Livestock and Animal Research
Accredited by Directorate General of Strengthening for Research and Development No. 10/E/KPT/2019

Open Access
Livest. Anim. Res., July 2022, 20(2): 118-129
p-ISSN 2721-5326 e-ISSN 2721-7086
https://doi.org/10.20961/lar.v20i2.59258

Original Article

Response of broiler chickens to different levels of Kepok banana weevil flour as partial mixture for basal commercial feed

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Received: February 14th, 2022; Accepted: April 12th, 2022; Published online: July 3rd, 2022

Abstrak

Tujuan: Penelitian bertujuan mengetahui respon broiler dengan penggunaan tepung bonggol pisang Kepok sebagai pengganti sebagian pakan komersial.
Metode: Penelitian menggunakan 256 ekor ayam broiler, dengan empat perlakuan pakan yaitu: T_0= 0; T_1=10; T_2 = 30 dan T_3 = 50% tepung bonggol pisang Kepok. Kandang percobaan bentuk boxs terdiri dari 32 unit petak kandang, dengan kepadatan kandang 8 ekor/petak kandang. Variabel penelitian: Konsumsi pakan, bobot badan, feed convertion ratio, bobot karkas, persentase karkas, persentase lemak abdomen, bobot alat pencernaan, bobot jantung, bobot hati, bobot ventrikulus, ammonia excreta dan *incame over feed cost*. Data yang diperoleh dianalisis sesuai dengan rancangan yang digunakan yaitu Rancangan Acak Lengkap, jika perlakuan berbeda sangat nyata, dilanjutkan uji-nyata terkecil.
Hasil: Hasil penelitian menunjukkan bahwa penggunaan tepung bonggol pisang Kepok dalam pakan komersial berbeda sangat nyata (P<0,01) terhadap Konsumsi pakan, bobot badan, *feed convertion ratio*, bobot karkas, persentase karkas, persentase lemak abdomen, bobot alat pencernaan, jantung, hati, ventrikulus, kandungan ammonia excreta dan *incame over feed cost*.
Kesimpulan: Tepung bonggol pisang Kepok sebagai pengganti sebagian pakan basal komersial dapat digunakan sampai taraf 30 % pada broiler dengan *Income Over Feed Cost* yang tertinggi dihasilkan pakan yang mengandung tepung bonggol pisang Kepok sebesar 10%, penambahan tepung bonggol pisang Kepok sebagai pengganti sebagian pakan komersial dapat menurunkan ammonia excreta ayam broiler.

Kata Kunci: Respon broiler; Strain MB-202; Tepung bonggol; Pisang Kepok

Abstract

Objective: The aim of the study was to determine the response of broilers to the use of Kepok banana hump flour as a partial substitute for commercial feed.
Methods: This study used 256 broiler chickens, with four feed treatments, namely: T_0 = 0; T_1 = 10; T_2 = 30 and T_3 = 50% Kepok banana hump flour. The experimental cages in the form of boxes consisted of 32 units of cage plots, with a cage density of 8 birds/cage plot. Research variables: feed consumption, body weight, feed conversion ratio, carcass weight, carcass percentage, abdominal fat percentage, digestive tract weight, heart weight, liver weight, ventriculus weight, ammonia excreta

and income over feed cost. The data obtained were analyzed according to the design used, namely: Completely Randomized Design, if the treatment was very significantly different, followed by the smallest real-test.

Results: The results showed that the use of Kepok banana hump flour in commercial feed was very significant (P<0.01) on feed consumption, body weight, feed conversion ratio, carcass weight, carcass percentage, abdominal fat percentage, digestive tract weight, heart, liver, ventriculus, content of ammonia excreta and income over feed cost.

Conclusions: Kepok banana weevil flour as a partial substitute for commercial basalt feed can be used up to 30% in broilers with the highest Income Over Feed Cost produced by feed containing 10% Kepok banana weevil flour, the addition of Kepok banana weevil flour as a partial substitute for commercial feed can reduce the ammonia excreta of broiler chickens.

Keywords: Banana weevil flour; Broiler response; Kepok; Strain MB-202

INTRODUCTION

One of the determining factors for the success of a livestock agribusiness business is the feed, because the cost of feed in a livestock business, especially broiler chickens is the largest component of the total production costs that must be incurred by farmers during the production process, which ranges from 60 to 70 percent [1]. Therefore, it is necessary to find potential alternative sources of feed ingredients to be used as animal feed. Generally, broiler chicken breeders always use commercial rations in the production process, because commercial rations already contain nutrients as needed for broiler chickens and feed is widely available in the market, but the price of commercial rations is relatively expensive, so it can reduce the profits for farmers, even in certain circumstances can cause losses because the production costs are much greater than the revenue from the sale of chickens.

