



Analysis of Proximate Rice (*Oryza sativa*) and Aromatic Ginger (*Kaempferia galanga*) Herbal Pulp as a Feed Additive for Fattening Meat Duck

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Abstract. Herbal pulp are waste from making herbal medicine that is not used consisting of various spice components such as rice aromatic ginger. The aim of this study was to map the proximate content of rice and aromatic ginger herbal pulp as additional feed for fattening duck. The research method used descriptive analysis of the results proximate tests with 4 treatments T1 (aromatic ginger 35%, rice 40%, pandan 5%, palm sugar and water 20%), T2 (aromatic ginger 50%, rice 35%, brown sugar and water 15%), T3 (aromatic ginger 35%, rice 45%, brown sugar and water 20%), and T4 (aromatic ginger 40%, rice 40%, brown sugar and water 20%). The results showed that herbal pulp had a dry matter content of 87-91%, water content of 8-12%, crude protein 5-10%, fat 9%, crude fiber 6-17%, and ash of 1-4%. Conclusion of the research the best herbal pulp treatment recommended as an feed additive for fattening duck at T3 (aromatic ginger 35%, rice 45%, brown sugar and water 20%) with maximum dose 1%.

Keywords: Beras kencur, Fattening meat ducks, Indonesian local herbal dregs, Proximate analysis.

1 Introduction

The poultry industry in Indonesia is facing challenges in increasing production efficiency and reducing dependence on antibiotics as growth promoters. The use of antibiotics as feed additive has been banned after the circulation of Indonesian Minister Agriculture Regulation Number. 14/PK.350/5/2017 concerning the classification of animal drugs [1]. The enactment of this regulation has made the use of natural growth promoters as alternative feed additives in animal feed. Natural additives that can be used is Rice and Aromatic ginger (*Kaempferia galanga*) herbal pulp. Herbal pulp are waste from traditional herbal medicine that is usually thrown away and not used correctly [2].

Rice and Aromatic ginger (*Kaempferia galanga*) herbal pulp has which have good nutritional content when consumed by livestock [3]. Aromatic ginger (*Kaempferia galanga*) as the main component various phytochemical compounds such as *camphor*, *eugenol*, and *sesquiterpenes*. *Monoterpene* and *sesquiterpene* essential oils of Aromatic

ginger (*Kaempferia galanga*) can increase endurance, appetite, antimicrobial, and improve blood circulation [4]. *Ethyl-p-methoxycinnamate* as a major component can be used as an initial precursor in synthesizing other cinnamic acid derivative compounds such as p-methoxycinnamic acid [5]. Antioxidant activity in Aromatic ginger (*Kaempferia galanga*) has contains 2.5-4% essential oils [6]. Rice per 100 grams contains 74.9-79.95 carbohydrates, 6-14 proteins, 0.5-1.08 total fat, thiamine (B1) 0.07-0.58 mg, riboflavin (B2) 0.04-0.26 mg, and niacin (B3) 1.6-6.7 mg. The main carbohydrate contained in rice is starch which consists of two glucose polymers, namely amylose and amylopectin [7].

Rice and aromatic ginger has various bioactive compounds such as essential oils, flavonoids, and saponins, that can have positive effects on livestock health and productivity [8]. Aromatic ginger has a main composition phenolic compounds that function as antioxidants. Antioxidant have the ability to reduce damaged cell conditions, capture free radical compounds, reduce oxidative stress, and reduce the expression of TNF- α which causes damage to [9]. The antioxidant effect of the flavonoid content of galangal rice can reduce oxidative stress in duck which has an impact on increasing productivity [10]. Another effect of the flavonoid content of galangal rice plays a role in fat metabolism which can affect carcass composition [11].

Based on the introduction, it is necessary to conduct research on the content of rice and aromatic ginger (*Kaempferia galanga*) herbal pulp as a feed additive. Proximate analysis is the first step on the research to evaluate nutritional content of rice and aromatic ginger (*Kaempferia galanga*) herbal pulp as feed additive for fattening duck such as dry matter, crude protein, crude fat, crude fiber, and ash to determine the effectiveness of the nutritional composition of rice and aromatic ginger in feed formulation.

