Physical characteristic management and palatability of processed mung bean sprout for duck

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Abstract. This research was conducted to observe three forms of processed mung bean sprouts on physical characteristic and palatability in 6 weeks male ducks. Mung bean sprouts were feed in the form of fine, fresh and fermented. Completely Randomized Design was used in this study as experimental design with 3 treatments and 4 replicates. Water activity, water absorption and palatability were measured as variables. The outcomes of this study showed that treatments significantly influenced water activity and mung bean sprouts palatability (P<0.05), respectively. High significantly difference was found among treatments in water absorption (P<0.01). It can be inferred from the research that to improve palatability, duck feed must contain water content between 11.5-14.46%. Mung bean sprout waste can be provided in the form of fresh or even fermented for the duck. According to its water activity, diet consist of mung bean sprout waste in the form of dried mash is recommended to be stored for a relatively longer period of time compare to the other treatments.

1. Introduction
Naturally, ducks have a higher tolerance for fiber-containing feed than other birds. Duck farmers usually utilize agricultural and plantation waste as an alternative feed ingredient, because ducks are able to digest crude fiber better than other poultry up to ± 10%. High feed costs encourage farmers to try to use alternative feed ingredients that are cheap and have good nutrient content to reduce production costs. One of agricultural waste that can be used as an alternative feed ingredient is mung bean sprout waste. Mung bean sprout waste is a part that has not been used again in the production process. It contents 88.5% dry matter, 13.56% crude protein, 33.07% crude fiber, 0.22% crude fat and 64.58% of Total Digestible Nutrient [1].

Grains contain a variety of Non Starch Polysaccharides (NSP), which consist mainly of arabinoxylans (pentosane), β-glucan and cellulose [2]. The type of non-starch polysaccharides in mung bean sprout waste flour is arabinose. Arabinose is a pentose sugar, in the class of polysaccharides or non-soluble fibers (NSP) so that in utilizing waste flour mung bean sprouts require the help of digestive tract microbes. Non-starch polysaccharides can be used optimally as a prebiotic source through a fermentation process. Fermented mung bean sprouts can increase the population of Lactic Acid Bacteria so that short chain fatty acids (SCFA) and lactic acid increase [3].

Mung Bean Sprout can be processed as feed for duck. However, improper feeding management can affect duck productivity. From an economic point of view, converting it to cheap animal feed is the right effort, it does not compete with human needs. Birds must be grown and developed with enough

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nutrients since they kept in a close housing cage all the time. Feed drying technology can compose feed product into powder form. Processing the bean sprout into powder form allows it to be easily mixed into the feed as a complete feed. Complete feeds are recommended to be given to ducks that are intensively maintained [4].

Furthermore, the use of mung bean by using feed processing technology may reduce environmental pollution. A simple and cheap processing technology is needed to make the mung bean sprouts wastes more durable, easy to store and to give. A technology process is required because this mung bean sprout wastes are perishable and voluminous (bulky). It’s also needed to overcome feed scarcity by simple, cheap and applicable processing technology to increase feed quality and storage. Therefore, the aim of this experiment is to find out the physical characteristics (water activity and water absorption) and palatability of the bean sprout waste in formed of fresh, fine and fermented.

2. Materials and method
2.1. Materials
Six weeks of male ducks used for the study were choosed in weight's range of 900 ± 110.15 g. The ration made up of yellow corn, rice bran, soybean meal, fishmeal, mineral mix and mung bean sprout waste. Waste of mung bean sprouts is served in fine, fresh and fermented. Trichoderma harzianum was used to mung bean sprout fermentation process. The composition and nutritional content of the research ration are listed in Table 1, referred on the results of the analysis in the Nutrition and Feed Science laboratory.

