The development of *kacang* goat based on the feed of Metroxylon sago pulp

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Abstract. Sago processing as local food continues, however, the sago pulp is not utilized optimally even unused so that there is a buildup of sago pulp waste which is increasing and can pollute the environment. This research aimed to investigate the potentials of sago pulp which could be used as the feeds of goat livestock, investigating the increase of the bodyweight of goat livestock; and investigating the effect of the use of sago pulp fermentation on the efficiency consumption, palatability, KcBK, given to *kacang* goat livestock. The research was conducted in Merauke Regency by using 12 *kacang* goats. The research was conducted for 2 months from May through July 2018. The goats were given three types of treatments and were divided into four groups (T₀ T₁ and T₂) with the following model: T₀ as the control group and received 100% of grass, T₁ as the control + 20% of sago pulp fermentation and T₂ as the control + 30% of sago pulp fermentation. The method used was Randomized Block Design (RBD), and the Variance analysis was used to analyze the efficiency of the feed of sago pulp waste, the level of palatability, the digestibility of dry matters (KcBK), and the body weight gain of the livestock. And in order to look at the effect of the feeds before and after the treatments, a T-test was used. The research results indicated that the increases in the body weight of the male *kacang* goats treated with 20% and 30% were 7.05 kg and 12.3 kg, respectively. The treatments using the sago pulp fermentation at the level of 20% and 30% were lower (5.9 kg) of the 30% group and (4.48) of the 20% group, compared to that of the control group (6.7 kg), A significant difference was also shown between the body weights of the male goats and female goats (12.3 kg and 5.9 kg respectively. The feed consumption of the *kacang* goats in the 30% treatment was 28.930 gr better than the control group which was 22.370 gr, and the treatment with 30% of sago pulp fermentation was more efficient 13.1 % compared to the control group which had only 7.87%. The KcBK in *kacang* goats showed an increase of digestibly of the dry matter in the 30% treated male goats were significantly different (63.25%) compared to that in the 30% female goats (59.40%). This proved that the addition of sago pulp fermentation given to the *kacang* goats could increase the body weight, feed efficiency, palatability level and therefore it could be used as the substitute feeds in the dry season.

1. Introduction

*Kacang* goat is a very prolific mutton, which often gives birth to twins. Twins birth of two children in common. Sometimes giving birth to triplets. This goat can breed throughout the year, so, it is very
suitable to be developed for mutton. Kacang goat can live very simply and are able to adapt well in various environments [1]. The development of goat livestock is no stranger to most farmers in Indonesia, managed simply as part of rural farming. Until now, goat livestock is still often identified as saviors saving farmers in addressing urgent needs [2]. The business of developing goats’ livestock, markets is not a barrier because basically they already have a strong traditional market, a market based on traditional and religious values [3].

The sago potential in Merauke is very large compared to other regions in Papua. According to previous research [4], it was revealed that sago forests in the Merauke are the largest in Papua, which is 1,232,151 hectares or about 25.9% of the total area of sago forests in Papua, which reached 4,749,325 hectares. The sago plant population in Merauke is relatively significantly high. The processing of sago as a local food continues, but the sago pulp is unutilized optimally and is not even used, resulting in an increase in the accumulation of sago waste. One female sago tree produced 3,450 kg of grated sago. From 3,450 kg of sago grater, it produces 725 kg of wet weight starch, leaving 2,725 kg of waste. Whereas, one male sago tree produces 1,066 kg of grated sago and produces 203 kg of starch and resulting of 863 kg of sago waste.

Feeding is one of the success keys in raising goats/sheep. The type of feed given, its existence around the husbandry and its application must be carried out appropriately and according to the needs of livestock to grow. A feed is a very influential factor on goat health. Feed also affects the growth and fat of the goat. Quality food or complete nutrition will make goats healthy and fat. Good food is also digested, so, absorption of nutrients takes place perfectly. Therefore, the availability of feed needs to be considered before even starting fattening. Sago waste can pollute the environment if not utilized. One of the efforts to use sago waste is as animal feed because the supply continues increasing [5,6].

