Performance of native chicken fed on ration containing fermented sago waste

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Abstract. The use of fermented sago waste (9 days incubation time) in the ration of native chicken is studied. 100 chicks of 7 days old native chicken were used. The experiment is being conducted in a completely randomized design in which the animals were divided into four treatments of ration. Each treatment was replicated five times. The experimental rations are: R0 (0% fermented sago waste), R1 (5% fermented sago waste), R2 (10% fermented sago waste) and R3 (15% fermented sago waste). Parameters measured were feed intake, feed conversion, body weight gain and carcass percentage. It appeared from this experiment that feeds intake were similar between birds. In grower birds, the use of fermented sago waste in the rations had no significant effect on feed intake. In both, starter and grower birds body weight gain was higher for birds consuming control ration than for those consuming ration with fermented sago waste. The use of 5 up to 15 percent fermented sago waste in the rations significantly affects feed conversion and carcass percentage in both, starter and grower birds. Keywords: sago waste, fermentation, aspergillus niger, native chicken.

1. Introduction

Native chicken is raised for meat, eggs and display. They are raised in extensive traditional semi-intensive and intensive system. The development of native chicken in Indonesia is important. As one of animal source that contributes largely to providing animal protein to the community. Compared to other chicken species, native chicken is more resistant to diseases, more adaptable to the environment, meat and eggs tastier [1]. The population of native chicken in Maluku province was about 2.871.000, in 2019 [2], this shows that the chicken has potentially been improved in the province.

Nutrition is one of the important factors that influence native chicken productivity. To achieve optimal production of native chicken, both quantity and quality of nutrition are necessary. On the other hand, feed cost is the highest cost of cost production, about 65–70% in chicken farming or poultry business. Therefore feed cost is a crucial factor determining whether or not a business can be profitable [3].

Commercial poultry/chicken feed factory is not available in Maluku province so, suppliers purchase poultry/chicken feed from outside the province. Generally, native chicken is raised in an extensive system in which farmers feed the chicken by offering rice, corn and chopped coconut. Such feedstuffs are not providing adequate nutrients, both in quality and quantity to the chicken, and this result in low production. In addition, those feedstuffs are also human food, so they become more expensive.
Therefore it is important to substitute or replace those kinds of feedstuffs with unconventional one which is cheap, contains enough nutrients and does not compete with human needs. Sago waste is a solid waste generated from sago processing that can be used in native chicken ration. [4], stated that the ratio between sago mash and the waste is 1:6. The production of sago meal from a mature sago tree is about 220 kg, so that the waste from the tree could reach about 1320 kg. This means that sago waste is available abundantly in the province and could be potentially used as local feedstuffs. The waste still contains high starch. However, its protein content is low and high in fibre, so to be used in the chicken ration, it needs to be treated. Nutrients content of sago waste is crude protein 2.30% [5] and starch 52.98% [6]..

Microbiology fermentation treatment can increase protein content, digestibility, and form many kinds of amino acids, to produce enzyme and vitamin. [7] reported that the protein content of sago waste increased from 1.2% (dry unfermented sago waste) to 12.31% (steam fermented sago waste). Fermentation mixture of chicken excreta and cassava meal with Aspergillus niger resulted in increasing protein digestibility from 56.45% to 65.90% [8]. Giving fermented sago waste 7.5% in swine ration at grower phase result in increase weight gain compare to ration without fermented sago waste [9]. Fermented mixture of sago waste and chicken excreta could be used in broiler ration up to 12% not affecting feed intake, abdominal fat, water and protein content of meat [10]. To improve native chicken production in Maluku province, using local feedstuffs in formulating the ration is meaningful.

The objective of this study was to determine the effect of using different level of fermented sago waste in ration of native chicken at starter and grower period on feed intake, live weight gain, feed conversion and carcass percentage.

2. Methods
2.1. Materials
The experiment was conducted for five months at Agricultural Poultry Research Centre, Passo, Ambon, six weeks for preliminary and fermentation period, eight weeks for a starter period and six weeks for the grower. Sago waste of Ihur sago (Metroxylon rumpii) collected from Tawiri and Hutumuri villages Ambon Island, Maluku province. Aspergillus niger van Tieghan MC 482 LIPI (average colony was 51,500,000) and minerals (ammonium sulphate, urea, sodium hydrogen phosphate, magnesium sulphate, potassium chloride, ferrous sulphate and calcium sulphate) were used to make fermented sago waste.

