambing) feed on other species of ducks.

NOVELTY STATEMENT

This study argues that Kiambang (Salvinia molesta) processed in the form of flour can be used as an affordable substitute for duck feed.

AUTHOR'S CONTRIBUTION

All the authors equally contributed in this study.

CONFLICT OF INTEREST

The authors have declared no conflict of interest.

REFERENCES

Anggorodi R (1979). Ilmu Makanan Ternak Umum. Gramedia, Jakarta.

Bagalkotkar G, Sagineedu SR, Saad MS, Stanslas J (2006). Phytochemicals from Phyllanthus niruri Linn and their pharmacological properties review. J. Pharm. Pharmacol., **58**: 1559–1570. https://doi.org/10.1211/jpp.58.12.0001

Batubara L (2012). Pengaruh penggunaan jamur tiram (*Pleuterus ostreatus*) dalam ransum terhadap total kolestrol, HDL, LDL plasma darahayam broiler. Skripsi. Fakultas Peternakan Universitas Andalas, Padang.

BPS (2010). (Central Bureau of Statistica). Sumatera Barat Dalam Angka 2010.

Cheeke PR (2000). Saponin: Surprising benefits of desert plant. Artikel. http://www.ipi.oredonstate.edu/sp-sbdp/saponins.html [18 February 2017].

Francis G, Zohar K, Harinder PS, Makkar HP, Becker K (2002). The biological action of saponin in animal systems: A review. J. Nutr. Br., 88: 587-605. https://doi.org/10.1079/BJN2002725

Frandson RD (1992). Anatomi dan Fisiologi Ternak. Edisi ke-4. B Srigandiono, Koen P, penerjemah. Yogyakarta: Gajah Mada University Press. Terjemahaan dari. Anat. Physiol. Farm Anim. Hlm, pp. 395- 408.

Ganong WF (1995). Buku Ajar Fisiologi Kedokteran, Kedokteran EGC, Jakarta.

Guyton AC (1996). Buku Ajar Fisiologi Kedokteran. Edisi ke-17. Bagian1. Ken Ariata Tengadi, Penerjemah. EGC. Terjemhan dari texbook of Medical Physiology.

Ismoyowati, Samsi M, Mufti M (2012). Different haemato and comfort of muscovy duck and local duck research peternakan. Univ. J. Soedirman, Purwokerto.

Kresno SB (2001). Imunologi (Diagnosis dan Prosedur Lanoratorium0 Edisi ke empat, Jakarta: Bagian Patologi Klinik Fakultas Kedokteran Universitas Indonesia.

Kumar V, Elangonvan AV, Mandal AB (2005). Utilization of reconstituted high-tanin sorghum in the diets of broiler chickens. Asian-Aust. J. Anim. Sci., 18(3): 538-544. https://doi.org/10.5713/ajas.2005.538

Melvin JS, William OR (1993). Duke's physiology of domestic animal. Ed ke-11. London: Cornel University Press.

Nuraini M, Mahata E, Nirwansyah (2013). Response of broiler fed cocoa pod fermented by phanerochaete chrysosporium and monascus pupureus in the diet. Pak. J. Nutr., 12(9): 886-888. https://doi.org/10.3923/pjn.2013.886.888

Purba M, Ketaren P (2011). Konsumsi dan konversi pakan itik lokal jantan umur delapan minggu dengan penambahan santoquin dan vitamin E dalam pakan. Balai Penelitian Ternak, Bogor.

Rahmayanti M (2015). Skripsi: Pengaruh kepadatan kandang dan level protein terhadap performans itik kamang betina periode starter. Universitas Andalas, Padang

Ricardo AY (2014). Skripsi: Gambaran bobot hidup, karkas, persentase karkas, dan lemak abdomen tiga jenis itik lokal di pembibitan itik "ER" di Payobasung Payakumbuh. Universitas Andalas, Padang.

Rosani U (2002). Performa itik lokal jantan umur 4-8 minggu dengan pemberian (*Salvinia molesta*) dalam ransumnya.

Institut Pertanian Bogor. Bogor. (Skripsi S1).

Scott ML, Nesheim MC, Young RJ (1982). Nutrition of the Chicken. 3rd Ed. M.L. Scott and Associates, Ithaca, New York.

Sent S, Harinder PS, dan Klaus B (1998). Alfalfa saponins and their implication in animal nutrition. J. Agric. Food Chem., 46: 131-140. https://doi.org/10.1021/jf970389i

Smith JB, dan Mankoewidjojo S (1988). Pemeliharaan, pembiakan dan penggunaan hewan percobaan di daerah tropis. Jakarta: UI-Press. Hlm, pp. 122-123.

Soeharsono (1977). Respon broiler terhadap berbagai kondisi lingkungan. Disertasi. Universitas Padjajaran, Bandung.

Sugiharto (2004). Pengaruh infus rimpang temulawak (*Curcuma xanthorrhiza*) terhadap kadar hemoglobin dan jumlah eritrosit tikus putih yang diberi larutan timbal nitrat [(Pbno3)2]. J. Biol. Res., 10(1): 53–57. https://doi.org/10.23869/bphjbr.10.1.200410

Sundari KM (1986). Toleransi ayam broiler terhadap serat kasar, serta detergen asam, lignin, dan silika dalam ransum yang mengandung tepung daun alang-alang. Disertasi. Fakultas Pasca Sarjana IPB, Bogor.

Thamrin A (1984). Pengaruh ransum dan galur ayam terhadap pembentukan lemak tubuh. Tesis. Fakults Pasca Sarjana IPB, Bogor.

Triyanto A (2006). Profil darah putih dan kolesterol ayam pedaging yang diberi ransum mengandung tepung daun sambiloto (Andrographis paniculata Nees). Tesis. Bogor (ID): Institut Pertanian Bogor.

Wahju J (1997). Ilmu nutrisi unggas. Cetakan keempat. Gadjah Mada University Press, Yogyakarta.

Wahjuningrum D, Ashry N, dan Nuryati S (2008). Pemanfaatan ekstrak daun ketapang (*Terminalia cattapa*) untuk pencegahan dan pengobatan ikan patin (*Pangasionodon hypophthalmus*) yang terinfeksi Aeromonas hydrophila. J. Akuakultur Indones., 7(1): 79–94. https://doi.org/10.19027/jai.7.79-94

Winarno FG (1997). Kimia Pangan dan Gizi. Jakarta. Gramedia Pustaka Utama.

Winarsih W (2005). Pengaruh probiotik dalam pengendalian slamolelosis subklinis pada ayam gambaran dan patologis dan performan. Thesis Pasca Sarjana. Institut Pertanian Bogor. Bogor.