Sago waste can pollute the environment if not utilized. One of the efforts to use sago waste is as animal feed because the supply continues increasing. Through the utilization of sago waste as kacang goat feed not only can reduce environmental pollution but also can reduce the use of forage, and can reduce the cost of feed, so, it can meet the market demand for goat meat and greatly help local communities in providing opportunities work.

2. Methods

2.1. Research design
This research is a quantitative approach. This study aims to determine the effect of sago pulp waste fermentation on consumption (efficiency), palatability of material to fed kacang goat and dry matter digestibility and also increase the weight gain of the kacang goat.

2.2. Population and sample techniques
The animals used were 12 male 6 male and 6 female goats with 6-7 months of age, which were kept for 60 days. Daily feeding is done in the morning and evening according to the design. Sampling is done every day by weighing feed, leftover feed, feces, and urine. Weighing is done once a week.

2.3. Measured parameters
Feed consumption (gr/head/day), body weight (kg), feed efficiency and palatability (%) and dry matter digestibility (KcBK).

2.4. Data analysis
The data obtained were analyzed using Variance analysis, based on the design implemented was Randomized Group Design (RGD). By using three treatments four groups, consisting of two factors, which are sex factor and type of feed factor. Using three treatments, four groups that are with the following model: P0 is control feed with 100% grass treatment, P1 is control + fermentation of 20% sago pulp and P2 is control + fermentation of 30% sago pulp. And t-test to see the effect of giving before and after treatment. The randomized block design is an environmental design that places
random treatments on each experimental unit in each group (block) [7]. The random group design model can be written as follows:

$$Y_{ij} = \mu + \tau_i + \beta j + \epsilon_{ij} = 1,2,\ldots,t$$

$$j = 1,2,\ldots,b$$

3. Result

Table 1 shows the results of research on the consumption of kacang goat and palatability level in the treatment of 30% sago pulp waste fermentation is better that is able to consume sago waste as much as 5,250 g/head/day and field grass 23,680 g/head/day, compared to the able control consuming 22,370 g/head/day, this is proven by the addition of 30% fermented sago pulp which is able to increase body weight gain better. T-test showed that feed treatment before and after the significant increase in all types of livestock.

Table 1. Average feed consumption and palatability level

| Gender | Feed | Treatment (gram/unit/day) | Average |
|--------|------|---------------------------|---------|
|        |      | P0 | P1 | P2 |     |
| Male   | Grass|x22.370a| x23.305b| x23.680b| 23.118 |
|        | Sago Waste Fermentation | - | 4.595a | 5.250b | 4.922 |
| Female | Grass| y22.240a| y22.349a| y22.100a| 22.229 |
|        | Sago Waste Fermentation | - | 4.026a | 4.265a | 4.145 |

Note: Different letters on the same line show significant differences (P <0.05), P0 (control), P1 (Control + 20% sago pulp), P2 (Contrast + 30% sago pulp).

Table 2 shows the results of the study after feeding either control or treatment experienced a significant increase in body weight in male goats, the highest weight gain value in the treatment of 30% sago pulp waste fermentation up to 12.3 kg where the initial weight of 13 kg increased to 25.3 kg, followed by 20% fermentation of sago waste 7.05 kg from the initial weight of 12.85 kg to 19.90 kg and control 5.9 kg with an initial weight of 13.15 kg to 19.05 kg. However, giving the final increase that occurs in female cattle is inversely proportional to male cattle, namely in control goats, the highest final value in body weight gain is 5.7 kg from the initial weight of 12.30 kg to 19 kg followed by 5.9 kg 30% fermentation of sago pulp waste from an initial weight of 12.15 kg to 18.05 kg and 4.48 kg at 20% fermentation of sago pulp waste from an initial weight of 11.06 kg to 15.54 kg. This shows that the provision of sago pulp fermentation has been unable to increase the body weight of female goats better than other controls.

Table 3 shows the results of research on the treatment of 20% sago waste fermentation and 30% sago pulp fermentation on male goats experience a significant impact on body weight gain. However, in female goats, the higher body weight gain was in control of 6.7 kg followed by 30% sago pulp fermentation treatment of 5.9 and 20% level of 4.48 kg. The weight gain between males and females is certainly very different, this is because the growth of male animals is faster when compared to female animals.

