Chemical analysis of commercial quail laying ration with substitution of fermentation waste bean sprouts

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Abstract. Japanese quail (Coturnix-coturnix japonica) has great potential to be developed as an alternative source of cheap animal protein. Generally, quail breeders use commercial rations. The problem is that commercial rations are expensive. From an economic perspective, the cost of the ration is very high, reaching 70% of the total cost of production. To reduce the cost of ration and to maintain the nutritional quality, it is tried to substitute commercial rations using feed ingredients that have good nutritional content and the price is cheap by using waste bean sprouts. The purpose of this study was to determine the chemical quality of commercial quail laying rations substituted with fermented waste bean sprouts. The study used a completely randomized design (CRD). The treatment consisted of substituting 0%, 5%, 10% and 15% waste bean sprouts in the commercial quail laying ration. From the research results obtained that the substitution of fermented waste bean sprouts in commercial quail laying rations has a very significant effect (P<0.01) on dry matter, water content, ash content and organic matter. Substitution of waste bean sprouts in quail laying rations up to the level of 10% produces the lowest ash content and water content and meets the SNI standard, as well as the highest organic matter content of the ration.

1. Introduction
Japanese quail (Coturnix-coturnix japonica) has great potential to be developed as an alternative source of protein. Compared to chicken meat, quail maintenance is faster and easier to handle. That is because quail is one of the poultry that has a fast production, early adult sex, has a small body [1] and its maintenance requires a relatively low cost. The main product in the maintenance of female quail is in the form of eggs and a by-product in the form of meat when the female quail is rejected. Egg production from quail is at 250-300 eggs / head /year, with an average weight of 10g/egg with lower production costs [2]. Quail eggs are the best source of protein and fat, containing vitamin A, iron, vitamin B and B12 [3]. Every 100 g of quail eggs contains 15 g of protein and 10.2 g of fat.

In general, quail farmers in running their business use commercial rations from factories because they are considered more practical. The problem is that commercial rations are expensive, while rations are the basic of livestock. From an economic perspective, the cost of ration is very high, reaching 70% of the total cost of quail livestock production [4]. To reduce the cost of rations and maintain the nutritional quality, it is tried to substitute commercial rations using feed ingredients that have good nutritional content and the price is cheap by using waste bean sprouts. Green bean sprout waste is a by-product of making bean sprouts, consisting of mung bean shells and bean sprouts fragments which are the waste of the production [5]. Bean sprouts qualify as animal feed ingredients because they are readily...
available, easily available, cheap, non-toxic, high in protein content (13.6%), and contain vitamins E and B. Because bean sprouts are high in protein, bean sprouts waste is used as an ingredient plant protein feed source. The addition of bean sprouts by 2.5% in commercial rations could improve the physical quality of rations such as reducing specific gravity, particle size for the better and expanding the contact surface between particles in the ration [6]. However, there are weaknesses of bean sprout waste, which is a high crude fiber content of 49.44% [7] and the water content is also high, it will not easily causing odor. High crude fiber content in bean sprouts will increase the crude fiber content in the ration. High crude fiber feed cannot be given directly to poultry because in the digestive tract of poultry there are no microbes that are able to digest crude fiber, so it requires fermentation treatment to reduce levels of crude fiber [8]. When rations are applied to quail it can reduce the digestibility of the ration which will ultimately reduce quail productivity. Efforts to reduce levels of crude fiber in bean sprouts can be done by fermentation. The fermentation process can break down complex molecules into smalls molecules so that feed ingredients have crumb textures, have better digestibility values because the complex components will be broken down into simple components so that they are easily digested [9]. Quail nutritional requirements according to SNI 01-3907-2006 consist of a maximum of 14% water content, a minimum of 20-22% crude protein, a maximum of 7.0% crude fat, a maximum of 7.0% crude fiber, a maximum ash content of 14%, calcium 2.50-3.50% and total phosphorus 0.6-1.0%. The purpose of this study was to examine the chemical content of laying quail rations substituted with fermented bean sprouts flour. The results showed that the substitution of fermented bean sprouts waste flour had a very significant effect (P<0.01) increasing water content and organic matter content and decreasing dry matter content and ash content of quail laying rations.

The Urgency of the research is that quail rations used by quail farmers are commercial rations on the market. The price of commercial rations is expensive because it still uses materials that compete with human food. To reduce the cost of ration, the research tried to substitute commercial rations with market waste, ie bean sprouts. Bean sprouts contain nutrients that are high in protein, but bean sprouts contain high crude fiber. So that the fermentation process is needed to reduce the levels of crude fiber. Testing of dry matter, water content, organic matter and ash content in the research ration is very important to know the quality of the ration. Dry matter is the total of food substances other than water in an ingredient [10]. Dry ingredients consist of organic and inorganic ingredients. Organic material comes from the carbohydrate (BETN) group, crude protein, crude fat, crude fiber and vitamins. While the inorganic material is a mineral group.