2.2. Preparations of mung bean sprouts waste
Making sprouts is done by washing the mung beans and then soaking them for 8 hours before draining them. Mung bean incubation is carried out at room temperature for 24 days. During the germination process, watering is done every 12 hours. Mung beans are separated between bean sprouts and mung bean sprouts waste. The wastes sprouts are set aside for the treatment of feeding fresh bean sprouts. While feeding fine treatment is done by drying the waste in the sun. Afterward, milling is done with the aim of reducing the size of the feed material so that it is easily digested.

The fermentation mung bean sprout waste processing begins by conditioning the wastes at 60-70% moisture content. Then Trichoderma harzianum was dissolved with 6% water of dry matter content. Trichoderma harzianum solution added by 5% molasses of dry matter content and then mixed with mung bean sprout wastes and stirred until homogeneous. At that point, it is put into a plastic that has been perforated and fermented for 6 days. Next 6 days, it aerated to stop the fermentation process [11]. Then the available feed ingredients are arranged in accordance with the formulations that have been previously calculated.

2.3. Research conducting
The experimental design used in this research was Completely Randomized Design with 3 treatments and 4 replicates. The treatments were feeding T0: fresh mung bean sprouts waste; T1: fine mung bean sprouts waste; T2: fermented mung bean sprouts waste. Data were analyzed using ANOVA and followed by Duncan Test [5]. Variables measured were (1). Physical characteristic of mung bean sprouts waste included water absorption and water activity. (2). The palatability of mung bean sprouts waste.

3. Results and discussions
3.1. Chemical composition
The nutrient composition of complete feeds which content mung bean sprouts wastes were presented in Table 1. Refer on proximate analysis, the lowest water content (9.42%) was found in diet contained fine mung bean sprouts waste. The highest water content (14.46%) was noticed in the ratio contained of fermented bean sprouts. The level of water content is affected by water content of raw materials and relative humidity (RH). Reference [6] stated that an increase in pellet water content in the range of
9.9% - 17.25% still meets the maximum water quality feed standard for poultry rations, namely 14%. The microorganism could be inactivity if water content of wafer was approximately 12% - 14% [7]. At this level the feed will not be effortless to be moldy and decayed. Water content of approximately 8-12% is necessary to get an ideal bounding [8].

### Table 1. Nutritional Composition and Content of Diet’s Study

| Feed Ingredients | T0  | T1  | T2  |
|------------------|-----|-----|-----|
| Corn             | 39.6| 40  | 40.7|
| Rice bran        | 18.4| 18.5| 18.3|
| Soy bean meal    | 19.2| 19  | 18.9|
| Fish meal        | 6.8 | 6.5 | 6.1 |
| Fresh mung bean sprout waste | 15 | -   | -   |
| Mineral mix      | 1   | 1   | 1   |
| Fine mung bean sprout waste | -  | 15  | -   |
| Fermented mung bean sprout waste | -  | -   | 15  |
| Total            | 100 | 100 | 100 |

### Table 2. Physical characteristic of ratio contained mung bean sprout waste

| Treatments | Variables | Water absorption (%) | Water activity (%) |
|------------|-----------|----------------------|--------------------|
| T0         |           | 121.53 ± 36.14a      | 0.91 ± 0.01a       |
| T1         |           | 137.79 ± 32.48b      | 0.82 ± 0.11b       |
| T2         |           | 109.75 ± 53.41c      | 0.91 ± 0.01c       |

### 3.2. Water absorption

Table 2 presented physical characteristic of ratio contained mung bean sprout waste includes water absorption. Water absorption is defined as the capability of materials to absorb water from the air to link with material’s particle [12].

T2 was found as lowest water absorption in diet contained of fermented mung bean sprout waste (109.75 ± 53.41). The highest water content was discovered in diet consisted of fermented mung bean sprout waste (14.46%). In diet contained with fine mung bean sprout waste (137.79 ± 32.48), the highest water absorption was found. This was because T1 include more fibers with more air hollow to absorb extra water. The water absorbing volume was inversely proportional with compactness. The higher the bulk the lower water absorbing capacity will occur [6].