One of the efforts to reduce feed costs is to reduce the use of commercial rations and replace them with other alternative raw materials that are cheaper and sufficiently available, as long as the nutrients in the rations can be met and without causing growth disturbances. Based on these problems, we must optimize the search for raw materials for new feed sources, both raw materials for feed by-products from food plant and horticultural waste and agro-industrial waste products. Banana plants in Indonesia are the easiest plants to grow and reproduce so that they are spread throughout the archipelago.

The distribution of banana production areas is almost all over Indonesia, with the highest production centers in Java (West Java, East Java and Central Java) at 57%. Other areas are on the island of Sumatra (North Sumatra, West Sumatra, Riau, South Sumatra, and Lampung) at 17%, Bali and Nusa Tenggara at 12%, and Sulawesi (South, Central and Southeast Sulawesi) at 8% [1]. The potential quantitatively for banana weevil in Indonesia is a banana garden covering an area of 92,307.6 Ha with banana fruit production of 5,755,673 tons/year, waste 20% of the total production or 1,151,014 tons/year of banana weeds [2].

Banana weevil is the part of the stem of the banana plant that is below the soil surface in the form of tubers, the chemical composition of the banana hump consists of: dry matter: 6.2-13.87%, crude protein: 2.99 - 6.4%, crude fat: 0.96-7.0% and crude fiber: 9.99-19.1% [3]. Banana hump flour contains 66.2% carbohydrates and 5.88% protein weevil from various varieties of banana plants has different physical properties and chemical compositions, hump flour varieties of banana batu and Kepok have a crumbly, calcareous texture of flour with the following chemical composition: dry matter 92.64%, crude protein 4.71- 6%, crude fat 1.15%, crude fiber 7.85-18%, ash 7.04-10%, carbohydrates 89.74 %, BETN 81.90% and energy 3145 kcal/kg [4].

Based on the nutritional potential of these raw materials, banana weevil can be used as an energy source for livestock. Feed ingredients as a source of energy are feed ingredients that contain less than 20% crude protein, crude fiber in the range of 18-19%. Based on the potential energy content contained in Kepok banana hump flour, it can be assumed that Kepok banana hump flour can be used as an energy source in combination with commercial feed, in this case it can reduce the use of factory-made commercial feed, in the hope of reducing production costs through utilization optimally the raw material in the form of banana plant waste in the form of Kepok banana weevil flour which is a potential source of future feed raw materials for broiler chickens.

MATERIALS AND METHODS

Materials

This research was conducted in experimental cages for 33 days rearing period using 256 MB 202 male and female broilers ranged 2-3 days old and commercial feed, termed 511-BRAVO. The chickens were placed in cages and randomly assessed to obtain the initial weight. These enclosures, in the form of boxes, consisted of 32 units of plots with a density of 8 birds/plot, size of 1 x 1 m x 130 cm, stage floor system with a distance of 45 cm from the ground floor. Furthermore, the stage floor boxes were composed of wooden bars with a size of 2 cm and a distance between bars of 1.2 cm.

The sample chickens were vaccinated with Lasota strain ND vaccine at 4 days old using eye drops to prevent the ND disease. Meanwhile, the cage boxes were sprayed with Wifol and Rodalon® to disinfect the area as well as the eating and drinking utensils, respectively. The research tools were a digital scale of 5kg capacity and 0.01 accuracy, Ases brand flour machine for feed raw materials, smart sensor ARB500 ammonia detector, hoe, shovel, cutting knife, drying section for feed raw materials, mixer (feed stirrer), scissors, hand protective equipment, etc.

Methods

Kepok banana weevil was obtained from clumps of banana plants harvested for fruit or obtained from reducing the number of banana trees from a group of clumps. The weevil was subsequently processed into flour and then mixed with the commercial feed, using a mixer to ensure a uniform distribution according to the pre-determined treatment composition and percentage. This experiment employed four kinds of treatment rations, termed T_0, T_1, T_2 and T_3, as represented in Table 1.

