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Performance and Carcases Percentage of Pekin Duck Supplied with Sago Pith Silage as an Energy Source

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ABSTRACT

Sago (Metroxylon sago, Rottb) is one of the most potential sources of food and energy, bu sago pith's use is limited due to its high crude fiber content, low protein content, and short shelf life. The purpose of this study was to determine the optimal level of use of sago pith silage to replace rice bran in the ration on the production performance of male Pekin ducks. The research treatments included: T0 = No sago pith silage (control), T1 = Use of 5% sago pith silage in the ration, T2 = Use of 10% sago pith silage in the ration, T3 = Use of 15% sago pith silage in the ration, T4 = Use of sago pith silage 20% in the ration. The experimental diet contained of 16% crude protein and 3000 kcal/kg metabolizable energy. The Pekin ducks used in this experiment were two weeks old. The research design used was a complete randomized design using five feeding treatments, five replications, and four ducks per replication pens. The parameters measured were feed intake, weight gain, body weight, feed conversion, the percentages of carcass, giblet, and abdominal fat at eight weeks of age. The results showed that the use of sago pith silage had no significant effect on feed consumption, weight gain, body weight, feed conversion, and the percentages of carcass and giblet. However, the use of sago pith silage increased abdominal fat. It can be concluded that the use of sago pith silage up to 20% to replace rice bran in the ration has no negative effects on the performance and carcass quality of Pekin ducks.

Keywords: Carcass, Pekin duck, Performance, Sago pith silage

1. Introduction

The duck is one of the livestock that produces meat and eggs, which contributes to meeting the animal protein needs of the community. In Indonesia, in terms of number and contribution to production, it ranks second after chickens, especially modern broiler chickens that produce meat and egg-producing layers. Ducks are reared extensively, semi-intensively, and intensively (Sulaiman & Rahmatullah, 2011; Tai & Tai, 2001)

Duck meat has remained popular in recent years, particularly in several Asian countries such as China, Hong Kong, Japan, Korea, and Taiwan. Duck breeds frequently farmed for meat and eggs include Pekin, Muscovy, Khaki Campbell, Indian Runner, and mule ducks. Duck meat and eggs provide a lot of protein and iron (Adzitey, 2011; Tai and Tai, 2001).

Feed is one of the most important aspects of any farming operation. Feed accounts for roughly 70% of total production costs (Singh et al., 2009). Imports of feed, feed ingredients, and supplements are common in commercial duck production. This raises production costs and does not help rural duck farmers who cannot afford the feed ingredients and supplements they produce. Rural duck producers, on the other hand, can rely on the natural ability of ducks to increase production. This eliminates the need for feed supplementation (manufacturing), resulting in even lower feed costs. Non-conventional feed ingredients have been shown to be valuable feed for poultry, both as feed ingredients and waste materials such as raw materials and by-products such as copra meal, pea nut meal, palm kernel, rice bran, broken rice, finger millets, groundnut cake, sesame cake, and many more (Adzitey & Adzitey, 2011; Adzitey et al., 2010).

Sago (Metroxylon sago, Rottb) is one of the most potential sources of food and energy. The total area of sago plantations in the world is two million hectares, and about 60% of the world's sago area is in Indonesia, 90% of which is spread in Papua and West Papua. It was reported that the total area of sago in Indonesia in 2011 was estimated at 100,616 ha, which is sago cultivation or semi-cultivation. Sago plants are widely spread in Indonesia, especially in Papua, West Papua, Maluku, North Sulawesi, Central Sulawesi, Southeast Sulawesi, South Sulawesi, South Kalimantan, West Kalimantan, Jambi, West Sumatra (Mentawai), and Riau (Puslitbang Pertanian, 2013). While data from the (Directorate General Estate, 2021) shows that the area of Indonesia's sago palms in 2017 (306,805 ha), 2018 (311,954 ha), 2019 (196,831 ha), 2020 (200,518 ha), and 2021 (206,150 ha), tends to decrease by 36.90%, especially for the year 2018-2019.

South Kalimantan has an area of sago plantations from 2017 to 2021 of 6510 ha, 6511 ha, 4990 ha, 4916 ha, and 4995 ha, which means that it has decreased or negative growth of -23.33%. (Directorate General Estate, 2021). Sago plants grow naturally in freshwater swamp areas where other crops find it difficult to grow. Sago, either in the form of sago pith or sago pulp, is one of the non-conventional feed ingredients that is often used for ducks. However, sago pith or sago pulp have weaknesses as animal feed ingredients, especially for poultry, because of low crude protein and high crude fiber.