Fermented sago waste made using dry sago waste, hot water with a ratio of 2:1. The minerals and 12 g of inoculum were added, mixed thoroughly and then incubated for 6, 9, 12, 15 days. After the incubation period, the fermented sago waste was dried at 60°C for two days. Proximate analysis was done, and based on the nutrient content of fermented sago waste incubated for nine days was selected to be used in the ration for the native chicken on starter and grower period.

100 native chicken aged one week with average live weight about 14.6–21.6 g were used and fed on homemade pellet. The animals randomly placed in battery cages, 100 × 75 × 60 cm, equipped with through, drinking bottles, lamp, thermometer and weighing scale.

The animals were divided into four treatments according to the level of fermented sago waste used in the tested rations, namely R0 (ration with 0% fermented sago waste), R1 (ration with 5% fermented sago waste), R2 (ration with 10% fermented sago waste) and R3 (ration with 15% fermented sago waste). An adaptation period of six days allowed the animal to accustom to the tested feed, followed by seven weeks and five weeks measurements period for starter and grower phase, respectively. During the trials, the animals were fed twice daily at 07.00 a.m and 16.00 p.m, and they had free access to drinking water. Fed offered was recorded daily, feed refusal was weighed every morning before the next feeding. Rations for starter and grower chicken are shown in Table 1 and 2.
Table 1. Composition and nutrient content of starter ration

| Feedstuffs (%) | R0   | R1   | R2   | R3   |
|----------------|------|------|------|------|
| Yellow corn    | 59.00| 58.50| 57.50| 55.50|
| Rice bran      | 18.25| 15.75| 13.75| 10.50|
| Coconut oil by-product | 9.00 | 8.00 | 7.00 | 9.00 |
| Fermented sago waste | 0.00 | 5.00 | 10.00| 15.00|
| Fish meal      | 13.00| 12.00| 11.00| 9.50 |
| Coconut oil    | 0.25 | 0.25 | 0.25 | 0.25 |
| Premix D       | 0.25 | 0.25 | 0.25 | 0.25 |
| Salt           | 0.25 | 0.25 | 0.25 | 0.25 |
| **Total**      | 100.00| 100.00| 100.00| 100.00|

Nutrient content:

| Nutrient content | R0   | R1   | R2   | R3   |
|------------------|------|------|------|------|
| Crude Protein (%) | 18.08| 18.05| 18.03| 18.07|
| ME ration (Kcal/kg) | 2903.61| 2903.66| 2904.82| 2908.12|
| Crude fibre (%)   | 3.47 | 3.41 | 3.40 | 3.37 |
| Fat (%)           | 4.07 | 3.91 | 3.73 | 3.83 |

Table 2. Composition and nutrient content of grower ration

| Feedstuffs (%) | R0   | R1   | R2   | R3   |
|----------------|------|------|------|------|
| Yellow corn    | 59.00| 59.75| 59.00| 59.00|
| Rice bran      | 17.50| 16.00| 14.00| 12.00|
| Coconut oil by-product | 13.00| 9.75 | 8.25 | 6.25 |
| Fermented sago waste | 0.00 | 5.00 | 10.00| 15.00|
| Fish meal      | 9.25 | 8.75 | 8.00 | 7.00 |
| Coconut oil    | 0.25 | 0.25 | 0.25 | 0.25 |
| Premix D       | 0.25 | 0.25 | 0.25 | 0.25 |
| Salt           | 0.25 | 0.25 | 0.25 | 0.25 |
| **Total**      | 100.00| 100.00| 100.00| 100.00|

Nutrient content:

| Nutrient content | R0   | R1   | R2   | R3   |
|------------------|------|------|------|------|
| Crude Protein (%) | 16.07| 16.09| 16.17| 16.02|
| ME ration (Kcal/kg) | 2900.14| 2901.39| 2900.16| 2903.36|
| Crude fibre (%)   | 3.56 | 3.50 | 3.47 | 3.42 |
| Fat (%)           | 4.34 | 3.98 | 3.77 | 3.51 |

2.2. Methods

Variables measured for starter were voluntary feed intake, live weight gain and feed conversion, besides that carcass percentage was also measured for the grower. A complete randomized design was used, four treatments and five replicates of each treatment with five chicken. Voluntary feed intake was calculated by subtracting feed refusal from feed offered. Live weight gain was determined by weighing the animal at the end of the week, then subtracting final with initial body weight. Feed conversion was calculated by dividing voluntary intake and live weight gain. Slaughtered weight was determined by weighing the live animal after 10 hours fasting, carcass weight was determined by subtracting non-carcass weight from the slaughtered weight.

