Performance native chicken treated by different stocking density and litter type

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Submitted: 24 February 2020, Accepted: 05 July 2021

ABSTRACT: This research was aimed to determine the effect of different stocking density and different litter materials on the production performance of native chicken. Material of this study was 324-day old chick (DOC) native chickens, reared for 12 weeks. The DOC were randomly divided into 9 treatment groups include a combination of 3 stocking density (8, 12 and 16 bird/m²) and 3 litter materials (rice hulls, wood shavings and corncobs) in 3 replication. A completely randomized factorial design was applied in the study then followed by Duncan's multiple range tests. The parameters observed were feed consumption (g/bird/12 weeks), body weight gain (g/bird), feed conversion ratio, and mortality (%). The results showed that feed consumption had affected by stocking density ($p < 0.05$), but it had not affected by litter materials type. Feed consumption at densities of 8, 12 and 16 bird/m² was 3890; 4020 and 4061 g/bird respectively. The highest feed consumption was obtained at a density of 16 bird/m². Weight gain, feed conversion and mortality had not affected by stocking density and litter material. It can be concluded that the body weight gain, feed intake, feed conversion ratio and mortality is same for stocking density 8, 12 and 16 bird/m² and same for litter type of rice hulls, wood shaving and corncob.

Keywords: litter material; Native chicken; Performance; Stocking density

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INTRODUCTION

Native chicken is a local Indonesian chicken that widely kept by people in the villages. Today's intensive rearing of native chicken was significantly increased. This is due to the increase of consumer demand and product prices relatively stable. This is illustrated by the increasing population of native chickens, as much 285.3 million in 2015 to 310.9 million in 2018 (Anonymous, 2018).

Constrain on intensive rearing of native chicken was of floor space. Increasing the stock density up to 16 birds/m² was needed but the comfortable of chickens still being focused. Pens with high density made the chicken uncomfortable because it's increased the competition in getting food, drinking water and oxygen. This competition resulting in non-uniform growth performance especially in male and female broiler chickens (Zuowei *et al.*, 2011). Stocking density level of cages 8, 10 and 12 birds/m² in native chickens were not influenced by the amount of feed consumption, drinking water consumption, body weight, body weight gain, feed conversion and mortality (Mahmud *et al.*, 2017)

Intensive maintenance of native chickens generally used open cages and using litter as bedding material. The litter material always used rice hulls, but rice hulls materials today were made to become competing with other businesses. Actually, litter material can be used the other materials such as wood shaving or corncob, other materials that can be used as litter were rice straw, wheat straw, sand, agricultural crop waste, chopped corncobs, paper chips, tea pulp and coconut fiber (Garcês, *et al.*, 2013).

The ideal litter material requirements must be dry with a high water-holding capacity but should also be able to absorbed moisture quickly (Atapattu & Wickramasinghe, 2007). Rice hulls litter material increasingly expensive and difficult to obtain so it needs to replace with the other sources of litter material as an alternative

with abundant availability including wood shavings and corncobs.

There was no more research on stocking density and litter type materials for native chickens. It was necessary to research about the effect of various stocking density and different litter types on the performance of native chickens.

MATERIALS AND METHODS

This study used day old chicken native chicken, a total of 324. The native chicken variety used in the research is Kampung Unggul Balitbangtan (KUB). Feed with crude protein 16.26%; Metabolized energy 2894.1 kcal/kg; calcium 1.63%; phosphor 0.58%; Lysine 0.85% and Methionine 0.30%, details in tables 1 and 2.

The 324 doc was randomly into 9 treatment groups (3 stock density densities and 3 litter materials) in 3 times replication. There are 3 densities groups of 8, 12 and 16 bird/m² with litter materials of rice hulls, wood shavings, and corncobs. The moisture content of the three types of litter material was equal to 10%. The mass (kg) of wood shavings with a thickness of 12 cm in depth/square meter, equivalent to a weight of 12.8 kg, was used as a reference for the use of rice hulls and corncobs. This research used an open cage with a monitor roof and litter floor in 1 m² (1 x 1 m) with a height of 2 m.

The data collected were Measurement variables were feed consumption, body weight gain, feed conversion ratio, mortality and other data is duodenal histology. Completely Randomized Design 3 x 3 Factorial, (3 stocking density and 3 types of litter material) and repeated 3 times replication. Design was used was applied in the study and followed by DMRT. Histology preparations was carried out from 1 cm long pieces for each sample from the duodenal then fixed in 10% buffered formalin, soaked for 24 to 48 hours, then made histological preparations. Each piece of tissue sample is hydrated which is passed one by one in an alcohol series with concentrated levels

ranging from 30%, 50%, 70%, 80%, 95%, and 100%. Each of the above samples is transferred one by one into each alcohol concentration for about 10 seconds. Then the sample is put in xylene and finally dipped in paraffin. Samples were sliced with 4 µm thickness using microtome and

histological process followed AlcianBlue stained. Histological preparations in object glass observed and measured using a microscope with the help of a computer. Take a sample area of 1 mm and counting the number of visible goblet cells under microscope electron.