Table 2. Increased body weight before and after treatment

| Variable | Treatment | Increased Body Weight (Kg) |
|----------|-----------|-----------------------------|
|          | P0 | P1 | P2 |
| Male     | Before | 13.15b | 12.85b | 13.00b |
|          | After | 19.05a | 19.90a | 25.30a |
| Female   | Before | 12.30b | 11.06b | 12.15b |
|          | After | 19.00a | 15.54a | 18.05a |
Table 3. Increased weight of end goat body (kg)

| Variable | Feed Type | Average |
|----------|-----------|---------|
| Male     | P0        | P1      | P2      |
|          | 5.9<sub>c</sub> | 7.05<sub>b</sub> | 12.3<sub>a</sub> | 8.41 |
| Female   | 6.7<sub>a</sub> | 4.48<sub>c</sub> | 5.9<sub>b</sub> | 5.69 |

Table 4 presents the results of the study. The interaction between the different types of rations and types of livestock did not affect the feed efficiency statistically. The average feed efficiency in this study was between 7.25 - 13.31%, the value of feed efficiency in male treatments 30% sago waste fermentation and female treatments 20% sago waste fermentation was closely related to body weight gain that occurred.

Table 4. Average feed efficiency (%)

| Gender | Feed Type | Average |
|--------|-----------|---------|
| Male   | P0        | P1      | P2      |
|        | 7.87      | 10.15   | 13.31   | 10.11 |
| Female | 7.25      | 5.96    | 9.64    | 9.95  |

Table 5 demonstrates the results of research on the increased digestibility of dry matter from the 30% treatment of sago pulp waste fermentation is significantly different males (P < 0.05) whereas, in treatment, females showed no significant difference. Digestion value of dry matter is equivalent to 6-6.6% of body weight. This value is high for the BK consumption value for goats. This means the palatability of feed in all treatments without fermentation, and fermentation is equally good. Consumption of the BK shows that the needs for basic living and the needs for the production of kacang goat have been fulfilled properly or it can be stated that sago pulp waste has potential as a good source of goat feed. The addition of fermented feed gives a very significant effect on the digestibility of BK up to the level of adding 30% fermented feed that is equal to 63.25%.

Table 5. Digestibility of KcBk dry ingredients in kacang goat (%)

| Gender | Treatment | P0 | P1 | P2 |
|--------|-----------|----|----|----|
| Male   |           | 62.20 | 60.10 | 63.25 |
| Female |           | 58.65 | 58.05 | 59.40 |

4. Discussion

This study shows that the consumption of feed and palatability of the kacang goat in the treatment of 30% sago pulp waste fermentation is better than the other control, this is evidenced by the addition of 30% sago pulp fermentation given is able to increase body weight gain better. In addition, the use of sago waste fermentation feed given during the study provides a good level of palatability and can be used as substitution food in the dry season. The increase in body weight gain is related to the value of feed conversion, which is the more feed absorbed into the meat, the better the feed is for daily body weight gain and becomes more efficient. According to the study [8], the increase in feed consumption
accompanied by the high body weight gain can increase the value of feed efficiency. T-test showed that feed treatment before and after a significant increase in all types of livestock.

Based on the results of the T-test that after feeding either control or treatment demonstrated a significant increase in body weight in male goats, the highest weight gain value in the treatment of 30% sago pulp waste fermentation up to 12.3 kg followed by 20% fermentation of sago waste 7.05 kg and 5.9 kg control. However, giving the final increase that occurs in female goats is inversely proportional to male goats, that is in control goats, the highest final value in body weight gain is 6.7 kg followed by 5.9 kg 30% fermented sago pulp waste and 4.48 kg at 20% waste fermentation sago pulp. This shows that the provision of sago pulp fermentation has been unable to increase female goat body weight better than the other control, one of the causes of increased body weight is less increased due to genetic factors.

The goat digestion process is generally divided into two, namely mechanical and enzymatic digestion, mechanical digestion occurs in the mouth and fermentative digestion in the rumen, while enzymatic digestion occurs after passing through the rumen. Mechanical digestion functions to change feed to be simpler. The fermentative feed is digestion which produces fermented products in the form of protein which is converted to ammonia by microbes in the rumen, while enzymatic digestion is one example of the change in glycerol into fat [9]. The digestion process is very influential on the performance of the production of kacang goat, production performance can be seen from several indicators namely feed efficiency, daily body weight gain. Nutrient composition of sago silage residues [10], the average protein content of 3-4%.

