Red dragon fruit peel (*Hylocereus polyrhizus*) as feed biosupplement on performance of fattening rabbits

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Abstract. Peels of red dragon fruit (*Hylocereus polyrhizus*) as an agricultural by-product contain antioxidants and nutrients that can be used as one of the raw materials for animal feed. This study aims to determine the effect of various concentrations of peels of red dragon fruit (*Hylocereus polyrhizus*) as feed biosupplement on the performance of fattening rabbits. 20 rabbits were placed in individual cages and adapted to basal feed. They were fed with addition of the supplement concentration at 0% (DP0), 7% (DP7), 8% (DP8), and 9% (DP9) respectively for four weeks. Data were collected during the first, second, third and fourth weeks (including twenty-eight days) in the form of feed consumption, feed conversion, and weight gain. Data were subsequently analyzed using Analysis of Variance (ANOVA) with a 5% significance level. The results indicated the significance between the control treatment (DP0%) and other treatments. The treatment with the addition of 9% biosupplement of the dragon fruit peel showed the highest performance improvement, with a mean value of feed consumption of 165.95 grams/day, mean of feed conversion of 3.61 and weight gain of 703.29 grams. In conclusion, this study demonstrates that the addition of fermented dragon fruit peel into the Rex rabbit feed can improve several aspects of rabbit performance.

Keywords: biosuplement of dragon fruit peel, feed consumption, feed conversion, weight gain, rabbits

1. Introduction

In the current development, rabbits have prospectively become good alternatives to overcome meat shortage as a source of protein and to sustain food availability in communities. Rabbits with their varieties can be utilized for five different products (4F + L), namely food (meat), fur, fancy rabbits, fertilizer, and laboratory animals [1]. In addition to their high reproductive capacity and easiness to raise, rabbits also produce meat that contains essential nutrients for good health. Rabbit’s meat contains such high protein with 20% - 21%, low fat, and low cholesterol that it can be used as an alternative for animal protein sources to fulfill people's nutritional needs for animal products [2]. Thus, increased livestock production, especially with rabbit farming, is expected to meet the needs of animal proteins [3].

According to last research [4], feeding is the most crucial part in rabbit farming and becomes the key component for each breeder to gain profit. Breeders with a huge number of rabbits that reach hundreds and above should need feed in high quantity and quality as well. Normally, feed used for
rabbit farming is produced from easily available, inexpensive, and good quality materials that have nutritional composition required to fulfill the nutritional needs of the rabbits. Feed has been a major limiting factor thatdisrupts the development of rabbit productivity, where balanced feed needs to be available at competitive prices. Therefore there should be an alternative for the balanced feed using local raw materials, particularly as a source of fiber and protein [5]. The strategy of ingredient selection for feed in rabbit fattening includes finding a fresh and easily available feed source that can be obtained from the local market at a low cost, especially in urban areas with limited availability of turfgrass [6]. Alternative feeds from agro-industry products are essential due to their rich nutrients and needs to be the focus of concern as a means to reduce agricultural waste [7, 8].

The availability of land as a source of fodder is reduced due to the used open land for housing and the tendency of farmers to plant land with agricultural crops that can be direct benefit for the needs of human. The utilization of agricultural waste as an alternative feed is one of the the solution to preventing a shortage of feed ruminants. With the diversification of the utilization of the side product (by-product) which is often considered as a waste (waste) from waste of agricultural and plantation be feed can encourage the development of agribusiness ruminants integrative in a production system integrated with the pattern of agriculture and plantation through recycling re-biomas environmentally friendly or known “zero waste production system” [9].

One of the sources for animal feeds is dragon fruit waste. Research on dragon fruit waste for concentrate feed mixtures has been conducted in cattle farming [10], showing that this supplement can increase the weight of the final carcass. Dragon fruit peel accounts for 30-35% of the total weight of the fruit is organic waste that has not been widely used in Indonesia. The low protein and high crude fiber in the fruit peel become the major constraints for its use as animal feed, especially in rabbits [11]. Furthermore, the other constraint to handle dragon fruit peels is short shelf life due to their high moisture content which is up to 94.05% [12]. High moisture content makes dragon fruit peel susceptible to microorganisms that can damage the structure the components of the peels. To overcome this, the dragon fruit peels should be dried to reduce moisture content in order to increase their resistance to microorganism attack.

