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Rice Bran Substitution Effect Using Fermented Rumen on Consumption, Egg Production and Feed Conversion of Duck

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Abstract: This study aimed to determine the effect of flour of fermented rumen digesta as a substitute for rice bran towards feed consumption, egg production, and feed conversion ratio of Khaki Campbell duck. This research used 50 Khaki Campbell ducks aged 24 weeks old. The method used rice bran substitution using alternative materials like fermented rumen digesta flour with some percentage and then observed feed consumption, egg production, and feed conversion ratio of duck. This method used a "Completely Randomized Design" with 5 treatments and 5 replications. The treatment used was fermented rumen digesta flour with varying doses 0% (T0); 7.5% (T1); 15% (T2); 17.5% (T3); and 25% (T4). Data were analyzed using *Analysis of Variance (ANOVA)* and continued with *Duncan's Multiple Range Test of SPSS.* The result showed that the best treatment was addition 17,5% rumen digesta (T3) were significant differences ($p<0.05$) between other treatment on feed consumption (gram/duck/day) = $138.51^a \pm 7.643$ (T0); $140.14^a \pm 7.823$ (T1); $142.06^{ab} \pm 6.070$ (T2); $150.77^b \pm 5.510$ (T3); $141.04^a \pm 7.166$ (T4), on egg production (gram/duck/day) = $68.57^a \pm 16.714$ (T0); $60.00^a \pm 21.773$ (T1); $55.71^a \pm 3.438$ (T2); $56.42^a \pm 18.898$ (T3); $34.28^b \pm 20.981$(T4), and on feed conversion ratio = $3.35^a \pm 0.626$ (T0); $3.78^a \pm 0.449$ (T1); $4.48^a \pm 1.174$ (T2); $4.93^a \pm 1.925$ (T3); $8.36^b \pm 4.661$ (T4). The conclusion is that fermented rumen digesta as a substitution for rice bran can be used until dose 17.5% in formula feed to improve feed consumption, egg production, and feed conversion ratio of duck.

Keywords: rumen digesta, Khaki Campbell duck, feed consumption, egg production, feed conversion.

发酵瘤胃的米糠替代对鸭肉消耗，产蛋量和饲料转化的影响

摘要:

这项研究旨在确定发酵的瘤胃消化粉作为米糠的替代物对卡其色坎贝尔鸭的饲料消耗，产蛋量和饲料转化率的影响。这项研究使用了24周龄的50只卡其色坎贝尔野鸭。该方法使用米糠代替其他材料，例如发酵的瘤胃消化的面粉，然后观察其饲料消耗，产蛋量和鸭子的饲料转化率。该方法使用了“完全随机设计”，并进行了5次治疗和5次重复。所使用的处理方法是0%（T0）的不同剂量的发酵瘤胃消化粉；7.5%（T1）;15%（T2）;17.5%（T3）;和25%（T4）。使用方差分析对数据进行分析，并继续进行邓肯的社会科学统计软件包的多范围检验。结果表明，最佳处理是添加17.5%瘤胃消化物（T3），其他处理之间的饲料消耗（克/鸭/天）之间的显着差异（p<0.05）=138.51a±7.643（T0）；140.14a±7.823（T1）;142.06ab±6.070（T2）;150.77b±5.510（T3）;产蛋量（克/鸭/天）为141.04a±7.166（T4）=68.57a±16.714（T0）;60.00a±21.773（T1）;55.71a±3.438（T2）;56.42a±18.898（T3）;34.28b±20.981（T4），进料转化率= 3.35a±0.626（T0）；3.78a±0.449（T1）; 4.48a±1.174（T2）;

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4.93a±1.925（T3）;
8.36b±4.661（T4）。结论是发酵的瘤胃消化液可以替代米糠，直到配方饲料中的剂量达到17.5%为止，以改善饲料消耗，产蛋率和鸭子的饲料转化率.

关键词：瘤胃消化，卡其色坎贝尔鸭，饲料消耗，产蛋量，饲料转化率.