2 Materials and Methods

2.1 Materials

Four samples of rice and aromatic ginger (*Kaempferia galanga*) herbal pulp with different compositions. The sample procedure was oven drying at 80°C for 2 days, milling, and filtering with a 120 μ m mesh. The materials used for proximate Analysis with n-hexane solvent and Whatman paper for the crude fat test, H₂SO₄, catalyst, and distilled water for the crude protein test, and H₂SO₄, 0.3 N HCL, 1.5 N NaOH, EDTA, and aquadest for the crude fiber test. The tools used in the proximate test were analytical scales (sensitivity 0.0001g), 105°C oven, a porcelain cup, clamping forceps, desiccator, furnace, goldfish extraction, breaker glass, S sleeve, 80°C oven, kjedahl destruction, distillation tube, oil paper, breaker glass, and crucible. Composition of rice and aromatic ginger (*Kaempferia galanga*) herbal pulp with the following details:

T1 : Rice and aromatic ginger herbal pulp with (aromatic ginger 35%, rice 40%, pandan 5%, palm sugar and water 20%)

T2 : Rice and aromatic ginger herbal pulp with (aromatic ginger 50%, rice 35%, brown sugar and water 15%),

T3 : Rice and aromatic ginger herbal pulp (aromatic ginger 35%, rice 45%, brown sugar

and water 20%)

T4 : Rice and aromatic ginger herbal pulp (aromatic ginger 40%, rice 40%, brown sugar and water 20%).

2.2 Methods

The method used in the study was proximate analysis with five test parameters: dry ingredients, ash, crude protein, crude fiber, and crude fat.

Dry Matter. The principle of dry matter test to remove water content in samples [12]. Determination of Dry Materials (DM) is the first step in proximate analysis. This procedure includes, drying the porcelain cup in a 105°C oven for 1 hour, placing porcelain cup in the desiccator for 30 minutes, weighing the porcelain cup after oven then adding sample of 5 grams with oven 105°C for 4 hours, the last procedure is placing sample in porcelain cup to desiccator for 1 hour then weighing it by calculating using the formula:

$$\text{Dry Matter (\%)} = \frac{(C-A)}{(B-A)} \times 100\% \quad (1)$$

Keterangan:

A = Weight of porcelain cup (g)

B = Weight of porcelain cup + sample (g)

C = Weight of porcelain cup + sample after oven (g)

Crude Protein. The sample was weighed as much as 3 grams of samples then put into the kjedhal flask with adding 1.2 catalysts. Add 5mL of concentrated H₂SO₄ using a dispenser slowly. The kjedhal flask was destroyed for 45 minutes until the sample color turned clear green and left for 10 minutes in the acid room. Then add 20mL of distilled water as much as 3 times into the kjedhal flask by shaking it and put it into the distillation apparatus. The next process is to turn on the distillation apparatus by setting it first then the distillation tube is inserted and pressing the start button. Sample testing is done by pressing the sample list button by filling in the code and sample weight listed on the distillator screen then waiting for the distillation results for up to 5 minutes by recording the results listed on the distillation screen. The crude protein results can be calculated using the formula:

$$\text{Crude Protein (\%)} = \frac{(D-A) \times N \text{ NaOH} \times 0.014 \times 6.25}{(B-A)} \times 100\% \quad (2)$$

Keterangan:

A = Weight of oil paper

B = Weight of oil paper + sample

C = Amount of NaOH for sample titration

D = Amount of NaOH for blank titration

N NaOH= Normality of NaOH

Crude Fat. Put the breaker glass in a 105°C oven for 1 hour then put it in a desiccator for 1 hour followed by weighing the empty breaker glass. Weighing a sample of 2 ± 0.0040 grams wrapped in whatman paper which is inserted into the S sleeve by adding 50mL of N-hexane to the breaker glass followed by installing the goldfish extraction tool and destructed for 4 hours. After 4 hours the S sleeve with the sample is taken and

replaced with a special flask to collect N-hexane again until the N-hexane is left a little for 1 hour. The breaker glass containing fat is inserted into a vacuum oven at 80°C for 1.5 hours, after being ovened it is inserted into a desiccator for 1.5 hours and weighing the breaker glass containing fat with the formula [13]:

$$\text{Crude Fat (\%)} = \frac{C-B}{A} \times 100\% \quad (3)$$

Keterangan:

A= Weight beaker glass (g)

B= Weight beaker glass after oven (g)

C= Weight of sample (g)

Crude Fiber. The sample was weighed as much as 1 ± 0.0040 g using oil paper then placed into a breaker glass by adding 50 mL of 0.3 N H₂SO₄ which had been boiled for 30 minutes. After boiling, add 1.5 N NaOH for 25 minutes, and 0.5 g EDTA for 5 minutes. When the sample has boiled, turn off the heating stove and pour the sample into the crucible gradually. The sample was filtered by adding hot distilled water, 50 mL of 0.3 N HCL, 50 mL of hot distilled water, and 40 mL of acetone to the crucible. After the sample was properly filtered, the crucible was ovened at 105° C for 1.5 hours then placed in a desiccator for 1 hour then weighed the weight of the cup and sample after being ovened. Then put into a furnace at a temperature of 550-660° C for 2 hours. The final stage is to place the filtration cup in a desiccator for 1 hour and weigh and calculate the results using the formula:

$$\text{Crude Fiber (\%)} = \frac{C-B}{A} \times 100\% \quad (4)$$

A = Weight sample

B = Weight crucible after oven 105°C

C = Weight Ccrucible + sample after tanner 550-660°C

Ash. Put the porcelain cup into the furnace at 550-660°C for 1 hour, then put it in the desiccator for 1 hour, weigh the empty weight of the porcelain cup. The sample is weighed as much as 5 grams then put into the porcelain cup and weighed again the porcelain cup + sample. The porcelain cup and the weighed sample are put into the furnace at 550-660°C for 4 hours, then put into the desiccator for 1 hour and calculated using the formula:

$$\text{Ash (\%)} = \frac{(C-A)}{(B-A)} \times 100\% \quad (5)$$

$$\% \text{ Organik Material} = 100\% - \% \text{ Ash} \quad (6)$$

Keterangan:

A = Weight of porceline cup

B = Weight of porceline cup + sample

C = Weight of porceline cup + sample after tanner 550-660°C

3 Results and Discussion

The content of different rice and aromatic ginger (*Kaempferia galanga*) is influenced by the composition of the ingredients, manufacturing procedures, methods, quality of raw materials, and particle size [14]. The variety and growing conditions of aromatic

ginger can affect the content of *ethyl p-methoxycinnamate* in aromatic ginger which can vary from 2.4% to 3.9% [15]. The results of the proximate analysis of rice and aromatic ginger with four different samples can be seen in Table 1.

Table 1. Nutritional Content of Rice and Aromatic ginger (*Kaempferia galanga*) Herbal Pulp.

Treatment	Feed Ingredients Parameters (%)					Ash
	Dry Matter	Moisture Content	Crude Protein	Crude Fat	Crude Fiber	
T1	91.44	8.56	10.30	9.46	10.17	2.74
T2	90.01	9.99	8.26	9.64	8.30	1.80
T3	88.40	11.60	11.19	9.62	6.79	1.54
T4	87.13	12.87	5.54	9.44	17.41	4.04

* Source: Proximate Analysis at Laboratorium Nutrition and Animal Feed Ingredients, Faculty of Animal Science, Universitas Brawijaya.

3.1 Dry Matter and Moisture Content

Based on the data, there was a consistent decrease in dry matter from T1 to T4, with a difference of around 1.43% between T1-T2, 1.61% between T2-T3, and 1.27% between T3-T4. Treatment T1 had the highest dry matter content of 91.44% indicating a more effective drying process or material with a lower water content. While T4 had the lowest dry matter content of 87.13%. T4 with the highest water content 12.87% indicate a less than optimal drying process or more hygroscopic material characteristics. This is in line with the opinion of [16] drying process can maintain nutritional value, minimize water content, and prevent the growth of spoilage microorganisms. The decrease in dry matter content shows that each treatment has an effect on the composition of the material, percentage of dry matter from T1 to T4 was caused by the difference in the composition of the treatments.