According to Wina et al. (1986), who examined the content of sago pith from South Kalimantan, the composition was (fresh weight) 56% moisture, 26.8% starch, 1.2% free sugar, 0.36% crude protein, 1.96% cellulose, 0.39% lignin, 1.23.0% ash, 0.09% Ca, 0.23% K. Meanwhile, according to (Sinurat, 1999), who states that based on proximate analysis, sago pith contains 2.95% crude protein, 1.44% crude fat, 16.47% crude fiber, 0.19% calcium, 0.05% phosphorus, 12.88–17.88% water content, 0.05–0.28 ash% and metabolic energy (EM) of 2900 Kcal/kg. Sago pulp contains 16.01% crude fiber and 2.01% crude protein, and the crude fiber component consists of 10.62% cellulose, 1.56 hemicellulose, and 1.67% lignin (Zulkarnain et al., 2017). However, sago pith's use is limited due to its high crude fiber content, low protein content, and short shelf life. Diets with high fiber are bulky and voluminous (Suciani et al., 2011), and cause the rate of passage of feed in the digestive tract to increase (Hetland & Svihus, 2001).

Efforts to increase the utilization of sago pith can be made through the application of fermentation technology because the fermentation process is expected to increase the crude protein content and reduce the crude fiber content. One application of fermentation technology in feed is the manufacture of silage, which allows the process of overhauling components of ingredients that are difficult to digest to become easier, increases the nutritional value, and can extend the shelf life of feed ingredients, so that if given, it can improve the performance of poultry. Probiotics such as SBP (Feed Burger Sauce) are inoculants for making silage from feed ingredients, where probiotics contain nutrients, vitamins, minerals, lactic acid microbes, cellulolytic microbes, amylolytic microbes, and other good microbes (Khan et al., 2004; Ridwan et al., 2005).

The purpose of this study was to determine the optimal level of use of sago pith silage to replace rice bran in the ration on the production performance of male Pekin ducks. The results of this study are expected to be useful for increasing the use of sago pith as feed in increasing productivity and the success of broiler duck farming.

2. Materials and Methods

Materials

The experiment of feeding sago pith silage was carried out for 10 weeks, with 2 weeks as a preliminary. The research was carried out at the Poultry Laboratory and the Nutrition and Animal Feed Laboratory, Faculty of Agriculture, ULM Banjarbaru, as a place for laboratory testing of samples. This study used a completely randomized design (CRD) with five treatments and five replications, where each replication consisted of four Pekin ducks, so that the total number of DOD used was 100. The pekin ducks are placed in a bamboo cage measuring 70 cm x 50 cm x 70 cm in length, width, and height. The research treatment was sago pith silage in the form of flour on male Pekin duck feed as a substitute for rice bran.

Methods

The research treatments included: T0 = No sago pith silage (control), T1 = Use of 5% sago pith silage in the ration, T2 = Use of 10% sago pith silage in the ration, T3 = Use of 15% sago pith silage in the ration, T4 = Use of sago pith silage 20% in the ration. The composition of the ration in this study was according to NRC (1994). In the starter phase (0–2 weeks), ducks were given a commercial ration from the factory with a content of 22% CP and 2900 kcal/kg ME. Then, in the finisher phase (3–8 weeks), they were given treatment rations (T0, T1, T2, T3, and T4) with isoprotein/nitrogen (CP 16%) and isocalories (ME 3000 kcal/kg). Sago silage was made from grated sago pith which was given a mixture of probiotic solution SBP (Saus Burger Pakan) and brown sugar as a fermentation material. The mixture is then stored in a tightly closed (anaerobic) container. Fermentation was carried out for seven days before being used as a feed ingredient. The results of the proximate test of sago pith material and pith silage can be seen in Table 1 and the composition of the ration in this study is presented in the Table 2.