Table 1. Arrangement of Feed Treatment with Various Levels of Kepok Banana Weevil Flour as a Commercial Feed Mixture (511- BRAVO)

No.	Feed Ingredients	Treatment (%)			
		T_0	T_1	T_2	T_3
1.	Commercial Feed (511-BRAVO)	100	90	70	50
2.	Kepok Banbana Weevil Flour	-	10	30	50
	TOTAL	100	100	100	100
Nutritional Content					
Crude protein %		22	21.23	20.68	17.87
Crude fat %		5	5.11	4.56	3.54
Water %		14	11.55	11.85	12.20
Crude Fiber %		5	5.28	6.24	7.81
Energy/ kcal/kg		3,200	3,642	3,833	3,945

* Feed iso protein and energy treatment

* Kepok banana weevil flour contains nutrients such as 15.12% water, 4.32% protein, 0.73 fat, 3145 kcal/kg energy, 18.86% crude fiber, and 10.14% ash.

T_0 = Feed made by PT. Charoen Pokphand Indonesia, South Sulawesi, Indonesia..

* T_1; T_2 and T_3 = nutrient content of the treated feed obtained from proximate analysis of rations at the Ciawi Livestock Research Institute Laboratory, Bogor, Ministry of Agriculture, Agricultural Research and Development Agency (analyzed on April 16, 2021).

Feed treatment was conducted on days 15-33 in ad libitum and initially weighed. Similar feed (511-BRAVO) was applied in all rations and weighed first on days 1-14, followed by the provision of drinking water. Subsequently, a total of 192 chickens were slaughtered, comprising 6 chickens x 32 units of cage plots in each treatment. A completely randomized design (CRD) consisting 4 treatments of percentage feed ingredients in the ration with 8 replications were applied, resulting in a total of 32 units of cage plots. The used CRD mathematical model was according to [5] as follows:

$$Yij = \mu + \tau i + \varepsilon ij$$

Where:

Yij = response or observed value of metabolic energy in treatment chicken feed (i) and the j-th replication.

μ = general average of experimental results.

τi = i-th treatment.

Ɛij = error value of i-th treatment and j-th replication.

The measured variables were weights, carcass, digestive tract, heart, liver and ventriculus (gizzard), feed consumption, feed conversion ratio (FCR), carcass percentage, abdominal fat percentage, ammonia excreta (NH_3) and income over feed cost (IOFC). Subsequently, the resulting data were examined using analysis of variance (ANOVA) by testing the F-count to determine the treatment effects. The ration with the most extensive impact is continued under the minimum significant difference test (BNT).

Variable measurement technique

1. Consumption of rations = the number of rations given (gr) minus the number of rations remaining each week (gr) during the research [6].
2. Weight gain = final weight minus initial weight (gr) [7]
3. Feed conversion ratio = Consumption of ration (gr)/weight gain (gr) [8].
4. Carcass weight (gr) = weight after being cut minus offal, minus head, feet to elbows [9].
5. The carcass percentage was obtained from the comparison between carcass weight (gr) and live weight (gr) multiplied by 100% [10].

   Carcass Percentage

   $$= \frac{carcass\ weight\ (gr)}{live\ weight\ (gr)} \times 100\%$$

   Percentage of abdominal fat was obtained from the comparison between abdominal fat weight (gr) and live weight (gr) multiplied by 100% [11].

   $$= \frac{abdominal\ fat\ weight\ (gr)}{live\ weight\ (gr)} \times 100\%$$

6. Digestive tract weight (gr) = digestive tract weighing result from the oesophagus to the cloaca [12].
7. Heart weight (gr) = heart weighing result [13].
8. Liver weight (gr) = liver weighing result [14].
9. Ventriculus (gizzard) weight (gr) = ventriculus weighing result [15].
10. Ammonia was measured using the smart sensor ARB 500 ammonia detector. The excreta and ammonia levels were observed using an ammonia detector which in principle, detects the ambient ammonia gas content and is detected on the monitor indicator [16].
11. Income over feed cost was calculated by comparing the income earned from poultry sales and the ration costs during rearing [17].