Nutritional values of the dragon fruit peels can be improved using biofermentation method by utilizing the Sacharomyces cerevisiae. Sacharomyces cerevisiae yeast can increase digestibility of the fiber by degrading lignocellulose and hemicellulose bonds and can serve as probiotics in animal feed [13]. Another benefit of such a fermentation product is that it can suppress the activity of the reductase 3-hydroxy-3-methylglutaryl Co-A enzyme that functions to synthesize cholesterol in the liver [14], and can reduce the amount of animal fat [15]. Research on dragon fruit peels for animal feed is rare, as concluded by several experts [11, 16]. Although unfermented dragon fruit peels can be given to the level of 1% - 4% without any negative effect on livestock, previous studies on the fermented dragon fruit flour (Hylocereus polyrhizus) have shown its effect on increased daily body weight and total body weight of livestock during growth [17].

Based on the background above that implies the potential role of fermented red dragon fruit peels as a feed source, the researchers are interested in exploring potentials impact of dragon fruit peel waste as a feed supplement on feed consumption, feed conversion, and weight gain. This study, therefore, is expected to provide valuable information about the efficient utilization of dragon fruit peels as an alternative feed raw material to address the nutritional needs of broiler rabbits.

2. Methods
This study was conducted at the Teaching Farm of Faculty of Veterinary Medicine (FKH) of UNAIR Banyuwangi. Feed manufacturing was carried out at Feed and Nutrition Laboratory of FKH UNAIR Banyuwangi, and the proximate test was performed at Animal Feed Laboratory of FKH UNAIR Surabaya. The present study is an experimental study using a completely randomized design (CRD). The animals used in the experiment involved 20 male Rex rabbits assigned into 4 treatment groups with 5 replications of each. The average bodyweight of the rabbits is 1052.19 ± 136.25 g and their age is around 3-4 months.
The fermented dragon fruit peel flour was made of sliced dragon fruit peels which were dried using an oven under a temperature of 55°C for ± 8 hours. The fermentation process red dragon fruit peel flour with *Saccaromyces cerevisiae* lasted until it was evenly distributed and the process was left to complete which takes approximately 2 weeks. The research materials involved complete rabbit feed of Rabbitfeed® that contains 19.18% crude protein, red dragon fruit peel flour, drinking water, disinfectant for hutch sterilization, and drinking tableware. The primary tool used in this is individual rabbit hutches with 60 cm long, 40 cm wide, and 40 cm high, with walls and floor made of bamboo and roof of asbestos, and equipped with mosquito nets to filter feces and urine. The tools also include a tool used to collect feces and feed residuals such as digital scales with an accuracy of 1 g, ovens, pans, plastic containers, and freezers.

For the first phase of the treatments, prior to the experiments, the rabbits were initially adapted for one week by giving grass and pellets until they are able to consume the feed that will be tested to give 100% pellets. The rabbits were fed twice a day at 07.00-09.00 in the morning and at 16.00-18.00 in the afternoon. The total feed in a single day was 250 g/head, divided into 125 grams in the morning and 125 grams in the afternoon. Drinking water was provided ad libitum. From the second to the fifth week, the feeding process only used pellets. Measurement of body weight was performed at the end of the adaptation period and the result was used as initial data for the study. The treatments consisted of feed supplement for complete rabbit feed with different concentration of fermented red dragon fruit peels (DP), namely DP0 = 100% of Commercial Feed without DFP, DP7 = 100% Commercial Feed + 7% DFP, DP8 = 100% Commercial Feed + 8% DFP, and DP9 = 100% Commercial Feed + 9% DFP. The treatment feed was administered with a total of 250 g/head/day.

| Nutritional Value (%) | DFP | DP0 | DP7 | DP8 | DP9 |
|-----------------------|-----|-----|-----|-----|-----|
| Dry Ingredients       | 92.21 | 90.14 | 90.15 | 90.17 | 90.09 |
| Dust                  | 17.13 | 9.08 | 9.30 | 9.76 | 9.79 |
| Crude Protein         | 10.66 | 19.18 | 17.34 | 18.87 | 19.86 |
| Crude Fat             | 7.60 | 12.03 | 12.05 | 11.99 | 12.03 |
| Crude Fiber           | 24.70 | 18.59 | 20.70 | 20.79 | 21.57 |
| BETN                  | 42.17 | 31.25 | 32.22 | 32.87 | 32.99 |
| ME (Kcal/kg)          | 2311.17 | 2699.43 | 2687.80 | 2708.18 | 2788.69 |