Table 1. The Nutritional Composition of Sago Pith Silage

	Sago Pith	Sago pith silage
Dry Matter (%)	91.51	88.72
Crude Protein (%)	1.88	1.81
Crude Fiber (%)	6.64	6.55
Crude Fat (%)	0.53	0.74
Ash (%)	4.36	2.91
NFEC (%)	86.59	87.99
ME (kcal/kg)	3141.5	3205.9

Notes: Based on proximate analyses of Nutrition and Animal Feed Laboratory, Faculty of Agriculture, ULM, NFEC (Nitrogen-Free Extract Contain), ME (Metabolic Energy)

Table 2. Arrangement of Experimental Feed Ingredients

	T0	T1	T2	T3	T4
Sago pith silage	0	5	10	15	20
Protein Source Concentrate	28	29	30.6	31.9	33.4
Rice Bran	63	58.2	52	46.2	40
Coconut Oil	9	7.8	7.4	6.9	6.6
Jumlah (%)	100	100	100	100	100
Crude Protein (%)	16.04	16	16.04	16.01	16.01
Crude Fiber (%)	14.15	10.26	12.79	12.04	11.23
ME (kcal/kg)	3044.43	3000.67	3005.8	3005.28	3016.87
Feed Price (Rp/kg)	5600	5400	5300	5100	5065

Notes: ME (Metabolic Energy)

Table 3. Feed consumption, feed conversion, body growth, body weight, carcass percentage, giblet percentage, and abdominal fat of treated Pekin ducks

	Feed Cons (g)	Feed Conv	Body Growth (g)	Body Weight (g)	% Carcass	%Giblet	%Abd Fat
T0	6709.57 ± 94.28	4.20 ± 0.05	1190.19 ± 28.05	1604.06 ± 28.66	70.04 ± 0.37	8.35 ± 0.27	1.42 ± 0.12^{a}
T1	6847.14 138.84	4.09 ± 0.08	1284.31 ± 16.61	1690.63 ± 14.46	68.59 ± 1.51	8.12 ± 0.43	1.58 ± 0.13^{ab}
T2	6969.06 ± 119.86	4.37 ± 0.12	1206.56 ± 40.83	1610.31 ± 41.55	67.69 ± 0.93	8.18 ± 0.29	1.97 ± 0.16^{bc}
T3	6613.51 ± 274.17	3.98 ± 0.17	1245.31 ± 20.92	1665.63 ± 21.59	69.04 ± 0.46	8.07 ± 0.30	2.17 ± 0.10^{c}
T4	6855.96 ± 71.32	4.33 ± 0.06	1205.63 ± 30.48	1610.00 ± 27.17	71.27 ± 0.78	7.54 ± 0.55	2.02 ± 0.18^{c}

Mean ± SEM

The observed variables were feed consumption, live weight gain, feed conversion, final weight, carcass weight, carcass percentage, giblet percentage (heart, liver, gizzard), and abdominal fat percentage. All data was analyzed for variance, and if there were differences, it would be continued with Duncan's Multiple Range Test (DRMT).

3. Results and Discussion

Performance of Pekin Ducks

The results of measurements of feed consumption, live weight gain, feed conversion, final weight, carcass percentage, giblet percentage, and abdominal fat percentage are shown in Table 3. The results of the analysis of variance showed that sago pith silage had no significant effect on feed consumption, weight gain, final weight, feed conversion, carcass percentage, and giblet percentage of Pekin ducks reared up to the age of eight weeks. However, sago pith silage had a significant effect on the abdominal fat percentage of Pekin ducks.

The consumption of feed for Pekin ducks fed with feed containing sago pith silage was not different from the control. This result is in accordance with the results reported by (Hehanussa et al., 2018), which found no effect of giving sago pulp on MA (crossing Mojosari-Alabio), which also confirmed the findings of Antawidjaja et al. (1997), who also concluded that the provision of unfermented or fermented sago dregs (Metroxylon sago) in duck rations had no significant effect on ration consumption. However, this result is different from that reported by (Subhan et al., 2009), which states that there is a significant effect of increasing the consumption of MA male duck rations by giving steamed sago combined with gold snail flour.

Although not significantly different, Table 3 shows that the ration consumption tends to be higher in the P2 treatment (10%), which is 6969.1 grams/head/6 weeks, while the ration consumption tends to be lower in the T3 treatment, which is 6613.5 grams/head/six weeks. The results of this study show that replacement of bran with sago pith silage did not decrease the palatability of the ration, as indicated by the not decreasing ration consumption compared to the control (T0). This is in accordance with the finding of Subhan et al. (2009). It is good to consume duck feed in the experiment because the addition of steamed sago gives a fresh aroma, so that its palatability increases.