2. Materials and methods
Research has been conducted at the Laboratory of Basic Sciences, Faculty of Agriculture, Warmadewa University and the Laboratory of Nutrition and Animal Feed, Udayana University. The research method uses a completely randomized design (CRD), consisting of 4 treatments and 3 replications. The treatments applied were P0 ration with 100% commercial ration of quail laying (as a control), P1 ration with 95% commercial ration and 5% fermented bean sprout flour, P2 ration with 90% commercial ration and 10% fermented bean sprouts, P3 ration with 85% commercial rations and 15% fermented bean sprouts flour. The variables tested were dry matter, water content, ash content and organic matter ration using proximate analysis with the AOAC method (1990) [11], with the following formula:

\[
\text{% Water content} = \frac{\text{weight sample before oven} - \text{weight sample after oven}}{\text{weight of sample}} \times 100\% \quad (1)
\]

\[
\text{% Dry matter} = \frac{\text{weight sample after oven}}{\text{weight of sample}} \times 100\% \quad (2)
\]

\[
\text{% Ash content} = \frac{\text{ash weight}}{\text{weight of sample}} \times 100\% \quad (3)
\]

\[
\text{% Organic matter} = \frac{(\text{weight of sample} - \text{ash weight})}{\text{weight of sample}} \times 100\% \quad (4)
\]
3. Results and discussion

Table 1 shows the results of the research, namely the level of substitution treatment of fermented bean sprout flour in commercial laying of quail laying showed a significantly different effect (P <0.01) on all variables tested such as dry matter, water content, ash content and organic matter of the ration compared to control ration.

Table 1. Fermentation waste bean sprouts substitution for dry matter, water content, organic matter and ash content of quail laying ration.

| Variables (%) | Treatments |
|---------------|------------|
|               | P0 P1 P3 P4 |
| Dry matter    | 92.07 90.90 90.24 89.21 |
| Water Content | 7.75 9.10 9.76 10.79 |
| Organic Matter| 83.07 84.19 86.40 84.15 |
| ash content   | 16.93 15.81 13.60 15.85 |

Information: Different letters in the same line are very significantly different (P <0.01)

The highest dry matter content is at P0 (control) is 92.07%, because there is no addition of water and fermentation as a substitute so that there is no increase in water content in commercial rations. Decrease in the value of dry matter was shown in treatments P1 (90.90%), P2 (90.24%), and P3 (89.21%), the higher the substitution level of fermented bean sprouts flour, the lower the dry matter ration (P <0.01). This is because the greater availability of dissolved carbohydrates causes an increase in fermentation activity by bacteria to produce lactic acid, causing greater loss of dry matter. Besides the fermentation of bean sprouts waste flour increases the water content of the ration. This is in accordance with the opinion of Surono, that the loss of dry matter is increasing along with the increasing level of additives [12]. In addition, the decrease in dry matter ration is influenced by respiration and fermentation, respiration causes many nutrient contents to decompose so that it will reduce dry matter, while fermentation will produce lactic acid and water [13]. Low levels of dry matter were 88.00% - 89.59%, due to the use of bean sprouts without fermentation [6]. Dry matter is influenced by water content, dry matter decreases if the water content of the material increases [14].

The water content of the study ration ranged from 7.75 to 10.67 (as shown in Table 1). This result is lower than the maximum water content determined by SNI, which is a maximum of 14% [15]. Substitution of fermented bean sprouts waste flour in commercial quail laying rations was very significant (P <0.01) increasing the water content of the ration. The lowest water content is at P0 (control), because there is no substitution in the control. In treatments P1, P2, and P3 an increase in water content due to the higher level of substitution in the ration. Increased water content due to the metabolism of microorganisms in the use of energy during the fermentation process that produces water. The increased water content after fermentation is caused by the metabolism of microorganisms that produce CO₂ and H₂O. The formation of water in the fermentation process comes from sugar fermentation. Therefore, the decrease in dry matter, is also influenced by an increase in water content derived from the fermentation process [16].

The highest organic matter ration in the P2 treatment is 86.40% (P <0.01) followed by P1 (84.19%) and P3 (84.15%) and the lowest in P0 (control) is 83.07% as in Table 1. is the same range of levels of organic matter, namely 84.10% - 86.50% [6]. Increased organic matter in the substitution treatment due to the addition of molasses as a source of carbohydrates, namely BETN with main constituent components of starch and sugar. Among the three substitution treatments the value of organic matter at P1 and P3 was significantly lower than P2 because of the degradation of organic matter, molasses as a fermentation medium was used as a food source for bacteria to produce lactic acid and also an increase in water content resulting in loss organic matter. This is consistent with the statement of Surono that in general lactic acid is produced from organic components, especially carbohydrates, so the addition of
molasses increases the formation of lactic acid [12]. The addition of molasses is intended to accelerate the formation of lactic acid and provide a source of energy for bacteria [16].

The ash content of the treatment ration was highest at P0 (16.93%), then P3 (15.85%), P1 (15.18%) and lowest at P2 (13.60%) as in Table 1. The ash content at P2 was significantly lower because the organic matter at P2 ration was lower (P <0.01) than the treatment P0, P1 and P3. The range of ash content in this study (13.60% - 16.93%) is almost the same as the range of ash content from Kurniawati's research, which is 13.50% - 16.68% which replaces some commercial rations with rations containing bean sprouts in laying hens [6]. Ash content of a material is largely determined by the content of organic matter. It was also explained by Setyawati, that the less organic matter degraded, the less ash content was decreased [17]. Ash content in P2 (13.60%) according to SNI for quail laying is 14%.

4. Conclusions
From the results of the study concluded that the substitution of 5%, 10%, and 15% fermented bean sprouts flour meal in commercial laying of quail laying very significantly (P <0.01) affects the chemical quality of the ration ie increasing water content and organic matter as well as reducing dry matter and content ash, compared to commercial rations without substitution. The best laying quail ration, approaching the nutritional quality of commercial rations and meeting the SNI standard requirements (2006) is a commercial ration substituted by 10% fermented bean sprouts waste flour. Substitution of 10% bean sprouts flour will be able to utilize waste and reduce the cost of ration.

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