**Note:** DFP = Dragon Fruit Peel Fermented

### 3. Result and Discussion

Based on the result of Analysis of Variance (ANOVA), there were significant differences between the treatment groups DP0 (0%), treatment DP7 (7%), DP8 (8%), and DP9 (9%) (p > 0.05). The highest feed consumption in the broiler rabbit was found in DP9 which contains 9% dragon fruit peel flour, with the value of feed consumption reaching 165.95 grams. Meanwhile, the lowest feed consumption was in the treatment of DP0 feed which has 0% content of dragon fruit peel flour, with the feed consumption value of 92.68 grams. Furthermore, there was no significant difference in the feed consumption between the treatment of P1, P2, and P3 which contain 7%, 8%, and 9% dragon fruit peel flour respectively and have feed consumption values of 143.18 grams, 143.39 grams, and 165.95 grams respectively. The value of feed conversion between controls (DP0) and DP7 did not significantly differ, while the best feed conversion was found in treatment DP9 with 3.61 which is
significantly different from all other treatments. As for the weight gain parameters of the treatment rabbits, the highest weight gain was found in the DP9 treatment with 703.29 grams, which differ significantly from all other treatments.

The results of feeding with several concentration levels of dragon fruit flour with feed supplement are presented in Table 2.

**Table 2.** Mean of feed consumption and standard deviation (Mean ± SD) in the treatment groups of Rex rabbits which were fed with different levels of flour concentration of fermented dragon fruit peels into commercial feed.

| Treatment | Feed Consumption | Feed Conversion | Weight Gain |
|-----------|------------------|-----------------|-------------|
| DP0       | 92.68a           | 7.83a           | 367.19a     |
| DP7       | 143.18b          | 7.48a           | 466.56a     |
| DP8       | 143.39b          | 5.65b           | 650.53b     |
| DP9       | 165.95b          | 3.61c           | 703.29b     |

Feed conversion is used to measure how efficient feeds are converted by livestock, or in the other word it assesses the efficiency animals to turn feeds into the final product which is flesh. Numerically, the lowest value of conversion ratio in this study was obtained in the DP0 or control treatment and the highest was indicated in DP9 treatment. Content of catechin can serve as an antibacterial that can facilitate the optimal absorption of food substances [11]. Catechin is a polyphenol compound that has the potential as an antimicrobial [18].

The low rate of feed conversion is more efficient because feed is consumed more optimally for growth [19]. There are several factors that influence feed conversion namely, environmental temperature, genetic potential, adequate feed supply during the fattening process, and energy level. In agreement with this, the difference in feed conversion is caused by the difference in feed consumption and body weight gain [20]. The factors that influence feed conversion involve feed quality, feeding techniques, the form of feed, and consumption. This study found similarity in the relationship between higher feed consumption which is positively correlated with more optimal feed conversion [21].

Based on the results of the Analysis of Variance (ANOVA), it was shown that the mixture of various levels of fermented dragon fruit peel flour in commercial feed significantly influence the final weight of broiler rabbits ($p > 0.05$). The addition of dragon fruit peel flour in the commercial feed with concentration ranging from 0% to 9% resulted in different weight gain, with the highest bodyweight found in the DP9 treatment. This study indicated that DP9 or giving 9% dragon fruit peel flour yields in the highest bodyweight gain. One of the factors that influence bodyweight gain of animals is feed consumption and the fulfillment of the nutritional needs of the animals. Therefore, feed consumption should positively be correlated with bodyweight gain [22]. Bodyweight is largely determined by the quality and quantity of feed consumed [23].

**4. Conclusion**

Based on the results of this study on the effect of fermented dragon fruit peel flour as feed supplements in commercial feed with a certain concentration on the performance of broiler rabbits, it can be concluded that the concentration of 7%, 8%, and 9% of the fermented dragon fruit peels can improve such performance parameters of the rabbits as feed consumption, feed conversion, and body...
weight. The advanced research on the digestibility of nutrients of feed which has been given the additional material of fermented dragon fruit peel.

