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Research Article
Betel Nut Husks as An Alternative Litter Materials for Broiler Production

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Abstract

Background and Objective: The availability of rice hulls has become infrequent due to competition and the development of residual rice byproducts; therefore, it has forced farmers to seek alternative litter materials. The objective of this study was to investigate the effect of using betel nut husks compared to rice hulls or dried leaves as litter material for broiler production on productive performance, carcass traits and internal organ characteristics. **Materials and Methods:** A total of 270 unsexed one-day-old broiler chicks (Lohmann) were included the study; a completely randomized design including three treatments with six replicates consisting of 15 chicks each was applied. The treatments comprised betel nut husks, rice hulls and dried leaves as litter materials. Standard feeding and management practices were followed during the experimental period. The body weight and feed intake were recorded weekly and the body weight gain and feed conversion ratio were calculated. Two broilers from each pen were used to measure the carcass traits, abdominal fat pad quantity and internal organ weight at 35 day of age. **Results:** The results from the present study showed that the litter materials did not affect ($p>0.05$) body weight gain, feed intake and feed conversion ratios during the experimental period. The carcass yield and abdominal fat quantity were not influenced ($p>0.05$) by the litter material. There was no difference ($p>0.05$) among the three litter materials in the internal organ weight; however, the gizzard weight was higher ($p<0.05$) in the broilers reared on rice hulls than in those reared on dried leaves and betel nut husks. **Conclusion:** Betel nut husks can be used as an alternative litter material for broiler production without sacrificing the performance of broiler chickens.

Key words: Betel nut husks, broiler, internal organ, litter materials, productive performance

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Broiler chickens are generally reared on floors covered with litter. The litter has several functions, including thermal insulation, moisture absorption and forming a protective barrier over the ground and it allows for natural scratching behavior and dust bathing[1-3]. Robins and Philips[4] stated that litter material has to meet numerous criteria since bedding has many roles and a significant impact on broiler production. As an important protective medium, litter must be not only highly absorptive but also light, inexpensive and nontoxic.

In some Indonesian regions, broilers are reared on floors covered by different types of litter materials, such as rice hulls and wood shavings. Among these litter materials, rice hulls are the most common and effective litter materials used by farmers in rural and periurban regions. Rice hulls are a class "A" insulating material because they do not burn easily and prevent moisture that permits the propagation of fungi[5]. The hull components include opaline silica and lignin, which provide excellent thermal insulation. Rice hulls appear to be a favorable alternative to wood shavings and their properties could be successfully used as poultry bedding[6,7].

As broiler production increases, the amount of rice hull required for litter material also increases; consequently, the supply of this litter material is sometimes inadequate and cannot meet local demand. This limited supply has often been accompanied by increased costs due to competition and the development of other rice residual byproducts. The replacement of rice hulls by other litter sources depends on economics and availability. Therefore, farmers have been forced to search for alternative litter materials.

Agricultural waste such as betel nut husks (BNHs) and dried leaves were found to have substantial potential as local and seasonal alternative litter materials. BNHs and dried leaves have become attractive alternative sources, as they can be obtained locally and inexpensively. These materials are abundant in rural regions. Until recently, using these materials as litter materials for broiler production by farmers was uncommon. BNHs are a byproduct of betel nut fruit processing and the husks account for approximately 60-80% of the total volume and weight of betel nut[8]. Water absorption was found to be the highest in raw BNH fibers and the lowest in dried BNH fibers[9]. However, there is no information regarding the use of BNHs as litter material for broiler production. Regarding leaves as litter materials, Willis *et al*.[10] reported that there were no significant differences in the live weight, feed conversion, breast blisters, mortality and carcass traits between the broilers reared on leaves, wood shavings and a 50-50% mix of the two materials. Therefore, the objective of this study was to investigate the effect of using betel nut husks as litter material compared to rice hulls or dried leaves for broiler production on productive performance, carcass traits and internal organ characteristics.

MATERIALS AND METHODS

Housing and management: This experiment was conducted in an experimental broiler house located in the Teaching Farm Faculty of Animal Husbandry, University of Jambi. The house was a conventional open-sided house, 30 m long, 10 m wide and 3 m high with natural cyclic temperatures (minimum, 25°C; maximum, 34°C). The pens in the house were cleaned and disinfected with formaline solution before spreading the litter and placing the chickens. The chicks were assigned to 18 pens with 15 chicks/pen (l 'w' h; 2'1.25'0.75 m). Each pen was equipped with a hanging tube feeder and a hanging tube waterer. Chicks were brooded using one 75 Watt lamp per pen. The lighting regime was 24 h of light provided by 40 W lamps during the entire rearing period.