Increasing weekly body weight in the kacang goat needs to be considered to determine the weekly effect of the treatment given. When the weight gain study occurred after week 2, it can be comprehended that despite the adaptation of the experimental feed for 1 week, this can occur which is thought to be caused by the process of absorption of nutrients into muscle meat after two weeks of treatment. Potential individual genetics in this treatment is sufficiently seen in male goats by feeding them containing 30% sago pulp fermentation.

Consumption is an essential factor as a basis for basic living and production. Factors that can affect the level of feed consumption are gender, body weight, the activity of growth stages, physiological conditions of livestock and environmental conditions. In addition, the weight gain of livestock is influenced by several factors including total protein obtained every day, type of livestock, age, genetic condition, environment, condition of each individual, and maintenance procedures [11]. Feed consumption is also influenced by the level of palatability that depends on several things, including appearance and feed form. Based on research [12], feed factors that influence the level of consumption include particle size and palatability of feed ingredients. From the results of research on body weight gain of these kacang goats, they are not so well influenced by genetic conditions, where the goat has been experiencing inbreeding since 2004 and there is no rejuvenation.

An increase in end body weight shows that the treatment of 20% sago pulp waste fermentation and 30% sago pulp fermentation in male goat goats has a significant effect on body weight gain. However, a good weight gain occurred in the control goat of 6.7 kg followed by 30% sago pulp fermentation treatment of 5.9 kg and 4.48 kg level of 20%. The weight gain between males and females is certainly very different, this is because the growth of male goats is faster when compared to female goats. According to a study [13], male goats' body weight gain was faster when compared to female goats by 6.44%.

The efficient use of feed can be measured from the ratio between the amount of feed consumed by livestock and the output produced. High efficiency in the use of feed can be achieved by proper management of feed, including the management of the optimal amount of feed allocation, efficient formulation of concentrate, selection of raw materials that are nutritionally balanced and economically feasible as well as determining the timing and frequency of strategic feeding. The contribution of efficient use of feed is very large on the economic efficiency of the overall production business [14].
A comparison of body weight gain with feed consumption is a way to determine feed efficiency. Feed efficiency can be used as an indicator of the calculation of feed ingredients consumption that will be given. Feed efficiency is an indicator of metabolism in livestock bodies.

The interaction between different types of rations and types of livestock did not affect the statistical efficiency of feed. The average feed efficiency in this study was between 7.25 - 13.31%, the value of feed efficiency in male treatments 30% sago waste fermentation and female treatments 20% sago waste fermentation was closely related to body weight gain that occurred. Referred to a study [15], increased consumption of dry matter has an effect on feed efficiency. Low ration consumption and high body weight gain will increase the efficiency value of goat feed by treating sago pulp fermentation more efficiently in converting rations, so, increasing body weight gain.

Dry matter digestibility (KCBK) is one indicator to determine feed quality. High digestibility of dry matter in ruminants indicates high levels of nutrients digested especially those digested by rumen microorganisms. The higher the percentage of digestibility of feed ingredients, the better the quality. Factors that influence the digestibility of dry matter, namely the number of rations consumed, the rate of food travel in the digestive tract and the type of nutrient content contained in the ration. Other factors that influence the digestibility value of dry matter ration are the level of the proportion of feed ingredients in the ration, chemical composition, protein level of the ration, percentage of fat and minerals [16].

The results of this study indicate that the increased digestibility of dry matter from the 30% treatment of sago pulp waste fermentation in males was significantly different (P < 0.05) whereas in treatment females indicated no significant difference. The digestion value of the dry matter in this study is equivalent to 6.6% of body weight. This value is high for the BK consumption value for goats. This means the palatability of feed-in all treatments without fermentation, and fermentation is equally good. Consumption of the BK shows that the needs for basic living and the needs for peanut goat production have been fulfilled properly or it can be stated that sago waste has potential as a good source of goat feed. The addition of fermented feed gives a very significant effect on the digestibility of BK up to the level of adding 30% fermented feed that is equal to 63.25%.

