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Original Research

Utilization of Fermented Sago Pulp and Effect on the Performance of Broiler Ducks

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Abstract

The purpose of this study was to evaluate the performance of broiler ducks fed ration based on fermented sago pulp using 96 of day old ducks (DOD). The treatment were T0 = 100% commercial ration, T1 10% fermented sago dregs; T2 20% fermented sago pulp, T3 = 30% fermented sago pulp. The design used was a completely randomized design (CRD) consisting of 4 treatments, each treatment was given 4 replications and consisting of 6 DOD. Application of sago pulp for 8 weeks, including 1 week as a pretreatment for adaptation. The results showed that the fermented sago dregs did not have a significant effect (P>0.05) on the average feed consumption and feed conversion of broiler ducks, but had a significant effect (P<0.05) on the average final body weight and weight gain. Histological observations of the intestinal villi showed that fermented sago pulp changed the structure of the villi. Statistical results showed that the width, height, and intestinal surface area of the intestinal villi had a smaller significant effect on each treatment than control. Based on the results of the research, it can be concluded that fermented sago pulp significantly reduced the characteristics and histology of the duck intestine.

Keywords: sago pulp, fermentation, duck, performance, villi

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Introduction

One important factor in increasing livestock production is the ration. Ration costs high in duck farming, the total production cost spent on ration needs is 70% [1]. Therefore one solution to reduce the cost of rations is by utilizing agricultural waste which has the potential to be an alternative feed raw material in the surrounding area. Aceh Province Aceh has good potential for sago plants to produce solid waste from the sago flour industry in the form of sago pulp. Meanwhile Aceh is one of the 8 largest provinces that have sago products (Riau, Papua, Maluku, South Kalimantan, Riau Islands, South Sulawesi, Southeast Sulawesi and Aceh) [2].

Sago waste (Metroxylon sago Rottb) is an agricultural waste that can be used as an alternative animal feed. Sago dregs is solid waste in the manufacture of sago flour. Processing sago into sago flour produces solid waste and liquid waste. Sago solid waste has not been utilized optimally for poultry feed. Whereas sago pulp contains 76.51% BETN, 11.68% water, 3.38% crude protein, 1.01% crude fat, 12.44% crude fiber, and 4.1% ash [3]. However, its use as animal feed cannot be given directly because it has a high crude fiber content of around 12-20% and a low crude protein of 0.1-3.1% [4]. Due to the high crude fiber, the pulp is only used as ruminant feed, whereas sago pulp also has considerable potential as poultry feed. Therefore, it is necessary to ferment to improve nutritional value and reduce crude fiber content. Fermentation is a process of breaking down complex compounds into simpler compounds by involving microorganisms. The results of research on fermented feed ingredients generally show an increase in nutritional quality by reducing the crude fiber content of the feed ingredients. Fermentation causes a number of proteins, carbohydrates and fats to be broken down into smaller fractions to facilitate digestion and absorption of nutrients [5]. Sago pulp after being fermented increases the crude protein content by 1.15% [6].

Material and Methods

This research was conducted at the Animal Husbandry Field Laboratory, Department of Animal Husbandry, Faculty of Agriculture and Histology Laboratory, Faculty of Veterinary Medicine, Syiah Kuala-Darussalam University. The experimental livestock used in this study were 96 day old day (DOD) Peking ducks. This study used feed ingredients consisting of commercial feed BR 511, sago pulp which was fermented anaerobically using EM 4 for 14 days, several feed ingredients such as fish meal, corn, oil, fine bran, cassava flour and coconut meal. The research parameters observed were performance which included ration consumption, ration conversion, body weight gain and body weight, as well as intestinal histology, width, height and surface area of the small intestine.

Results and Discussion

Feed Consumption

The average feed consumption of Peking ducks fed rations containing fermented sago pulp can be seen in Table 1. The results of the second week of analysis of variance showed that feeding fermented sago pulp had a significant effect ($P<0.05$) on Peking duck feed consumption. The lowest amount of feed consumption was obtained in the T3 treatment, namely 1219.25 grams, namely the 30% fermented sago pulp treatment. Meanwhile, the highest average feed consumption rate was obtained in the T0 (organic) treatment. Treatments T1, T2, and T3 in certain weeks

Table 1. Average Peking Duck Feed Consumption (g/head/week).