Collection and processing of litter materials: The litter materials used were collected from a local area of Jambi Province from November to December 2017. After proper drying in sunlight, they were processed for the preparation of litter material. The litter materials were provided at a depth of 5 cm during the rearing period.

Chickens and feed: A total of 270 unsexed Lohmann 1-day-old broiler chicks bought from a poultry shop (body weight mean±STD; 40.98±1.07 g) were used in the study. The chicks were vaccinated against Newcastle disease using strain B1 (lentogenic), with a drop into the chicks' nostrils at 4 day of age; they were then boostered using strain La Sota, which was administered to the drinking water at 18 day of age. The chicks were fed a standard starter diet (crumble; 21% CP) from 1-21 days of age and a finisher diet (pellet; 19% CP) from 22-35 days of age. The feed was purchased from a poultry shop (manufacture by PT Japfa Comfeed, Lampung, Indonesia). Feed and water were provided *ad libitum*.

Treatments and experimental design: At 1 day of age, all the birds were weighed and randomly allocated to each floor pen. The following litter materials were tested: betel nut husks, rice hulls and dried leaves. All the tested litter materials were placed on the floor of the pens, with a litter depth of 5 cm. A completely randomized experimental design, with 3 types of litter materials as treatments and six replicates per treatment, was applied in this study.

Variable measurements and statistical analysis: All the chicks were weighed individually at 1, 7, 14, 21, 28 and 35 days of age. Feed intake was measured based on the pen's value and feed conversion was calculated as the ratio of feed consumption adjusted for mortality to average weight gain. Feed intake, body weight gain and the feed conversion ratio were calculated for the periods of 1-21 days and 22-35 days as well as the total period, from 1-35 days.

At the end of the experiment (35 day of age), 2 broilers per pen with body weights close to the mean pen weight were selected for the determination of carcass traits, abdominal fat pad quantity and internal organ weights. The broilers were fasted for 6 hours, weighed individually and then slaughtered by severing the jugular vein. Following bleeding, the chicks were scalded at 60°C for sixty seconds, defeathered in a machine picker and chilled with ice water for 8-10 h. Whole carcasses were drained for 5 min and eviscerated before determining the carcass weight. The viscera were manually removed and the internal organ weights, such as the gizzard, liver and small intestine weights, were recorded. The abdominal fat pad was manually separated from the carcass and weighed.

The data of the performance traits, carcass traits and internal organ characteristics were analyzed with a completely randomized design. The general linear model procedure in SAS software[11] was used to analyze the data and the treatments were compared by Duncan's multiple range tests. All statements of significance were based on a $p<0.05$.

RESULTS AND DISCUSSION

The effects of the different litter materials on broiler growth performance are summarized in Table 1. There was no effect of litter material ($p>0.05$) on body weight gain, feed intake and the feed conversion ratio measured during the starter period (1-21 days of age), growth period (22-35 days of age) and overall period (1-35 days of age). In addition, the litter material had no effect on body weight until 35 days of age (Fig. 1). These results suggest that betel nut husks were technically viable and equivalent to rice hulls and dried leaves as litter material. These findings indicated that betel nut husks could be a suitable litter material for broiler production. Studies evaluating different litter materials for broilers obtained similar results. Garces *et al.*[12] reported that broilers reared on coconut husks, rice hulls, grass, corn cob, newspaper and wood shavings showed no differences in body weight and feed intake. Similarly, Sigroha *et al.*[13] reported that litter material such as saw dust, wheat straw, rice husks, riverbed sand and sandy soil had no significant effect on the feed intake or daily feed intake of broilers up to six weeks of age. Other researchers have reported that the type of litter material was associated with non-significant differences in live weight, feed intake and feed conversion ratios, consistent with these findings[14-21].