References
[1] Raharjo Y C 2005 Prospek, Peluang, dan Tantangan Agribisnis Ternak Kelinci. Prospects, Opportunities, and Challenges in Agribusiness, Livestock Rabbit. Prosiding Seminar Nasional Teknologi Peternakan dan Veteriner (Bogor) p 255-271
[2] Yanis M, Aminah S, Handayani Y, and Ramdhan T 2016 Buletin Pertanian Perkotaan 6 11
[3] Azti I S 2010 The use of flour the peel of the cocoa fermentation In ration against digestibility on Rabbit new zealand white male [Thesis] (Sebelas Maret University)
[4] Widodo R 2005 The cultivation of rabbits and its potential (Bandung: Peternak kelinci) p 24
[5] Oseni S O and Lukefahr S D 2014 World Rabbit Science 22 147
[6] Lebas F, 2013 Feeding strategies for small and medium scale rabbit units 3rd Conf. Asian Rabbit Prod. Association - Bali Indonesia - 27-29 August 2013
[7] Schader C H, Muller A, El-Hage Scialabba N, Hecht J, Isensee A, Erb K H, Smith P, Makkar H P S, Klocke P, Leiber F, Schwegler P, Stolze M and Niggli U 2015 J. R. Soc. Interface. 12 12
[8] Van Zanten H H E, Meerbong B G, Bikker P, Herrero M and Boer J M 2016 Animal 10 547-549
[9] Wahyono D E, Hardianto R, Anam C, Wijono D B, Purwanto T and Malik M 2003 The strategy of Utilization of Agricultural Waste and Agro-industry To the Manufacture of Complete Feed Ruminant Proceeding Semnas Pengembangan Sapi Potong Pusat Penelitian dan Pengembangan Peternakan Badan Litbang Pertanian Bogor (Bogor)
[10] Astuti I, Mastika I M, Kristina Dewi G A M 2016 Majalah Ilmiah Peternakan 19 65-70
[11] Mustika A I C 2014 The effect of the Addition of Red Dragon Fruit peel flour (Hylocereus Polyrhizus) in the Feed to the performance of the Production of Quail (Coturnix Japonica) [Thesis] (Brawijaya University, Malang)
[12] Prasetyo E G 2013 The ratio of the Amount of Meat and the Skin of the Dragon Fruit In Jam Making Red Dragon Fruit (Hylocereus polyrhizus) plus of Roselle (Hibiscus sabdariffa L) and cinnamon (Cinnamomum Sp) [Thesis] (Jember University, Jember)
[13] Ahmad R Z 2005 Wartazoa 15 49
[14] Tanaka K, Okazaki K, Okazaki N, Ueda T, Sugiyama A, Nojima H, Okayama H 1992 EMBO. J. 11 4923
[15] Ketaren P P, Sinurat A P, Zainuddin D, Purwadaria T and Kompiang I P Indonesian Journal of Animal and Veterinary sciences 4 107
[16] Wu L C, Hsu H W, Chen Y C, Chiu C C, Lin Y, and Ho A 2005 Food Chemistry Volume 95 319
[17] Dewi G A M, Nuriyasa I M and Wijana I W 2016 Laporan Penelitian LPPM (Udayana University, Denpasar)
[18] Miguel M G, Neves M A, and Antunes M D 2010 Journal of Medicinal Plants Research 4 2836
[19] North M O 1992 Commercial Chicken Production Manual 3 th Edition (Connecticut: Avi Publishing Co. Inc.) pp 12-18
[20] Achmanu, Muharlien and Salaby 2011 Jurnal Ternak Tropika 12 14
[21] Amrulloh I K 2003 Seri beternak mandiri: nutrisi ayam broiler (Bogor: Lembaga Satu Gunung Budi) p 15
[22] Fadilah R 2005 Panduan Mengelola Peternakan Ayam Broiler Komersial (Jakarta: PT. Agromedia Pustaka) p 42
[23] Widjastuti T and Kartasudjana R 2006 Journal Indonesia Tropical Animal Agriculture 31 162