Water content is an important parameter in feed material analysis because it affects the shelf life and quality of the material. High water content can accelerate the growth of microorganisms and increase enzyme activity which can reduce the quality of the material [17]. Good feed contains a maximum water content of 14% which is related to shelf life to reduce the risk of mold growth and quality degradation during storage [18]. Factors that can affect water content and dry matter include processing methods, drying temperature, storage time, and environmental conditions [19]. Dry matter and water content are important indicators in assessing feed quality as a determination of the amount of nutrients available to livestock after water is removed.

The consistent decrease in dry matter from T1 to T4 was inversely proportional to the increase in water content from T1 to T4. This shows a significant relationship between the two parameters and the main components of the rice and aromatic ginger herbal pulp. The percentage of dry matter and water content of each treatment produces a total of 100%. with the calculation of the percentage of dry matter = 100% - percentage of water content. Comparing the results of the water content analysis with SNI

8508:2018 [20] regarding the nutritional requirements of fattening meat duck feed with a maximum content of 14%. Based on the standards for dry matter and water content of animal feed, all treatments (T1, T2, T3, and T4) have water content that is within safe limits so that they meet the requirements as a feed additive with the highest water content of 12.87%.

3.2 Crude Protein

The data shows that the T3 treatment produced the highest crude protein content of 11.19%, followed by T1 at 10.30%, then T2 at 8.26%, and the lowest at T4 at 5.54%. The significant difference between the T3 and T4 treatments with a difference of 5.65%. The difference in crude protein content in the rice and aromatic ginger herbal pulp influenced by several factors such as the composition of the raw materials, processing methods, and the herbal medicine making process [21]. T3 with the highest crude protein content 11.19% showed good potential as additional feed for fattening meat duck. The crude protein of the T1 treatment 10.30% was classified as good as additional feed, the T2 treatment of 8.26% could be considered as additional feed, but it needs to be combined with other protein sources to meet the needs of duck, and the lowest T4 treatment 5.54% was less than ideal as an additional protein source.

Feed Protein is an essential component for muscle growth, egg formation, and other physiological functions in poultry [22]. Low crude protein in feed can slow growth and decreased production performance. The use of rice and aromatic ginger herbal pulp as additional feed has added value in terms of bioactive content. Herbal ingredients such as aromatic ginger contain flavonoid compounds that can improve liver function to increase nutrient metabolism which leads to increased endurance and improved feed conversion in poultry [23]. Based on the analysis results, treatment T3 with a crude protein content of 11.19% and T1 with a crude protein of 10.30% have the best potential as additional feed for fattening meat duck. Both treatments can provide a significant protein contribution to the duck feed ration. Treatment T2 8.26% can still be used but with a smaller proportion or combined with other protein sources, while treatment T4 5.54% is less recommended as an additional protein source due to its low content.

3.3 Crude Fat

The data showed that the crude fat content in the four treatments was relatively uniform with a range of values between 9.44% and 9.64%. Treatment T2 had the highest crude fat content 9.64%, followed by T3 9.62%, T1 9.46%, and T4 9.44%. The difference between the highest and lowest values was only 0.20%, indicating the consistency of the crude fat content in all treatments. The uniformity of the crude fat content in the rice and aromatic ginger herbal pulp from various treatments indicated that the difference in treatment did not have a significant effect on the fat content. Ideal fat content in poultry feed ranges from 3-8% depending on the growth phase and maintenance objectives [24]. The crude fat content of the rice and aromatic ginger herbal pulp which ranges from 9.44-9.64% is quite high for poultry feed. High crude fat content in feed can increase the metabolic energy value.

The crude fat content value in the rice and aromatic ginger herbal pulp from the research results is around 9.5% indicating that its use needs to be limited in proportion in the total ration with a maximum dose of 1% still within the range of not being excessive if used as additional feed. The relatively high crude fat content in the rice and aromatic ginger herbal pulp needs to be balanced with other feed ingredients that have a lower fat content when used as feed additive. The crude fat content in the rice and aromatic ginger herbal pulp from essential oils and bioactive components found in rice and aromatic ginger. Aromatic ginger contains essential oils of around 2.4-3.9% consisting of various terpenoid compounds that can affect fat content and provide health effects on duck [25].