The effect of treatments on voluntary feed intake, live weight gain, feed conversion and carcass percentage were examined analysing of variance using the General Linear Model. Main effect differences were detected using LSD.
3. Results and discussion

3.1. Starter period

3.1.1. Voluntary feed intake

The result shows that average voluntary intake decrease as the level of fermented sago waste increase in the ration. Statistically, there is a significant effect on voluntary feed intake ($P<0.05$), as shown in Table 3. The energy content of the ration is one of the factors that contribute largely to voluntary feed intake. According to [11], chicken eats to meet their energy requirement, as feed energy is high, feed intake will decrease.

| Treatments | Feed intake (gr) | Live weight gain (gr) | Feed conversion |
|------------|-----------------|-----------------------|-----------------|
| R0         | 23.38$^a$       | 6.78$^a$              | 3.48$^a$        |
| R1         | 21.90$^{ab}$    | 6.47$^{ab}$           | 3.40$^a$        |
| R2         | 20.82$^b$       | 5.69$^b$              | 3.67$^a$        |
| R3         | 21.07$^b$       | 5.70$^b$              | 3.74$^a$        |

$^{a,b}$ within categories of response, means with different superscript are significantly different ($P<0.05$)

It appears from Table 1 that Energy metabolism of R0 was the lowest, although the differences among the treatments are not much. This result in high voluntary feed intake for R0 compares to R2 and R3. The result of the present study is in line with [12], who states that animal will consume a large amount of feed if the energy content of ration is low.

3.1.2. Live Weight gain

Using fermented sago waste in the ration of starter native chicken has a significant effect ($P<0.05$) on live weight gain. Data from Table 3 indicates that as the level of fermented sago waste increase in the ration, live weight gain decrease. BNJ test result shows no significant difference between R0 and R1, but differed significantly with R2 and R3. [13] states that, poultry which starts to grow to require high protein because their body needs to form new cells. The difference in live weight gain between R0 and R2, R3 is in line with voluntary feed intake and protein intake. Protein intake is 4.22 g/h/d, 3.95 g/h/d, 3.75 g/h/d and 3.80 g/h/d for R0, R1, R2 and R3, respectively. In addition, the quality of feedstuffs protein is another factor that could affect the difference in live weight gain. It can be seen from Table 1, increasing the amount of fermented sago waste leads to decreasing in a fish meal as a source of protein. Therefore protein from the fish meal was substituted by fermented sago waste protein. If the protein qualities are the same, then it is expected that live weight gain would be the same. However, using fermented sago waste above 5 % in the ration gives less live weight gain than that of control ration (R0). This indicates that the quality of protein in fermented sago waste is not as good as in fish meal. [14] points out that fish meal contains complete amino acid. Fermented sago waste protein is a single-cell protein of \textit{Aspergillus niger}. It has been known that single-cell protein contains low sulphur amino acid such as [15]. It is suggested that increasing fermented sago waste in the ration may increase methionine deficiency. However, there it needs to be proved by amino acid analysis and digestibility of fermented sago waste.

3.1.3. Feed Conversion

Statistical analysis shows that using fermented sago waste in the ration does not significantly affect feed conversion ($P>0.05$). However, using 5% fermented sago waste decreased feed conversion, numerically. This means that chicken utilises ration containing 5% fermented sago waste and convert it to be meat more efficiently compare to control ration (R0) those of 10 and 15 % fermented sago waste. Low feed conversion ration shows that add some more feed result in increase live weight gain of broiler with big proportion [16]. This current study shows that voluntary feed intake and live weight gain differed significantly, in which control ration (R0) was consumed more and also results in high live weight gain, compare to ration with 5%, 10 % and 15%, but it gives similar feed conversion. This may be caused by high digestibility of fermented sago waste. [17], reported that the digestibility
of cassava meal fermented with *Aspergillus niger* increase, enzyme formed during the fermentation process could digest certain substituents in dry matter of the cassava to be digested. [8] also reported that fermentation of mixed chicken excreta and cassava meal with *Aspergillus niger* increased protein digestibility from 56.45% to 65.90%. Moreover, [18] states that a nutrient balance influences feed conversion in feed and animal ability to digest feed nutrients, feedstuffs.