Week	Treatment			
	T0	T1	T2	T3
1	556.75	551.75	559.75	556.25
2	1255.75^{a}	1250.50^{ab}	1228.50^{bc}	1219.25^{b}
3	1771.00	1848.00	1771.00	1848.00
4	2656.50	2772.00	2656.50	2772.00
5	2919.00	3010.00	2919.00	3001.00
6	2497.25^{b}	3140.25^{a}	2463.50^{b}	2817.75^{ab}
7	6668.50^{b}	8547.50^{a}	7040.25^{ab}	8216.75^{ab}
8	8265.25	9760.25	8977.50	8103.25
Average	3233.7	3588.4	3376.75	3256.1

Description: T0: Without adding fermented sago dregs, T1: Adding 10% fermented sago dregs, T2: Adding 20% fermented sago dregs, T3 : Adding 30% fermented sago dregs.

significantly reduced the average ration consumption compared to treatment T0. However, in general, from the average total consumption, this is thought to be due to the treatment ration having a more voluminous or bulky impact on the digestive tract so that the ducks stop eating when the digestive tract is full.

However, the impact of providing crude fiber content on the consumption of broiler ducks, the higher the crude fiber ration significantly increased the ration consumption [7]. Another allegation is that the low average feed consumption is closely related to energy adequacy, if livestock have sufficient energy, these livestock will stop eating [8].

Body Weight Gain

Body weight gain is defined as an increase in the shape and weight of tissues such as muscles, bones, heart and all other body tissues. The average body weight gain is presented in Table 2.

Analysis of variance showed that differences in the feeding of fermented sago pulp in several weeks had a significant effect (P<0.05) on body weight gain of broiler ducks. The follow-up test resulted that a significant difference was found in T0 (organic) which was significantly different from T3 (30% addition of fermented sago pulp). T3, this is due to the use of sago pulp up to a level of 30% affecting the body weight of broiler ducks. Greater the percentage of fermented sago pulp contained in the ration, more difficult it is for ducks to digest the feed, which can lead to a decrease in body weight gain. The observation on 21st day of crude fiber content in ration significantly reduced the body weight gain of ducks given high fiber, but on the 35th day of observation the body weight gain was not significantly affected by the crude fiber content [7].

Final Body Weight

The mean final body weight of Peking ducks aged 8 weeks fed with fermented sago pulp was best obtained in treatment T0 (organic), namely 1353.42 g/head, and the lowest body weight was found in treatment T3 which contained 30% fermented sago pulp, namely 848.96 g / head (Table 3). These results show a difference from the other results who found that the final body weight was not significantly affected by the fiber content of the feed ingredients [7]. The final weight of Peking ducks was the body weight obtained at the end of the study. The results of the final body weight analysis of variance can be seen in Table 3.

Intestinal Villi Width

The morphology of the intestine in the duodenum including the results of the width of the villi given fermented sago pulp is presented in Table 4. The width of the villi in the duodenum had a significant effect (P<0.05) compared to the control (T0) intestinal villi of broiler ducks aged 8 weeks. In the table it can be seen that the width of the intestinal villi increased in all treatments. This is presumably because the administration of fermented sago pulp can stimulate the intestine to form wider villi. Organic substances formed from the fermentation process are thought to be able to increase the width of the villi.

Utilization of sago pulp waste, as much as 7% in broiler rations while sago pulp can be given in duck rations up to a level of 15% [9]. The increase in the width of the villi is in line with the growth of the ducks [10] . The length and width of the cross-sectional area of the small intestine can affect the ability to digest and absorb nutrients. The increase in weight and length, accompanied by an increase in the size of the cavity in the small intestine and an increase in its surface area,

Table 2. Peking Duck Body Weight Gain.