3.4 Crude Fiber

Crude fiber is one of the important nutrients in feed that functions to stimulate the peristaltic movement of the digestive tract so that the digestion process of food substances runs well. The results of different crude fiber content in the crude fiber of rice and aromatic ginger are influenced by several factors such as processing methods and raw material composition. The composition of the ingredients for making rice and aromatic ginger herbal pulp has an effect on the crude fiber content, aromatic ginger has a crude fiber content of 7.93% [26] and rice has a crude fiber content of 3.57% [27] making it difficult for instant powder to dissolve in water. The crude fiber content of rice and aromatic ginger based on the results of the study T4 has the highest crude fiber content 17.41%, T3 has the lowest content 6.79%, T1 and T2 are between the two with values of 10.17% and 8.30% respectively. Giving 10% crude fiber level to duck can increase carcass weight, body weight, and chest weight [28]. This is caused by the relatively same nutrient content and the alleged contribution of VFA as an energy source for duck. This indicates that the maximum level of crude fiber provision in duck feed is a maximum of 10%.

Treatment T3 crude fiber content of 6.79% and T2 8.30% meet the standard of crude fiber provision so that it has the potential as additional feed for fattening meat duck. T1 10.17% is at the upper limit of tolerance, T4 very high crude fiber content 17.41% is less suitable for use as the main component of fattening meat duck feed. Crude fiber content that is too high can reduce feed digestibility, reduce nutrient utilization, and reduce nutrient absorption while low crude fiber can maintain digestive tract health and stimulate intestinal motility [29]. Based on crude fiber content, treatments T3 6.79%, T2 8.30%, and T1 10.17% the best treatment as additional feed for fattening meat duck because they meet the provision standard. T4 17.41% is not recommended but can be used with restrictions and improving the processing process to reduce its fiber content.

3.5 Fat

The ash content of T4 rice and aromatic ginger has the highest ash content of 4.04%, T3 has the lowest ash content of 1.54%, T1 is 2.74%, and T2 is 1.80%. Ash content is an indicator of mineral content in feed ingredients. Ash is an organic substance that is not burned in the combustion process of a food ingredient indicating the total minerals

contained in the food ingredient which function as building and regulating substances [30]. The T4 treatment with the highest ash content of 4.04% shows a higher mineral content than other treatments so that it contains important nutrients for the growth and development of fattening meat duck. The appropriate ash content for poultry feed is generally between 3-7%, ash content that is too high can interfere with digestion and absorption of nutrients while ash content that is too low can interfere with the metabolism and growth of poultry [31]. Thus, all treatments are still within the normal range, although T3 1.54% and T2 1.80% are slightly below this limit.

Treatment T3 with the lowest ash content 1.54% indicated a lower mineral content. Low ash content is predicted to have a higher organic matter content that can contribute to the energy value of feed [32]. Fattening meat duck require essential minerals such as calcium, phosphorus, sodium, and magnesium for optimal growth, bone formation and other physiological functions. The mineral content in the rice and aromatic ginger can contribute to meeting these needs, especially in treatments T4 and T1 which have higher ash content. Herbal plants such as aromatic ginger contain various minerals such as potassium, sodium, magnesium, and iron which can have a positive effect on poultry health. The ash content rice and aromatic ginger in fattening meat duck feed must be considered because it is related to the balance of minerals in the total ration. Ash content that is too high can disrupt the balance of calcium and phosphorus, while ash content that is too low may not provide the expected mineral contribution.

Based on the ash content, all treatments of rice and aromatic ginger are still within the range of meeting the standards for additional feed for fattening meat duck. Treatments T4 4.04% and T1 2.74% have better potential in contributing minerals for the needs of fattening meat duck, while T2 1.80% and T3 1.54% are predicted to have higher organic matter content that contributes to energy value.

4 Conclusion

Based on the results of proximate analysis, rice and aromatic ginger herbal pulp have the potential to be used as feed additives for fattening meat duck with the best composition in T3 and T1 because they contain nutritional requirements that meet the standards for fattening meat duck feed.

Disclosure of Interests. The authors have no competing interests to declare that are relevant to the content of this article.

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