Table 1. Ration composition

Feed Ingredient	Proportion (%)
Yellow Corn	56.81
Bran	21.95
Meat bone meal	6.32
Soybean meal	13.50
Calcium	0.13
Premix vitamin	0.42
DL – methionine	0.19
L – lysin HCL	0.68
Total (%)	100.00

Table 2. Content of nutrient rations

Nutrient content	Total (%)
Dry ingredients (%) ¹⁾	90.00
Metabolic Energy (kcal/kg) ²⁾	2894.1 (kcal)
Crude Protein (%) ¹⁾	16.26
Crude fat (%) ¹⁾	3.46
Ash (%) ¹⁾	8.28
Crude Fiber (%) ¹⁾	10.00
Calcium (%) ³⁾	1.63
Phosphorus (%) ³⁾	0.58
Methionine (%) ³⁾	0.30
Lysin (%) ³⁾	0.85

Note: ¹⁾ The results from animal feed laboratory UGM 2019 analysis, ²⁾ Based on (NRC, 1994) NRC (1994), ³⁾ The calculation results are based on (Lisnahan, 2018).

RESULT AND DISCUSSION

The production performance of native chickens that rearing until 12 weeks were shown in Table 3.

Feed consumption

Different levels of stocking density resulting significantly difference on feed consumption ($P < 0.05$), but litter material had not affected feed consumption. Feed consumption at densities of 8, 12 and 16 bird/m² were 3890; 4020 and 4061 g/bird (Table 3), shown that the increase of stocking density also increases the feed consumption. The more feed consumption at the density of 16 was caused by more

competition to get feed than the other density. Another factor was caused higher density of chicken made busy sound can attract to eat feed more. (Aplleyby et al., 2004) states that the vision and sound of chickens that were eating trigger the other chickens to eat.

The different types of litter had not to affect feed consumption, because different litter materials did not change the pens comforting. One of the behavioral expressions can be seen from the feeding and foraging activities. (ElKhloya, 2017) reported that wood shavings, rice hulls, and corn stalks materials did not affect the

proportion of feeding and foraging, which was 11.70; 13.70; 11.38 for feeding and 5.8; 5.53; 5.68 for foraging. One factor that can affect consumption are chicken health and environmental (Muharlién *et al.*, 2011). Stocking density and litter type did not have affected interaction for feed consumption.

Weight gain

The final weights were 1018, 1004 and 1038 grams for densities of 8, 12 and 16 bird/m², the weight gain based on litter type is 980; 1041 and 1040 for rice hulls, wood

shaving, and corncob. The stocking density and the different litter type had not significantly affect weight gain. It showed that the density of the pens had no direct effect on weight gain because weight gain was more determined by the consumption of feed, especially protein. Protein was needed to maintain basic life, muscle and bone growth (Leeson & Summers, 2005). Protein consumption for 12 weeks was 632.4; 653.7 and 660.4 g for densities of 8, 12 and 16 bird/m² respectively.

Table 3. Performance of native chickens with different stocking density and litter material

Treatments	Feed consumption (g/chick)	Weight gain (g/ chick)	Feed conversion ratio	Mortality (%)
Stocking density (bird/m ²)				
8	3890±14 ^b	1018±11	3.85±0,33	0.00±0,00
12	4020±82 ^a	1004±80	4.02±0,26	0.93±2,78
16	4061±28 ^a	1038±52	3.92±0,20	0.69±2,08
Litter type				
Rice hull (RH)	3966±11	980±61	4.06±0,23	0.00±0,00
Wood shaving (WS)	4014±78	1041±90	3.88±0,29	0.69±2.08
Corncob (CC)	3993±16	1040±89	3.86±0,27	0.93±2.78
Stocking density x Litter type				
8 x RH	3866±37	1000±62	3.87±0,20	0.00±0,00
8 x WS	3959±12	1052±15	3.80±0,42	0.00±0,00
8 x CC	3844±22	1003±15	3.87±0,45	0.00±0,00
12 x RH	3962±14	932±59	4.26±0,12	0.00±0,00
12 x WS	4038±20	1023±87	3.97±0,34	0.00±0,00
12 x CC	4062±17	1059±36	3.84±0,12	0.69±2.08
16 x RH	4069±13	1009±49	4.04±0,19	0.00±0,00
16 x WS	4044±43	1048±32	3.86±0,12	0.93±2.78
16 x CC	4072±23	1058±73	3.86±0,26	0.00±0,00
Anova				
Stocking density	0,05	n.s	n.s	n.s
Litter type	n.s	n.s	n.s	n.s
Stocking density x Litter type	n.s	n.s	n.s	n.s

^{a,b,c} Mean within columns with different superscripts are significantly different (P<0.05, P<0.001), n.s: no significant

The results of these experiments agreed with those of (Na-lampang, 2014) he reported similar body weight and body weight gain for Thai crossbred chicken reared at three-level density 8, 12, and 16

bird/mm² result not significant. However, (Jobe et al., 2019) reported a significant decrease of average weight gain of indigenous chicken in stocking density 20 than 5 and 10 bird/m².