Week	Treatment			
	T0	T1	T2	T3
1	51.04^{b}	78.67^{a}	73.00^{a}	67.04^{ab}
2	98.55^{b}	72.17^{ab}	64.07^{a}	59.58^{a}
3	124.74	108.50	79.77	80.63
4	210.00^{a}	125.83^{b}	130.58^{b}	92.08^{b}
5	233.33^{a}	128.75^{b}	110.96^{b}	95.83^{b}
6	184.25	199.58	160.83	172.92
7	302.96^{a}	261.25^{ab}	232.38^{ab}	177.92^{b}
8	140.96	97.50	59.25	69.79
Average	168.22875^{a}	134.03125^{b}	113.855^{b}	101.97375^{b}

Description: T0: Without adding fermented sago dregs, T1: Adding 10% fermented sago dregs, T2: Adding 20% fermented sago dregs, T3: Adding 30% fermented sago dregs.

Table 3. Peking duck final weight.

Repeatation	Treatment			
	T0	T1	T2	T3
1	1371.67	1131.67	1129.00	790.00
2	1372.50	984.17	955.83	865.83
3	1307.50	1182.50	827.50	923.33
4	1362.00	1145.00	856.67	816.67
Total	5413.67	4443.33	3769.00	3395.83
Average	1353.42 ± 30.98[a]	1110.83± 87.14[b]	942.25 ± 136.07[c]	848.96± 58.69[c]

Description: T0: Without adding fermented sago dregs, T1: Adding 10% fermented sago dregs, T2: Adding 20% fermented sago dregs, T3: Adding 30% fermented sago dregs.

Table 4. The width of the intestinal villi of broiler ducks by administering fermented sago pulp using EM4.

Treatment	Average width of the intestinal villi (μm)
T0	44.67±6.658[a]
T1	115.33±37.448[b]
T2	92.00±4.583[b]
T3	78.33±14.295[b]

Description: T0: Without adding fermented sago dregs, T1: Adding 10% fermented sago dregs, T2: Adding 20% fermented sago dregs, T3: Adding 30% fermented sago dregs.

Table 5. Height and surface area of intestinal villi of broiler ducks by administering fermented sago pulp using EM4.

Treatment	Villi height (μm)	Surface area villi (μm)
T0	840.00±79.505[a]	1625.33±93.75[a]
T1	638.67± 58.586[b]	1395.00±30.00[b]
T2	779.67±62.931[b]	1471.00±67.50[b]
T3	782.33±113.032[b]	1511.66±44.61[b]

Description: T0: Without adding fermented sago dregs, T1: Adding 10% fermented sago dregs, T2: Adding 20% fermented sago dregs, T3: Adding 30% fermented sago dregs.

has an effect on the absorption process. The length and width of the small intestine are closely related to the body weight of the poultry [11]. The intestinal villi in the duodenum are more numerous and longer than those in the ileum [12].

The Height and Surface Area of the Intestinal Villi

The small intestine is the main place where the process of digestion and absorption of digestive products takes place, various enzymatic reactions occur in the small intestine which function to accelerate and efficiently break down carbohydrates, proteins and fats to facilitate the absorption process. The administration of fermented sago pulp had a significant effect ($P<0.05$) on the height of the intestinal villi observed in Table 5.

Histology of Intestinal Villi

The wall of the duodenum consists of 4 layers. The first layer is the mucosal layer with the muscularis mucosa, lamina propria and epithelium. The second layer is the submucosal connective tissue with the douedenal (Brunner) glands. The third layer is the two layers of smooth muscle in the muscularis external. The last layer is the visceral peritoneal serosa. The small intestine has several features, namely finger projections called villi, layers of columnar epithelial cells lined with microvilli that form striated borders, intestinal glands that are tubular and short (Kripte lieberkhun). The villi are modified. Between the villi there is an intervillous space. Each villi contains a core, the lamina propria, smooth muscle fibers that project from the muscularis mucosa to the villi, and a central lymphatic vessel, the lacteal.

Intestinal histology in the duodenum fed fermented sago pulp feed had a significant effect ($P>0.05$) as shown in Fig. 1. In Fig. 1-T0 the intestinal villi appear upright so that their surface can still be measured. Lieberkhun's glands are still present, this condition indicates that the histology of T0 still has the ability to digest feed better. In figure 1-T1, the intestinal villi can be seen lysis, this indicates that the intestinal villi are physically damaged. The feeding treatment disrupts the physical condition of the intestinal villi. However, in 1-T2 Lieberkhun's glands are more numerous than in 1-T1, Lieberkhun's condition is also still better, so 1-T2 is still able to help digestion. In figure 1-T3 physically the condition of 1-T3, both from the state of the intestinal villi that have been uprooted and a lot of surface lysis where the villi are present so that it can be concluded that there is a large absorption disturbance.