The development of the cultivation of goat nuts by providing fermented sago waste fermentation feed is expected to help the community of farmers to apply goat farming technology in Merauke, so that, the development of the goat population can be accelerated.

The development of the goat breeding business will have an impact on social and economic factors of the potential development of goat livestock business. The resulting economic impact is an increase in livestock population, employment opportunities and community income. The resulting social impact is improved education and family health due to increased income. Besides, the waste of sago which has been unutilized has turned into useful and economic value.

5. Conclusions
The use of 30% substitution fermented sago pulp can increase body weight gain of male kacang goat 12.3 kg better when compared to female goats 5.9 kg. The effect of adding 30% sago pulp fermentation had a beneficial impact on feed efficiency in the amount of 13.31% in male goats and good palatability. Evidenced by the amount of feed consumed can be spent in each feed. KcBK in goat nuts showed increased digestibility of dry matter from 30% treatment in 63.25% males. Sago pulp waste has potential as a goat feed and can increase body weight gain. Sago waste as the digestibility of dry matter (KcBK) has been widely unused by the community, the results of the study show the beneficial effect of sago waste, so, it needs to be promoted that farmers can use it, but fermentation treatment should be used to increase the nutritional content of sago waste. Sago waste can be used as the substitution of forage in the dry season. The proportion of sago pulp to forage needs to be increased in volume.

References
[1] Sarwono B 2012 Beternak kambing unggul (Niaga Swadaya)
[2] Sutama I K and Budiarsana I G M 2017 Kupas Tuntas Beternak Kambing Jakarta Timur:
[3] Syukur 2016 99% Gagal Beternak Kambing (Jakarta: Penebar Swadaya)
[4] Firsoni J, Sulistyoe A S and Tjakradijaja S 2008 Uji fermentasi invitro terhadap pengaruh suplemen pakan dalam pakom plat Pusat Aplikasi Teknologi Isotop dan Radiasi BATAN 233–40
[5] Waluyo S and Mahmud Efendi S T 2016 Beternak Ayam Broiler Tanpa Bau, Tanpa Vaksin (AgroMedia)
[6] Kaleka 2013 Beternak Kambing Tanpa Bau Angon dan Ngarit (Solo: Arcita)
[7] Heryanto E 1996 Rancangan percobaan pada bidang pertanian Trubus Agrowidya. Ung.
[8] Wijaya G H, Yamin M, Nuraini H and Esfandiar A 2016 Performans Produksi dan Profil Metabolik Darah Domba Garut dan Jongsol yang Diberi Limbah Tauge dan Omega-3 J. Vet. 17 246–56
[9] Parakkasi A 1999 Ilmu nutrisi dan makanan ternak ruminan (Penerbit Universitas Indonesia)
[10] Simanihuruk K, Potong L P K, Sirait J and Potong L P K 2018 Silase Ampas Sagu Menggunakan Tiga Bahan Aditif sebagai Pakan Basal Kambing Boerka Fase Pertumbuhan (Prosiding Seminar Nasional Teknologi Peternakan dan Veteriner)
[11] Council N R 2007 Nutrient Requirements of Sheep (Washington)
[12] Pond W G, Church D B, Pond K R and Schoknecht P A 2004 Basic animal nutrition and feeding (John Wiley & Sons)
[13] Sains S Bobot Lahir Dan Pertumbuhan Anak Kambing Peranakan Etawah Sampai Lepas Sapih Berdasarkan Litter Zise Dan Jenis Kelamin
[14] Anggorodi R 1994 Ilmu Makanan Ternak Umum Cetakan ke 5 PT. Gramedia. Jakarta
[15] Maurya V P, Naqvi S M K and Mittal J P 2004 Effect of dietary energy level on physiological responses and reproductive performance of Malpura sheep in the hot semi-arid regions of India Small Rumin. Res. 55 117–22
[16] Djoefrie M H B, Herodian S, Ngadiono A T and Amarillis S 2014 Sagu untuk kesejahteraan masyarakat Papua: Suatu kajian dalam upaya pengembangan sagu sebagai komoditas unggulan di provinsi Papua dan provinsi Papua Barat Jakarta Unit Percepatan Pembang. Papua dan Papua Barat