RESULTS

Feed consumption

The average feed consumption of the sample MB-202 strain broilers on commercial feed 511-Bravo at various levels of Kepok banana weevil flour generated certain differences in the rations. This was evidenced from the analysis of variance results where the treatments T_0, T_1, T_2 and T_3 varied significantly with P<0.01. Furthermore, the smallest significant difference test (BNT) showed that using Kepok banana weevil flour mixed with the feed as a partial substitute for commercial feed was favored by broiler chickens (palatability). The consumption rate was greatly dependent on the palatability of the feed ingredients [18]

Based on the average broiler feed consumption in each treatment during the 33-day rearing period Table 2, the results statistically recorded a very extensive difference. Literally, the average feed consumptions from the maximum to the

Table 2. Effect of the Provision of Various Levels of Kepok Banana Weevil Flour in Commercial Feed (511-Bravo) on MB 202 Strain Broilers for 33 Days Rearing Period

Variable	Treatment			
	T_0	*T_1*	*T_2*	*T_3*
Feed Consumption (gr/head)	2,449±98.753^{A}	1,860 ±403.05^{B}	1,765±52.49^{B}	1,117.49±51.38^{C}
Weight (gr/head)	1,457.25±12.09^{A}	1,348±61.25^{A}	951.73±118.25^{B}	539.25±41.25^{C}
Feed conversion ratio (FCR)	1.69±0.191^{A}	1.38±0.32^{B}	1.87±0.192^{C}	2.09±0.236^{D}
Carcass Weight (gr/head)	948.00±90.96^{A}	861.25±40.70^{B}	603.75±87.60^{C}	300.00±20.97^{D}
Carcass Percentage (%)	65.15±2.60^{A}	63.9±1.44^{A}	63.31±1.41^{A}	55.66±3.73^{B}
Abdominal Fat (%)	1.41±0.15^{A}	1.34±0.28^{A}	0.81±0.13^{B}	0.73±0.18^{B}
Digestive Tract Weight (gr/head)	193.5±23.01^{A}	179.25±21.23^{A}	131.25±15.17^{B}	113.00±25.98^{B}
Heart Weight (gr/head)	6.48±0.708^{A}	6.25±0.95^{A}	4.25±1.25^{B}	2.48±0.340^{C}
Liver Weight (gr/head)	40.00±6.879^{A}	29.00±3,651^{B}	21.15±1,892^{C}	13.50±1,290^{D}
Ventriculus Weight (gr/head)	38.00±0.81^{A}	36.75±1.50^{A}	29.00±4.14^{B}	22.25±5.57^{C}
Ammonia Excreta (NH_3) ppm	15.00±15.00^{A}	8.75±2.5^{B}	6.25±2.50^{C}	5.00±00^{C}
Income Over Feed Cost (IOFC) (IDR)	17,854 ± 0.321^{A}	23,059±0.47^{B}	13,420± 0.56^{C}	6,053±0.71^{D}

^{A,B,C}Capital letters are different, the difference is very significant at: P < 0.01)

minimum values were T_0, T_1, T_2 and T_3 at 2,449; 1,860; 1,765 and 1,117 g/head, respectively.

The highest feed consumption was produced from T_0 treatment with 0% banana weevil flour, while the lowest was obtained in T_3 at 50% banana weevil flour. This is because T_3 has a crude fiber of 7.81% and cumulative feed energy of 3,945 kcal/kg. However, due to Kepok banana weevil flour content of 18.86% crude fiber and 3,145 kcal/kg energy in the commercial feed mixture, a cumulative increase is possibly obtained in variables. This is in line here the high and low consumption of broiler rations is influenced by energy composition [19].

Finisher phase broilers required energy between 2,900-3,400 kcal/kg ration and 18.1-21.2% crude protein, further specified 3,000 kcal/kg with 3200 kcal/kg in the ration [20]. Hejdysz et al. [21] stated that the need for finisher phase broilers ranged from 18–21.2% PK and 2,900-3,400 Kcal/kg metabolic energy. In comparison with several similar research, T_1, T_2 and T_3 treatments in this research were above the energy requirements for broilers by T_1 = 3,642; T_2 = 3,833 and T_3 = 3,945 kcal/kg.

Weight gain

Table 2 represents the average weight gain of MB-202 strain broilers using Kepok banana weevil flour from various treatment levels (T_0, T_1, T_2, and T_3) in commercial feed (511-BRAVO) up to 33 days rearing period. The analysis showed that the use of weevil flour has a very significant effect on weight gain with P<0.01. Furthermore, the least significant difference (BNT) test indicated no weight variation in T_1 and T_0, but generated significant differences in T_0 and T_1 with T_2 and T_3. Table 2 also observes a decrease in the average weight at T_2 and T_3, due to the content of banana Kepok weevil flour by 30 and 50%, correspondingly.