Feed Conversion Ratio

The feed conversion ratio had not affected by stocking density. The feed conversion ratio for densities of 8, 12 and 16 birds/m² is 3.85; 4.02 and 3.92 respectively. Stocking density and type of litter material had not significantly affected the feed conversion on this study. Because of the chicken comfortable in the pen and had no

become stress. It can be seen from the equal height, width of the villi and the depth of crypt in the duodenal segment of all treatment (Table 4). The increase of villi height in the chicken intestine was parallel with the increasing of digestive and absorption function that expresses the nutrient transport system throughout the body (Awad *et al.*, 2006).

Table 4. Average villus height, villus width, crypt depth and goblet cell density of duodenal

Treatments	Villus height(μm)	Villus width (μm)	Crypt depth(μm)	Goblet cell density (n/mm ²)
Stocking density (birds/m ²)				
8	1316.1±121.5	209.7±32.1	259.6±18.2	530.7±197.9
12	1262.5±109.9	220.7±26.9	254.8±34.2	623.2±278.2
16	1342.4±80.6	218.0±18.9	261.6±15.3	723.3±258.5
Litter type				
Rice hull (RH)	1339.8±112.4	217.9±27.6	249.2±20.2	604.3±259.9
Wood shaving (WS)	1293.1±88.5	214.4±23.6	257.0±18.3	521.2±196.0
Corn cob (CC)	1288.1±121.5	216.0±29.3	269.7±15.3	751.6±260.2

^{a,b,c} Mean within columns with different superscripts are significantly different (P<0.05)

Using wood shavings, rice hulls, bagasse, and wheat straw in broiler chickens did not affect feed conversion (Monira *et al.*, 2003). The use of rice husk litter, softwood sawdust, wood shavings, hardwood sawdust, pieces of paper, chopped straw and recycled litter had not significantly affect the conversion of chicken feed of 28 days (Torok *et al.*, 2009). The stressor pressure mechanism in increasing stocking density had not influenced the intestinal morphology. It can be seen that in all treatment, the small intestine segments have the same villi height and villi width (Table 4). This indicated that stocking density of 16 birds/m², did not change the condition of the digestive tract.

The height and width of the villus affect the nutrient uptake process which provides growth and feed efficiency. Increasing the height and width of the villus increases the surface area of the villus for absorption of nutrients in the digestive process (Miles *et al.*, 2006). The width and height of the duodenal villus in this study were the same so that the same feed

efficiency was produced, where in the end feed conversion ratio was not significantly different.

Mortality

The stocking density and the different types of litter material did not give a significant difference to the mortality of chickens. The consecutive mortality was 0; 0.93 and 0.69% for densities 8, 12 and 16 bird/m² and 0; 0.69 and 0.93% for litter Rice hulls, wood shaving and corncob (Table 3). This same mortality is possible because at different densities and types of litter chickens have the same Goblet cell density. The same goblet cell density at the level of cage density and type of litter can protect chickens from various pathogens that can cause death. High stocking density will reduce the performance of chickens and have a negative effect by disrupting the intestinal barrier function (Goo *et al.*, 2019).

The Goblet cells secreted gel-shaped glycoprotein mucus to protect intestinal epithelial cells from invader invasion, including worm invasion (Balqis *et al.*, 2007). When an infection occurs, Goblet

cells will undergo proliferation which aims to maintain life from this infection. Goblet cell proliferation plays a role in the removal mechanism of mucin produced by Goblet cells continuously producing mucus that can trap pathogens (Balqis *et al.*, 2015)

The different types of litter had not significantly affected mortality, this shows that the three litter materials are suitable to be used. In the same research (Toghyani *et al.*, 2010) compared wood shavings litter, rice hulls, paper rollers, sand, and no litter showed no different results in mortality. (Ali *et al.*, 2012) using a stocking density of 0.186; 0.279 and 0.372 m²/bird rearing up to 2-6 months did not affect mortality, while this study used a density of 8, 12 and bird/m² (0.125; 0.083 and 0.063 m²/ bird).

CONCLUSIONS

As the basis of present findings, it was concluded that the body weight gain, feed intake, feed conversion ratio and mortality is same for stocking density 8,12 and 16 bird/m² and same for litter type of rice hulls, wood shaving and corncob.

ACKNOWLEDGMENT

The acknowledgment was awarded to Indonesian Agency for Agricultural Research and Development for the research grant.

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