3.2. Grower period

3.2.1. Voluntary feed intake

Although statistical analysis has shown that using fermented sago waste in the grower ration has no significant (P>0.05) effect, in general, voluntary feed intake tends to decrease as the level of fermented sago waste in the ration increase. This shows that fermented sago waste could be used up to 15% in the grower ration. [19] stated that protein and energy had been related to voluntary feed intake, live weight gain and feed conversion. Protein and energy content of tested ration were relatively similar, therefore no significant effect was found in voluntary feed intake among the treatments. Both energy and protein levels of the diet should be taken into account when formulating diets aimed at achieving optimal feed intake in growing chicken [20]. [11] and [21], pointed out that, poultry eat to fulfil the requirement of energy, high level of feed energy will lead to low voluntary feed intake. A similar response in voluntary feed intake also shows that using fermented sago waste in the ration does not affect the ration's palatability.

| Treatments | Feed intake (gr) | Live weight gain (gr) | Feed conversion | Carcass percentage (%) |
|------------|------------------|-----------------------|-----------------|------------------------|
| R0         | 41.55<sup>a</sup> | 8.48<sup>a</sup>      | 4.90<sup>a</sup> | 66.37<sup>a</sup>      |
| R1         | 38.78<sup>a</sup> | 8.03<sup>ab</sup>     | 4.84<sup>a</sup> | 65.62<sup>a</sup>      |
| R2         | 38.44<sup>a</sup> | 7.72<sup>b</sup>      | 4.99<sup>a</sup> | 63.26<sup>a</sup>      |
| R3         | 38.61<sup>a</sup> | 7.65<sup>b</sup>      | 5.06<sup>a</sup> | 66.06<sup>a</sup>      |

<sup>a, b</sup> within categories of response, means with different superscript are significantly different (P<0.05)

3.2.2. Live Weight Gain

Data in Table 4 show that using fermented sago waste in the grower ration has a significant effect (P<0.05) on live weight gain. Giving 5% (R1), 10% (R2) and (15%) fermented sago waste in grower ration gives low live weight gain compared to control ration (R0). It is suggested that the difference in live weight among the treatments is because of amino acid unbalance in the tested rations. [22] state that amino acid balance which adequates to support animal growth is needed. As stated earlier, fish meal contains complete and balanced amino acid compared to those in the fermented sago waste, therefore, increasing the level of fermented sago waste in the ration up to 10 and 15% results in high unbalanced amino acid. This means that the quality of protein ration R0 and R1 is better than R2 and R3. [23] state that intake nutrient has related to chicken performance. Nutrients deficiency could not support the optimum performance of chicken. This is in line with [24] who point out that nutrient has related directly to growth rate and body composition during growth. Nutrients deficiency is also slower the peak of growth and fat deposit.

3.2.3. Feed Conversion

Statistical analysis shows that voluntary feed intake on grower native chicken was similar among the treatments, but numerically R0 tend to be higher, resulting in higher live weight gain significantly. However, feed conversion was high for ration, which contains 5% fermented sago waste, numerically. It is suggested that ration R1 (5% fermented sago waste) is more digestible so that the chicken uses it more efficiently.
3.2.4. Carcass Percentage
Statistical analysis shows that using fermented sago waste up to 15% in grower ration has no significant effect (P>0.05) on carcass percentage. This determines that fermented sago waste can be used up to 15% in the grower ration. Carcass percentage in the present experiment is ranging from 63.26–66.37%. This value is lower than that reported by [25], who feed the chicken with pollard and duckweed in the ration, which was 66.49–69.33%. [26] used fermented sago waste in the grower duck ration reported that carcass percentage is about 63.22–68.35%.

4. Conclusion
It can be concluded from the present study that using fermented sago waste in starter ration at 5% has no significant effect on voluntary feed intake, meanwhile using 10% and above decreased voluntary fed intake significantly compare to control ration. Control ration gives high live weight gain, while using fermented sago waste 15% results in lower live weight gain on both period, starter and grower and has no significant effect on feed conversion on starter and grower chicken also carcass percentage.

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