1. Introduction

Ducks are one of the poultry that can be used as a promising business opportunity in the livestock sector. Ducks are one of the choices in the business of providing eggs and meat so that they can be used as mainstay livestock [1]. One type of duck that has a high ability to produce eggs is the Khaki Campbell. Khaki Campbell has a high enough production capacity of 365 items per year [2], and feeding is the most important factor in determining the efficiency of livestock production. However, one of the obstacles in raising poultry is the cost of feed. The largest proportion of costs in livestock management is used for feed 70% [3]. Various efforts are needed to find alternative feed, one of which is utilizing rumen contents as alternative feed.

The rumen digesta of slaughterhouse (abattoir) waste has the potential as an alternative feed [4]. Food substances contained in the rumen include 8.86% protein, 2.60% fat, 28.78% crude fiber, phosphorus 0.55%, 18.54% ash and 10.92% water. The rumen also contains nutrients that are used by microbes as an energy source, so that also functions as a bio activator to accelerate the process of maturation of organic compost because the rumen contents comprised many microorganisms, including bacteria (109 mL–1 to 1012 mL–1 rumen fluid), protozoa (105 mL–1 to 106 mL–1 liquid rumen), and some fungi [5]. The contents of the beef rumen can be used as animal feed and give optimal results, so it needs to be processed into flour first before giving it to livestock [6], [7]. The use of beef rumen content as feed cannot be applied directly to poultry because of its high crude fiber content. High crude fiber can affect consumption levels, feed digestibility, body weight gain, sex maturity, egg production, and egg quality [8]. A decrease in the crude fiber of them can be done through biological fermentation using probiotics. The probiotics used in this study contained cellulolytic bacteria, namely Enterobacter spp., Bacillus spp., Cellulomonas spp., Actinomyces spp.

Based on the description above, it is necessary to research using fermented rumen content as an alternative feed ingredient for rice bran substitution in formula feed on feed consumption, egg production, and feed conversion of female Khaki Campbell (Anas platyrhynchos domesticus) ducks.

2. Materials and Methods

2.1. Place and Time of Research

This research was conducted from August 2020 to October 2020 at Khaki Campbell Duck Farm, Sawahan Village, Turen District, Malang Regency. Proximate analysis was carried out at the Faculty Animal Feed Laboratory Faculty Veterinary Medicine Universitas Airlangga Surabaya, Indonesia.

2.2. Research Materials

The materials used in this study included 50 Khaki Campbell ducks aged 24 weeks old, layer-phase duck feed consisting of 25% concentrate, 50% *karak* and 25% rice bran, and rumen-filled flour (rumen digesta), which had been fermented using 6% probiotic, molasses 3% and water as much as 30% per 1 kg. Lysol 3%.

2.3. Research Material

The tools used in this research are food and drink containers, digital scales, plastics, cage cleaning tools. In addition, tools used in this research include plastics, grinding machines, spray, digital scales.

2.4. Treatment of Experimental Animals

The treatment stage was given to Khaki Campbell, aged 24 weeks old, as many as 50 ducks, and they were randomly divided into 5 treatments, each treatment consisting of 5 ducks as replications. Ducks were fed twice a day, morning and evening, as much as 160 g/duck/day. The feed treatment for P0 as control consisted of 25% concentrate, 50% *karak*, and 25% bran. Whereas for treatment feed T1, T2, T3, and T4, respectively, rumen-filled flour that has been fermented using probiotics at a dose of 7.5%; 12.5%; 17.5%, 25% were used for rice bran substitution, and drinking water was given ad libitum.

2.5. Feed Consumption

Feed consumption can be formulated as follows:

Feed consumption (g/hens) = feed given – left over feed.

2.6. Duck Egg Production

Egg production can be calculated using the formula DDP (Duck Day Production) as follows [9]:

$$DDP = \frac{\text{number of eggs (egg)}}{\text{number of ducks (hens)}} \times 100\%$$

2.7. Feed Conversion Calculations

The feed conversion value can be calculated using the formula [10]:

$$\text{Feed conversion} = \frac{\text{feed consumption (g)}}{\text{egg weight (g)}}$$

2.8. Data Analysis

The data obtained from this research were tested for normality using the Kolmogorov Smirnov test. If the data is normally distributed, it is analyzed using Variant (ANOVA) followed by Duncan's Multiple Range Test. Data analysis using SPSS 23 for Windows computers.