The results showed that the average weight gain from the maximum to the minimum estimate was produced by T_0, T_1, T_2 and T_3 at 1,457.25; 1,348; 951.73 and 539.25 g/head, respectively. This weight is a manifestation of feed consumption where a higher intake generates excess nutrients, resulting in additional mass. The average feed consumption in this research was 2,449; 1,860; 1,765 and 1,117 g/head for T_0, T_1, T_2, and T_3, respectively.

Feed conversion rate

Feed conversion rate refers to the kilograms of feed required to produce kilograms of weight under a certain period. Smaller FCR values generate superior weight, indicating higher nutrient absorption and feed-to-meat conversion. In this research, the treatment of various levels of commercial feed containing Kepok banana weevil flour for the ration conversion of MB-202 strain broilers encompasses 33 days of rearing.

Statistical analysis results showed that the treatment with Kepok banana weevil flour as a commercial feed mixture in broilers had a very significant effect on FCR at P<0.01. Furthermore, the least significant difference test obtained separate outcomes by the addition of Kepok banana weevil flour at T_1, T_2, and T_3 with T_0. The FCR increased at T_2, with subsequent increment at T_3. This rate in the present research was attained at 1.69, 1.38, 1.87, and 2.09 for T_0, T_1, T_2, and T_3, respectively. Based on the results, T_0, T_1, and T_2 obtained a fairly efficient ration conversion compared to *T3*. The maximum FCR was produced in the treatment with 50% banana weevil flour (T_3), while the lowest occurred at T_1 with 10% sample, followed by T_2.

Carcass weight

Carcass weight is a manifestation of uniform tissue and bone growth from the weight within a certain period. Higher weight causes further increase in mass, leading to extensive growth of meat and bone tissue in the carcass component.

The analysis of variance (ANOVA) results showed that the use of Kepok banana weevil flour in commercial feed (511-BRAVO) generated a very significant effect on carcass weight at P<0.01. Furthermore, the least significant difference test (BNT) did not report any mass variation between T_0 and T_1, while T_0 and T_1 compared to T_2 and T_3 demonstrated different average carcass weights.

The carcass weights from T_3, T_2, T_1, and T_0 were 300.00, 603.75, 861.25, and 948.00 g/head, respectively. Based on these results, the maximum value occurred at T_0, while the lowest was in T_3. This is because T_3 contains 50% Kepok banana weevil flour in commercial feeds, affects the shift in the nutritional content, particularly protein, crude fiber and energy Table 1.

Carcass percentage

The analysis of variance results showed that the treatment with Kepok banana weevil flour in commercial feed (511-BRAVO) on MB-202 strain broilers had a very significant effect on carcass percentage at P<0.01. Furthermore, the least significant difference test did not record any variation in T_0, T_1, and T_2, while T_3 with T_0, T_1, and T_2 had significant differences of 55.66, 65.13, 63.90, and 63.31% on broiler rearing for 33 days, respectively.

The lowest carcass percentage was reported in the treatment with 50% Kepok banana weevil flour (T_3 = 55, 66%). This occurrence was due to a shift in nutritional element contents, specifically related to crude fiber and energy which increased at T_3 (crude fiber = 7.81%; energy = 3,945 kcal/kg), and initially affects the ration consumption, weight, as well as the carcass weight and percentage. T_3 also produced the lowest ration consumption of 1,117.49 g/head with a live weight of 539.25 g/head.

Abdominal fat

Based on the analysis of variance results, the treatment with various levels of Kepok banana weevil flour in commercial rations had a significantly different effect on the percentage abdominal fat at P<0.01. Furthermore, the least significant difference test showed that the average percentage abdominal fat from T_0, T_1, T_2, and T_3 was 1.41, 1.34, 0.81, and 0.73%, respectively. T_0, T_1 and T_2, T_3 were also not significantly different, but T_0, T_1 with T_2, T_3 varied substantially.

The minimum average percentage of abdominal fat was obtained from T_2 and T_3 with 50% introduction of Kepok banana weevil flour in a commercial ration, while the maximum value was obtained from T_0 and T_1 without any addition. This research showed that higher composition of weevil flour as a substitute in commercial feeds tends to decrease the abdominal fat in broilers.