The lack of effect of sago pith silage on ration consumption was also thought to be due to the relatively same metabolic energy and crude protein content of the rations (iso calorie and protein iso), namely the ME of the treatment rations ranged from 3000.67–3044.43 kcal/kg., and crude protein (CP) 16.00–16.04%. Zuprizal (2006) also said the same thing, that the main limiting factor that is directly related to appetite is the energy needs of poultry.

The growth of Pekin ducks fed with feed containing sago pith silage was not different from the control. This result was in accordance with the results reported by Hehanussa et al. (2018), which found that there was no effect of giving sago pulp on MA duck crosses, and also in accordance with what was reported by Subhan et al. (2009), which stated that there was no effect of giving steamed sago combined with golden snail flour on MA male ducks.

Likewise, the final weight of Pekin ducks was not affected by silage giving sago pith, where the final weight of the treatment had an average of 1610.00 g (T4) to 1690.63 g (T1), which was relatively larger than the control weight of 1604.06 g/head. This was in line with the difference in cumulative body weight gain of experimental Peking ducks as well as ration consumption, which did not differ for each treatment. This finding is in accordance with the conclusion by Hehanussa et al. (2018) that the growth rate and final weight of MA ducks treated with sago dregs did not differ due to no difference in ration consumption.

The results of the analysis of variance showed that the use of sago pith silage up to 20% had no effect on the feed conversion of Peking ducks reared up to eight weeks of age. Treatment conversion ranged from 3.98 (T3) to 4.37 (T2), not different from control at 4.20 (T0). This result is in accordance with the results of Subhan et al. (2009), which stated that the use of steamed sago and gold snail flour had no significant effect on feed conversion for MA male ducks, with a conversion value of between 3.45 and 3.86. Likewise, Hehanussa et al. (2018) stated that the use of sago pulp in the ration had no significant effect on feed conversion for MA ducks, ranging from 4.35 to 4.96. These results illustrate that sago pith silage can be utilized to a level of 20% in pekin duck rations without affecting feed conversion. The addition of sago pith silage had no effect on feed conversion because the average feed consumption and weight gain were relatively the same for each treatment.

Protein and energy are the first nutritional requirements to consider when designing a diet, not only because they are the most expensive dietary components, but also because they have an impact on the productive and reproductive performance of flocks for meat or egg production (Fouad and El-Senousey, 2014). Thus, based on the growth performance, they recommended 3,000 kcal of apparent metabolizable energy (AME)/kg when the diet contains 18% crude protein (CP). Furthermore, the requirement of protein and energy of ducks was calculated based on growth performance and carcass quality (Fouad et al., 2018)

Carcass, Giblet, and Abdominal Fat Percentage of Pekin Ducks

Carcass is a component of the Peking duck body after being cut and processed by evisceration, namely removing the head, feathers, shanks, and digestive parts. The results of the analysis of variance showed that the provision of sago pith silage up to 20% of the ratio did not significantly affect the percentage of carcasses and giblets. There was a trend of a linear increase in carcass percentage from T1 (5%) to T4 (20%), from 68.59% to 71.27%, but it was not different from control (T0).

These results are in agreement with Subhan et al. (2009), who also found that there was no effect of steamed sago and gold snail flour on the percentage of MA duck carcasses, which ranged from 59.70 to 61.10%. Similarly, the results of Hehanussa et al. (2018) found the percentage of carcasses ranged from 60.98–63.45% and tended to decrease with the addition of sago pulp in the ration, although statistically it had no significant effect. to the percentage of carcasses. This shows that sago pith silage can be used in duck rations up to 20% without affecting the carcass percentage.

According to Soeparno (2005), the percentage of carcass is influenced by growth rate and feed quality, and the large percentage of non-carcass will affect the percentage of carcasses. This is because carcass weight is related to final live weight (Subhan et al., 2009). Wickramasuriya et al. (2016) investigated increasing energy levels (2,600 to 3,300 kcal of AME/kg) and discovered that native Korean ducks require 2,900 kcal of AME/kg with 18 CP percent from hatching to 21 days of age to maximize productive performance and carcass weight. Fan et al. (2008) investigated the effects of energy levels on performance and carcass quality in Pekin ducks ranging in age from two to six weeks. According to Fan et al. (2008) findings, increasing the AME/kg energy level from 2,600 to 3,100 kcal had a positive effect on productive performance but a negative effect on carcass quality by increasing body fat deposition. Xie et al. (2010) proposed 2,900 kcal of AME/kg with 20.5 % CP for male White Pekin ducks during the first 3 weeks of age when energy levels ranging from 2,450 to 3,050 kcal of AME/kg were tested.