3. Results

3.1. Feed Consumption

Table 1 Average feed consumption of Khaki Campbell duck

Treatment	Feed consumption (gram/duck/day) [mean ± SD]
T0	$138.51^{a} \pm 7.643$
T1	$140.14^{a} \pm 7.823$
T2	$142.06^{ab} \pm 6.070$
T3	$150.77^{b} \pm 5.510$
T4	$141.04^{a} \pm 7.166$

Fig. 1 Fermented of rumen filled flour

Fig. 2 Khaki Campbell ducks

3.2. Daily Duck Eggs Production

Table 2 Average egg production Khaki Campbell duck

Treatment	Daily duck eggs production (gram/duck/day) [mean ± SD]
T0	$68.57^{a} \pm 16.714$
T1	$60.00^{a} \pm 21.773$
T2	$55.71^{a} \pm 3.438$
T3	$56.42^{a} \pm 18.898$
T4	$34.28^{b} \pm 20.981$

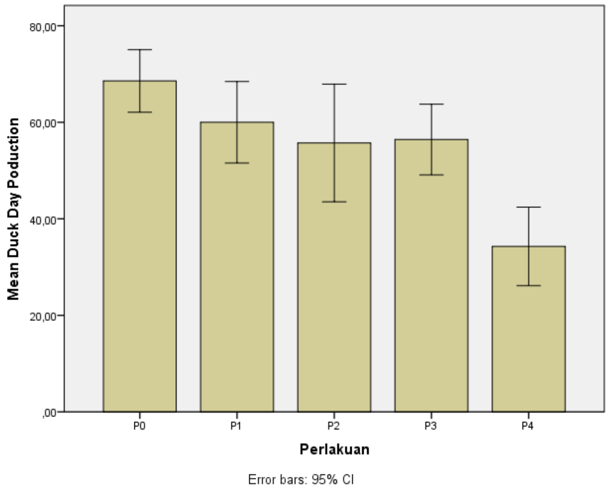

Fig. 3 Bar chart of average egg production

The results show that there is a very significant difference in T4 against other treatments. The balance of protein and energy levels in T4 feed is lower than in other treatments.

3.3. Feed Conversion

Table 3 The average feed conversion value of Khaki Campbell duck

Treatment	Feed Conversion Ratio [mean ± SD]
T0	$3.35^{a} \pm 0.626$
T1	$3.78^{a} \pm 0.449$
T2	$4.48^{a} \pm 1.174$
T3	$4.93^{a} \pm 1.925$
T4	$8.36^{b} \pm 4.661$

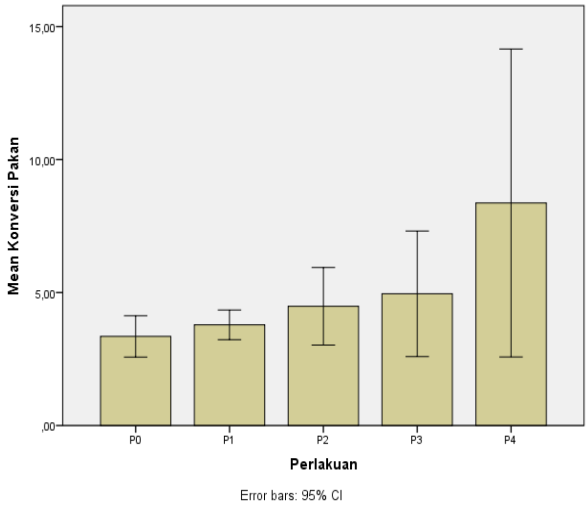

Fig. 4 Bar chart of average feed conversion

The best feed conversion results were obtained in treatment T0 as a control. Meanwhile, the best results for the substitution dose of TIRF with rice bran was T1 (7.5% fermented rumen digesta flour + 17.5% rice bran) which resulted in the difference of conversion value that was not much different from the control feed.