Digestive tract weight

The analysis of variance results showed that the use of Kepok banana weevil flour as a partial substitute for commercial feed had a very significant effect on the digestive tract weight at P<0.01. Furthermore, the smallest significant difference test reported that the digestive tract weights from treatments T_0, T_1, T_2, and T_3 were estimated at 193.5, 179.25, 131.25 and 113.00 g/head, respectively.

The digestive tract weights from T_0, T_1 and T_2, T_3 were not significantly different, but T_0, T_1 with T_2, T_3 varied extensively. Higher composition of Kepok banana weevil flour in the basal feed (commercial) resulted in minimal digestive tract weight. This circumstance is observed from T_2 and T_3 of weevil flour where the lowest digestive tract weight was obtained, while the highest weight occurred in the control treatment T_0 and T_1.

Heart weight

The statistical analysis results showed that the treatment with Kepok banana weevil flour as a partial substitute for basal feed had a very significant effect on the heart weight at $P<0.01$. Furthermore, the least significant difference test indicated that the heart weight at T_0 and T_1 had no difference, but obtained an average value of 6.37 g/head. Meanwhile, T_0, T_1 compared to T_2, T_3 observed a significant weight difference with an average of 6, 48, 6.25, 4.25, and 2.48 g/head, respectively.

The maximum average heart weight was produced from T_0 and T_1, while the minimum estimate occurred at T_3, with a composition of 50% kapok banana weevil flour as a partial substitute for commercial feed. This outcome certainly influenced the composition of the nutritional components in the treatment feed consisting of crude fiber and energy Table1. The result also indicates that Kepok banana weevil flour as a partial substitute for commercial feed has a significant effect on broiler heart weight during the research.

Liver weight

Based on the statistical analysis results, the treatment showed a very significant effect on the average liver weight at $P<0.01$. This is followed by the smallest significant test (BNT), where the treatment T_0, T_1, T_2 and T_3 obtained different weights of 40.00, 29.00, 21.15 and 13.50 g/head, respectively. The lowest average liver weight resulted from T_3 with 50% banana Kepok weevil flour, while the highest value occurred at T_0.

Ventriculus (gizzard) weight

The statistical analysis results also showed that the feed treatment had a very significant effect on ventriculus weight at $P<0.01$. This was followed by the smallest significant difference test (BNT), where no variation was observed between treatments T_0, T_1, but T_0, T_1 with T_2 and T_3 treatments showed significantly differences, with the average ventriculus weights at 38.00, 36.75, 29.00 and 22.25 g/head, respectively. In this research, the minimum ventriculus weight was obtained in T_3 with a composition of 50% Kepok banana weevil flour, containing 7.81% crude fiber.

Ammonia in excreta

Based on the analysis of variance (ANOVA) results, the treatment with various compositions of Kepok banana weevil flour, as a partial substitute for commercial feed, had a very significant effect on the ammonia content at $P<0.01$. This was followed by the smallest significant test where T_0 treatment with T_1, T_2 and T_3 varied extensively, while no significant difference was observed between T_2 and T_3. The carbohydrate content in the digestive tract is assumed to play an important role in reducing nitrogen from the protein digestion process. This diminishes the ammonia released from the excreta, due to T_3 treatment with a composition of 50% banana weevil flour. As a consequence, a different texture was observed in the excreta results from each treatment, as clearly shown in Figure 1. In comparison to the control treatment (T_0) without weevil flour, the highest average ammonia concentration in the excreta was 15.00 ppm. Furthermore, the average ammonia excreta from T_0, T_1, T_2 and T_3 occurred at 15.00, 8.75, 6.25 and 5.00 ppm, respectively.

Kepok banana weevil flour contains high amount of carbohydrates as a source of energy. This was evidenced by the nutrient composition in the form of protein 4.32%, crude fiber 18.86% and energy 3,145 kcal/kg Table 1**.** Feed ingredients as an energy source contain less than 20% crude protein, and between 18-19% crude fiber.

Income over feed cost (IOFC)

Based on the analysis of variance results, the use of banana kapok weevil flour as a

Figure 1. The excreta of broiler: P0 = T_0; P1 = T_1; P2 = T_2; P3 = T_3

substitute for commercial feed mix (511-BRAVO), showed a very significant effect on the average consumption at P<0.01 administered in several levels Table 2. The highest average IOFC resulted from T_1 treatment at IDR 23,059, with the addition of 10% Kepok banana weevil flour, while the lowest occurred in T_3. Also, the average IOFC of various treatments, including T_0, T_1, T_2 and T_3, obtained IDR values of 17,854; 23,059; 13,420 and 6,053 respectively. Higher addition of banana Kepok weevil flour obtained lower IOFC.