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### 3.3. Water activity

One of the important chemical compound for life is water. Microorganism capable to grow at water activity around 0.70. Water activity is the sum of free water that microorganisms rely on for growth [9]. When water activity outside the cell becomes low enough, it causes osmotic stress: the cell cannot take up water and becomes dormant. The microorganisms are not eliminated, they just become unable to grow enough to cause infection [10].
The water activity which found in diet consisted of fresh mung bean sprouts waste (T0) and fine mung bean sprout waste (T1) was not significantly difference (Table 2). The lowest water activity was found in ratio contained fermented mung bean sprouts waste (0.82±0.11). The higher the Aw value (near 1), the more microbes can grow [9]. Addition of molasses to fermented mung bean sprouts waste decreases the water activity in accordance with the hygroscopic nature of sugar which has the ability to form hydrogen bonds with water. The presence of hydrogen bonds between water and sugar causes a decrease in the amount of free water and a decrease in the Aw value, so that water cannot be used for microbial growth. Reference [10] stated that the process of drying, evaporation, adding sugar, adding additional ingredients that are hygroscopic or adding salt is a way to reduce the value of Aw. The water activity ratio can be stored. The water activity of ratio could be concerned by water content in raw materials or environment temperature where the diets was kept [6].

3.4. Palatability
In the current study, the palatability of ratio contained mung bean sprout waste was consumed as indicator to identify how male ducks choose to consume. The palatability of feed ingredients might be indicated by the organoleptic such as aroma and perception (salty, sweet, and bitter), consistency and temperature that draw livestock to eat. Palatability is defined as the reaction provided by the feed given to the livestock. The ability of livestock to digest feed deeply persuaded by the performance and the physical condition of the feed stuff processed. Livestock will be easier to received and attracted to the food particles that are easier to consumed and digest. Improved digestibility will lead to increased consumption [13]. This palatability test was conducted in 3 days presented in Table 3.

| Replication | Treatments | T0   | T1   | T2   |
|-------------|------------|------|------|------|
| 1           |            | 122.50 | 89.70 | 118.10 |
| 2           |            | 125.10 | 80.50 | 116.90 |
| 3           |            | 121.60 | 86.80 | 118.55 |
| 4           |            | 120.50 | 97.20 | 120.20 |
| Mean        |            | 122.43 | 88.55 | 118.44 |

Ratio contained fresh mung bean sprout waste showed the highest palatability. Since, this diet contains some mung bean sprout waste which had particle size that is easy to be consumed. The results in Table 3 presented that ratio contained fermented mung bean sprout waste (T2) is not significantly different with diet content of fresh mung bean sprout waste (T0). Besides, T2 had the highest water content that make it easy to swallow. Good diets should have good palatability. This remains crucial because it is an outcome of a combination of aspects that animals were stimulated by eyesight, aroma, toching base and taste [14].

From the three types of feed given, the treatment of fine mung bean sprout waste containing rations shows the lowest average yield (88.55 g / head / day). Reference [15] clarified that duck should provide with a wet diet instead of a fine dried diet. Because the duck's beak is wide and jagged. It is difficult for the duck to take smooth and dry feed. However, if they are forced to eat dry food, some of the feed will stick to the beak. Feed that has entered the oral cavity will be attached to the palate of the oral cavity, tongue and throat. This situation will stimulate the duck to drink so that it is easy to swallow the feed. But when the duck is drinking, some of the feed in the beak and oral cavity will be left in the drinking water and will be wasted. Based on study observations, the food scattered in drinking water reaches 20-22% of the given.

4. Conclusion
It can be inferred from the research that to improve palatability, duck feed must contain water content between 11.5-14.46%. Furthermore, mung bean sprout can be provided in the form of fresh or even...
fermented for the duck. According to its water activity, diet consist of mung bean sprout waste in the form of dried mash is recommended to be stored for a relatively longer period of time compare to the other treatments.

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