Giblet is an edible component, consisting of liver, heart, and gizzard. The average percentage of giblets of Peking ducks aged eight weeks was obtained between 8.07% (T4) and 8.35% (T0), which seems to tend to decrease and is lower than the average percentage of giblets of Peking ducks obtained by Sari et al. (2013) with a range of 12.07% to 16.21%. The giblet component tends to decrease with age. This is because the giblet is an organ that grows early, so that at a young age the percentage of live weight is greater. As stated by Murawska (2012), the percentage content of giblets decreased with age (in contrast to the remaining edible portions), from 10.1% total body weight (BW) in first week to 5.3% in eight week. Over that period, the share of the liver, gizzard, and heart decreased by 2.5% (from 4.3% to 1.9%), 2.0% (from 4.8% to 2.8%), and 0.4% (from 1% to 0.65%), respectively. Furthermore, Murawska (2012) stated that total muscle weight, breast muscle weight, leg muscle weight, and gizzard weight were higher in males than in females.

Abdominal fat is part of the carcass, which is a fat deposit that forms with the growth of the Pekin duck. Fat deposits are found in the intense part of the lower abdomen. In this study, the percentage of abdominal fat was the only parameter that showed a significant difference between the experimental treatments, where the higher the utilization of sago pith silage, the higher the percentage of abdominal fat in the treated Pekin duck carcass. Treatment T3 (2.17%) was the highest but not significantly different from T2 and T4, while control (1.42%) was the lowest but not significantly different from T1 (1.58). This result is different from that of Subhan et al. (2009) and Hehanussa et al. (2018), who found no significant effect of the use of sago on the percentage of abdominal fat. Further, Hehanussa et al. (2018) stated that there was a tendency for lower abdominal fat levels to be accompanied by the greater use of sago pulp in MA duck rations due to the increase in crude fiber rations. According to Subhan et al. (2009), the abdominal fat of MA ducks fed a combination of steamed sago and golden snail flour ranged from 1.04 to 1.68 %, while according to Hehanussa et al. (2018), the abdominal fat of MA ducks given sago dregs ranged from 0.67% to 0.97%. As stated by Murawska (2012), the percentage of abdominal fat in poultry will increase with age. The carcasses of one-week-old birds contained only 0.37 g of abdominal fat, and abdominal fat weight increased around 200-fold by eight weeks of age.

According to Fouad & El-Senousey (2014), one of the nutritional factors that can regulate the accumulation of abdominal fat includes energy, protein, and amino acid levels in the feed. The high crude fiber content in the ration can reduce cholesterol and fat levels in the poultry body. The ration in this study contained the same energy-protein balance, causing relatively the same nutrient consumption, but the fermentation treatment of sago pith was thought to cause a decrease in the crude fiber content of the feed, thereby increasing the absorption of nutrients, especially carbohydrates, in the feed, thereby leading to increased abdominal fat deposits in the treated pekin ducks. It can be concluded that sago pith and even sago pulp can still be used as an alternative source of energy for ducks, although it has limitations due to its low crude protein content and high crude fiber (Hehanussa et al., 2018; Zulkarnain et al., 2017)

In this study, sago pith could be used up to 20% to replace rice bran, and fermentative silage treatment improved its nutrition by decreasing the crude fiber content of the feed. In addition, with the increasing use of sago pith silage, the price of feed/kg becomes relatively cheaper (Table 2). However, the declining natural resources of sago palms in South Kalimantan need attention.

4. Conclusions

Based on the results and discussion, it can be concluded that sago pith silage can be used in rations of Pekin ducks up to 20% to replace rice bran as an energy source without reducing ration consumption, growth, final weight, feed conversion, weight, or carcass quality. There was an increase in abdominal fat with increasing use of sago pith silage due to the decrease in crude fibre of feed due to fermentation, but still in normal amounts.

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Conflict of Interest

Authors declare no conflict of interests.

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