The present study showed that carcass yield and abdominal fat quantity were not influenced ($p>0.05$) by the

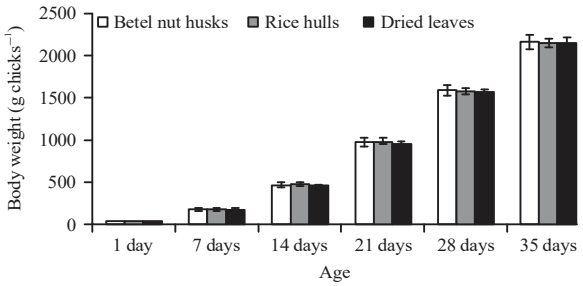

Fig. 1: Body weights of the broiler chicks reared on the three different litter materials during the experimental period

Table 1: Effects of litter materials on the performance of broiler chickens

	Litter materials				
Variables	Betel nut husks	Rice hulls	Dried leaves	SEM	p-value
Feed intake (g chick^{-1})					
1-21 days	1192.00	1203.00	1165.00	20.70	0.4401
22-35 days	2044.00	2044.00	2019.00	25.66	0.7292
1-35 days	3236.00	3246.00	3184.00	37.85	0.4749
Body weight gain (g chick^{-1})					
1-21 days	937.00	945.00	913.00	15.63	0.3471
22-35 days	1191.00	1177.00	1208.00	18.45	0.5201
1-35 days	2128.00	2122.00	2121.00	28.05	0.9806
Feed conversion ratio (g g^{-1})					
1-21 days	1.27	1.27	1.28	0.01	0.9469
22-35 days	1.72	1.74	1.67	0.02	0.0950
1-35 days	1.52	1.53	1.50	0.01	0.0797

Table 2: Effect of litter materials on the carcass traits of broiler chickens

	Litter materials				
Item	Betel nut husks	Rice hulls	Dried leaves	SEM	p-value
Carcass weight (g chick^{-1})	1697.00	1756.00	1698.00	32.78	0.3680
Carcass weight (BW%)	78.25	79.21	78.26	0.49	0.3034
Abdominal fat pad (g chick^{-1})	39.20	37.62	32.51	2.34	0.1411
Abdominal fat pad (BW%)	1.80	1.70	1.50	0.11	0.1568

Table 3: Effect of litter materials on the internal organ characteristics of broiler chickens

	Litter materials				
Item	Betel nut husks	Rice hulls	Dried leaves	SEM	p-value
Crop (mg g^{-1} BW)	2.42	2.16	2.16	0.09	0.0881
Proventriculus (mg g^{-1} BW)	2.43	2.54	2.35	0.09	0.3567
Gizzard (mg g^{-1} BW)	9.76^{b}	10.71^{a}	9.46^{b}	0.30	0.0270
Liver (mg g^{-1} BW)	16.53	18.84	18.23	0.90	0.2056
Pancreas (mg g^{-1} BW)	1.77	1.89	1.73	0.07	0.2708
Small intestine (mg g^{-1} BW)	16.29	17.41	18.10	0.74	0.2509

^{a,b}Means within a row with different letter are different significantly at $p<0.05$

litter materials (Table 2). These results were similar to several reports suggesting that the litter type did not influence the carcass yield[12,17,20-23].

Internal organ traits, such as the weights of the crop, proventriculus, small intestine and pancreas, were unaffected by the type of litter material (Table. 3). However, the broilers reared on rice hulls had a greater ($p<0.05$) gizzard weight at d 35 than those reared on dried leaves and betel nut husks. This result was associated with the continued consumption of litter particles to stimulate gizzard activity. One possible explanation is that increased gizzard activity caused the gizzards to weight more than those in other broilers reared on dried leaves and betel nut husk. Garces *et al.*[12] reported that the gizzard weights of broilers reared on sand and rice hulls were greater than those of broilers reared on other litter materials. Similar to the results in this research, Kheravii *et al.*[24] reported that at 24 day, the relative gizzard weights of the birds reared on wood shavings were heavier than those of the birds reared on pelleted straw and shredded paper, suggesting the consumption of wood shavings during this time.

CONCLUSION

Based upon the findings of this study, it may be concluded that betel nut husks can be used as an alternative litter material for broiler production without sacrificing the performance of broiler chickens.

SIGNIFICANCE STATEMENT

This study showed that betel nut husks have similar advantages to rice hulls and dried leaves as litter material without sacrificing the performance of broiler chickens. This study will help researchers or producers select betel nut husks as an alternative litter material to promote economically intensive broiler production.

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