DISCUSION

Kepok banana hump flour is indicated as a feed ingredient containing high enough carbohydrates, as a source of energy, as evidenced by the nutrient composition in the form of protein: 4.32%, crude fiber: 18.86% and energy: 3145 kcal/kg. The crude fiber and high energy contents tend to disrupt the digestive process as the feed rate certainly influences consumption. High crude fiber and energy also instigate rapid satisfaction in poultry and potentially reduce the consumption level, these extensive contents in the ration result in slower nutrient digestion and absorption rates and in turn affect feed consumption [22].

The crude fiber of feed raw materials appears bulky, causing excessive filling of the digestive tract and also tends to reduce the digestion process which causes the livestock to stop eating. Higher fiber content influences the feed volume because of the bulky properties, feed consumption of broilers decreases with an increase in crude fiber and energy [22]. The crude fiber and high energy in poultry rations also affect the consumption and speed of food flow in the digestive tract. Undigested crude fiber ejects portions of the food substances with the feces, leading to nutrient shortage, such as protein, vitamins, and others including energy. In this research, the ration consumption was significantly different at T_0 with T_1 and T_2 with T_3. The laboratory analysis of banana weevil flour obtained a fairly high crude fiber of 18.86% and energy of 3,145 kcal/kg, while the cumulative treatment feed contained 7.81% crude fiber and 3,945 kcal/kg energy.

Figure 2 shows the highest average weight gain of 1,457.25 g/head occurred in control treatment without any flour material, while the lowest was produced from T_3 with the inclusion of weevil flour in the commercial feed of 50 %. This is because the composition of weevil flour in the treatment feed is relatively high at 50%. In addition, the weevil flour contains high energy and crude fiber known to cumulatively enhance the crude fiber content in the treatment feed by 7.81%. Feed quality is a major factor affecting weight gain, as high crude fiber content is known to reduce the digestibility, due to extensive digestion time and energy. The physical form of feed is considered as an important influencing factor on broilers' growth rate and blood biochemical processes [23].

The high feed conversion rate was also due to the treatment feed content of excess crude fiber and energy. This condition causes the nutrients to be less utilized, leading to low weight. Kepok banana weevil flour increases the crude fiber and energy. In addition, the extensive FCR in T_3 was due to the relatively high crude fiber content of 7.81% and energy of 3,945 kcal/kg, causing a decline in feed digestibility and with the need for extra energy during the digestive process. Factors

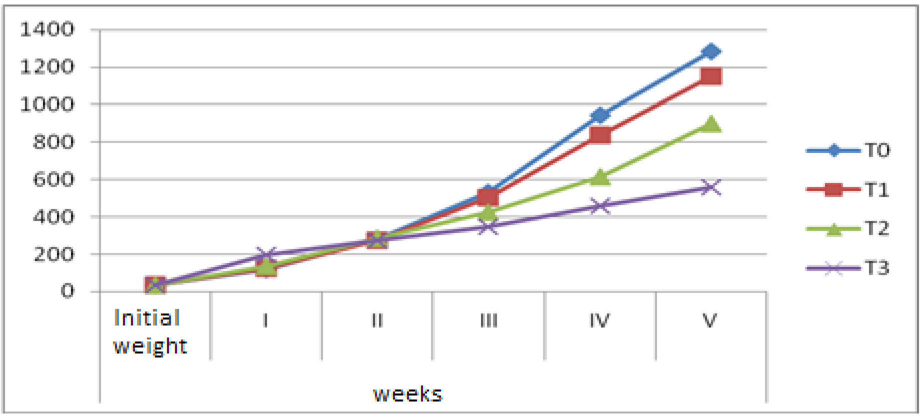

Figure 2. Effect of Treatment on Weight Gain of MB-202 Strain Broilers (gr/head) for 33 days Rearing Period

affecting FCR include genetics, temperature, ventilation, sanitation, feed quality, ration type, additives, water quality, disease and rearing management [24].