4. Discussion

The results of data analysis showed that the lowest feed consumption was in treatment P0 of 138.51%, while the highest yield of feed consumption was in the T3 treatment of 150.77%. Several factors can influence the level of feed consumption; one factor is the nutritional content in the feed. The high crude fiber feed will reduce the digestibility of feed ingredients so that the absorption of food substances will also decrease, including energy metabolism (EM) [11].

Metabolic energy in treatment T0 (control) is higher than T3. That means the highest feed was obtained in T3 treatment. In addition, crude fiber is also one of the bulky (filling) ingredients; thus, the greater the crude fiber consumed, the faster the birds will feel full and tend to stop feed consumption. That can be seen from the decrease in feed consumption in treatment T4 because it contains crude fiber, which is greater than the other treatments. That is in line with the opinion that crude fiber has bulky properties (filling) consisting of cellulose, hemicellulose, and lignin, most of which are difficult to digest by poultry [12].

In addition, feed consumption is also affected by protein in the feed. The protein content in the ratio of each treatment started from the highest, those are T0= 16.25%, T1= 16.11%, T2= 16.02%, T3= 15.92%, T4= 15.78%.

The protein percentage in the feed for layer-phase ducks is at least 15%. It is in line with the opinion from [13] that the balance between protein and energy in the ration affects feed consumption.

Table 2 shows a very significant difference in T4 against other treatments. The balance of protein and energy levels in T4 feed is lower than in other treatments. In line with [14], the higher the energy-protein level given, the higher egg production is produced and vice versa. Feed consumption is closely related to egg production, which is related to the absorption rate of nutrients, affecting the balance of protein and metabolic energy. In addition, high crude fiber can also affect egg productivity. The high crude fiber is one factor that hinders the digestibility of livestock so that it can affect the productivity of the eggs produced [9].

The factors that cause differences in egg production are the amount of feed and its nutritional content that is not optimal because the nutrient needs during the egg formation process are inadequate [15]. Other factors affecting egg production other than feed are genes and sex maturity speed [16].

Feed conversion is a parameter used to determine feed use efficiency, which is useful for knowing how much ability to lay ducks to convert the consumed feed into eggs.

The best feed conversion results were obtained in treatment T0 as a control. Meanwhile, the best results for the substitution dose of TIRF with rice bran was T1 (7.5% fermented rumen digesta flour + 17.5% rice bran) which resulted in the difference of conversion value that was not much different from the control feed. The use of fermented rumen digesta-filled flour substitution up to T3 or rumen content doses of up to 17.5% in the ANOVA test did not produce a very significant effect. However, each additional dose could increase the feed conversion rate, which means that the level of efficiency of use feed tends to decrease. Substitution in the P4 feed treatment with a substitution dose of 25% to replace rice bran produced a very significant effect due to the lower protein and EM content compared to other treatments. That is in line with the opinion from [17], which states that the high and low rate of ratio conversion is largely determined by the balance between metabolic energy and nutrients, especially protein and essential amino acids, and lysine and methionine.

Furthermore, the feed conversion value depends on feed consumption and the weight of the eggs produced. In T4 treatment, the feed consumption tended to be the same as the other treatments. However, egg production was so low that it had a devastating effect on feed conversion. Besides, the use of feed is not efficient in laying and broiler ducks; it can be caused by several factors, including genetic/seed factors, the amount of scattered feed, and the nutritional content of the feed that are not suitable for needs [3].

The novelty of the research, there is no similar research applied to ducks. The addition of dried rumen digesta (DRD) in livestock diet can be used as alternative feed ingredients to lessen prevailing cost and scarcity of feed materials with high competition between animals and humans. DRD in the undigested rumen content that may be recycled into the animal feed [11]. Until now, duck feed substitution with rumen digesta has only been applied to layer chickens [18], broiler chickens [19], [20], and finisher broiler chickens [21] and has not been applied to ducks.

The practical limitations for applying the results are that the rumen digesta can be used as a substitute feed for ducks after undergoing processing in the form of drying, refining, and adding probiotics to increase digestibility [11], [22].

5. Conclusion

Fermented rumen digesta-filled flour can be used as a substitute feed with rice bran up to a dose of 17.5% in formula feed. It can still maintain the value of feed consumption, egg production, and feed conversion in Khaki Campbell ducks.

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