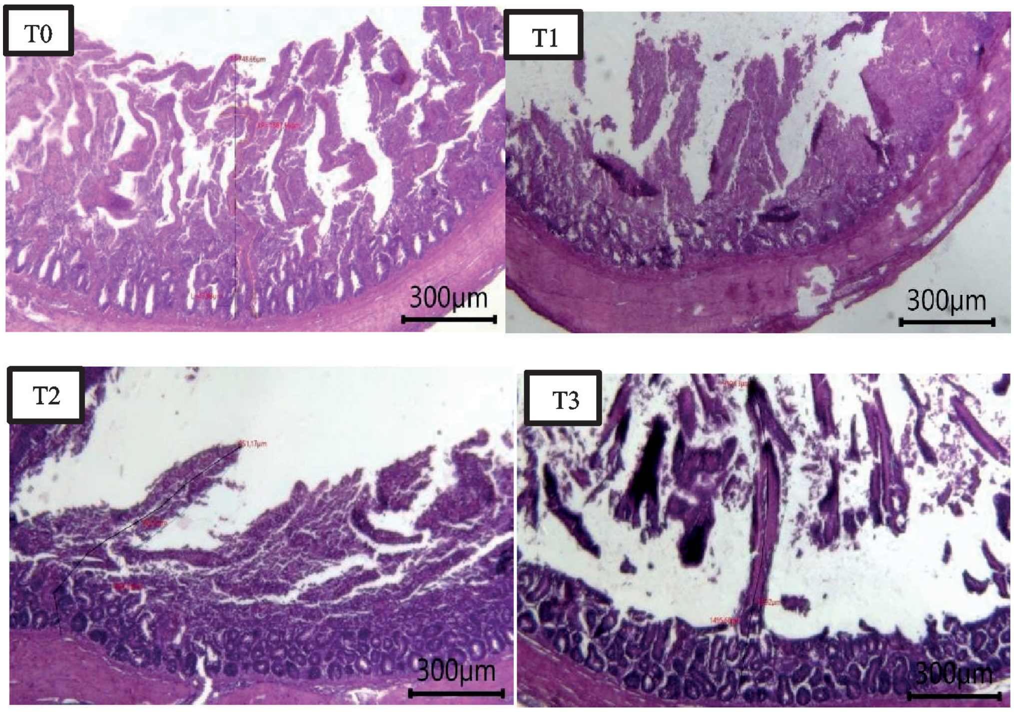

Fig. 1. Histology of the duodental intestinal villi.
Description: T0: Without adding fermented sago dregs, T1: Adding 10% fermented sago dregs, T2: Adding 20% fermented sago dregs, T3: Adding 30% fermented sago dregs.

The digestive glands or crypts of Lieberkhun are tortuous tubular glands with a wide lumen, located between the lamina propria tunica mucosa jejunum [13]. This is in line with the opinion who stated that Leiberkhun's crypts function as stem cells that continuously regenerate epithelial cells and goblet cells that have been damaged [14]. The number of goblet cells is related to the number of Leiberkhun crypts, presumably because goblet cells are produced by Leiberkhun crypts, the more Lieberkhun crypts, the more goblet cells produced. Goblet cells are cells that play a role in synthesizing and secreting mucus glycoprotein in the form of a gel to protect intestinal epithelial cells from pathogens and limit the movement and attachment of pathogens [15].

Conclusions

The use of fermented sago dregs using EM4 in this study cannot be used in Peking duck feed, because it can significantly reduce the average weekly body weight and final body weight, as well as reduce the characteristics of the small intestine so that fermented sago dregs using EM4 cannot be used as an alternative feed. Therefore it is necessary to make more process for EM4 or using other starter, which can improve the quality of fermented sago pulp for alternative feed for ducks.

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Conflict of Interest

There is no conflict of interest between authors.

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