In addition, the broiler feed consumption was initially influenced, as evidenced from the results where the lowest feed consumption was also obtained from T_3. The level of ration consumption and energy affect the carcass composition where the factors influencing broiler carcass weight include genetics, sex, physiology, age, weight and ration. Nahashon *et al.* [25] further stated that carcass weight was strongly influenced by the generated live weight. Carcass percentage is influenced by the final live weight, where a large live weight corresponds to an extensive carcass percentage. The high carcass percentage was the result of large final weight in broilers [25]. Carcass percentage is an illustration of tissue and bone growth, where higher carcass weight results in an increasing growth of meat and bone tissue in the carcass component.

Banana weevil flour is a feed ingredient from plant tubers with a nutritional composition mostly consisted of hemicelluloses and cellulose (fiber). Proximate results indicated that weevil flour has a slightly high fiber content of 18.86% where the crude fiber has the ability to increase the rate of feed motion. This property causes the nutrient absorption to be below optimal, particularly the absorption of energy sources, leading to a reduction in accumulated body fat.

Abdominal fat is influenced by several factors, including temperature, cage, ration energy levels, crude fiber, age and sex. Saputra et al. [26] stated that broilers fed on easy-to-use carbohydrate-based diet had a higher abdominal fat content, compared to fibrous feed. This is because easy-to-use carbohydrates are easily converted to energy reserves in the form of fat. A healthy digestive tract is characterized by its adequate development, in terms of weight and length, as well as the optimal villi – villi development that optimizes nutrient absorption. Sufficient nutrient absorption from feed help to increase the live weight of chickens [26].

Poultry digestive tract perform the respective roles after the feed entry, including digestion, absorption, and metabolism, assisted by internal organs. Also, the heart aids the pumping blood into the atrial chambers as well as from the ventricles to the tissues and then reverses. Metabolic processes occur after feed enters the body and potentially affect the work activities of the gizzard, liver, and heart. Birds increase their metabolic ability to digest crude, leading to an enhanced workability of the gizzard, liver, and heart as well as impact on the size and weight of these organs.

The liver plays an important role in bile secretion, egg fat and protein metabolism, carbohydrates, iron and vitamins, detoxification, red blood formation, as well as vitamin storage [27]. Increasing the composition of kapok banana weevil flour by 50% as a substitute for commercial feed, tends to alter the nutritional content of the feed cumulatively, particularly crude fiber and energy, as well as the nutritional content of the T_3 feed. These results indicate that the increase in the sample composition possibly contributed to the lower liver weight. The outcome was also in line with [28], where the increase in crude fiber ration significantly impacted the relative weight of the liver and pancreas. Furthermore, Kubena et al. [29] concluded that high crude fiber is known to trigger the internal organs and digestive tract to work harder, leading to morphological changes that are characterized by a size decrease.

Carbohydrates in poultry feed are generally required as inexpensive energy sources and their application help to streamline the protein function by conserving the used protein to an energy reserve. The lack of protein by broilers has the ability to reduce the ammonia from excreta because of similar carbohydrate functions [30]. The increase in the N content of excreta instigates more conversion of N into ammonia by bacteria, leading to further increment of ammonia excreta.

This was due to a decline in the broiler's final weight; therefore, the smaller live sales are due to the low weight, leading to poor bargaining value. Furthermore, the result is also directly proportional to the higher ration conversion value produced by the T_3 alongside the addition of weevil flour usage levels, where inefficient use of feed is observed.

Carbohydrates in poultry feed are generally needed as a cheap energy source for poultry, the use of carbohydrates can streamline the function of protein by saving the use of protein as an energy source, the lack of use of protein by broilers will certainly reduce the ammonia that comes out through excretion, because in the digestive tract by Carbohydrates reduce or reduce N that comes out through the excreta. Allegedly due to the increase in N excreta due to more N output, if the N content of excreta increases, more N will be converted to ammonia by bacteria, this will certainly increase the ammonia excreta. Commercial broiler chicken feed mixed with Kepok banana hump flour can reduce the ammonia content in the excreta of broiler chickens, and can increase the IOFC.

CONCLUSION

Kepok banana weevil flour as a partial substitute for commercial basalt feed can be used in broilers, with the highest Income over feed cost produced feed containing 10% Kepok banana hump flour, the addition of Kepok banana weevil flour as a partial substitute for commercial feed can reduce N excreta broilers of the strain (Broiler MB-202). In addition, the higher of addition of Kepok banana weevil flour followed by the higher income over feed cost.

CONFLICT OF INTEREST

The authors declare no conflict of interest with any financial organization regarding the material discussed in the manuscript.

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