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Effect of Different Litter Materials on the Performance of Broiler Chicken

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ABSTRACT

The present study attempts to analyze the effect of different types of litter materials on the performance of broilers. Total 300 unsexed day-old broiler chicks (Cobb-400) were used on a completely randomized design in five treatments with four replicates, each consisting of 15 broilers. The treatments comprises of saw dust, wheat straw, rice husk, river bed sand and sandy soil (*Balu ret*) as litter materials. Standard feeding and management practices were followed during the experimental period. The effect of different treatments on growth parameters of broilers *i.e.* body weight, bodyweight gains, feed consumption and feed conversion ratio (FCR) were observed on regular interval of time. The results showed that feed conversion ratio was significantly different ($p<0.05$) among the litter types selected during 3rd and 4th week of experiment and other parameters were non-significant during the growing interval of broilers. The present study investigated the effect of different litter materials on broiler chicken performance may be viable for use of unconventional litter materials for broilers production due to cheap and locally available to the poultry entrepreneurs.

Keywords: Broiler, feed conversion ratio, growth performance, litter materials

Broiler farming is mainly done on deep litter system in India and the management of the litter is key factor under deep litter housing. There are many factors which must be taken into consideration for successful litter management in broiler production (Snyder *et al.,* 1958). Litter management can be influenced by type of litter material used, depth of the litter material, floor space per bird, composition of feed, watering facilities used, floor type, ventilation system and time of the year. The litter material is used in a broiler farm to give more comfort to the birds for best profitable outcomes. The quality of litter material significantly influences the overall performances of the broilers. A good litter serves as an insulator to maintain uniform temperature round the year and also acts as a blotter through absorbing the extra moisture of the feces by increasing surface area of the floor which prevents fungal contamination. Optimum depth of litter is important to reduce bacterial load and unhygienic conditions for better growth of birds to overcome mainly bird stress, insect problems, footpad lesions and breast bruises.

Conventionally sawdust is a preferred litter material in poultry farming but due to limited supply and comparably high cost, high moisture susceptible, it involves high risk factors to use in broiler production. Rice husk can be a better alternate as litter material for broiler production in India but availability at a competitive price is a challenge in present scenario due to source of energy production in the industries (Bilgili *et al.*, 1999). Due to light weight and local availability wheat straw is also used as litter material but cake formation and mold growth is a major constraint for intensive broiler farming. Increasing cost, scarcity and spoilage of these conventional litter materials

make farmers to re-use old litter which may increase the chances of spread of diseases and reduction in performance of the broilers. Above mentioned problems related to conventional litter materials have encouraged the research for unconventional litter materials for poultry farming.

A variety of litter material including paper products (Lien *et al.*, 1992), gypsum (Grimes *et al.*, 2007), hardwood bark (Brake *et al.*, 1992), peanut hulls (Lien *et al.*, 1998), sand (Shields *et al.*, 2005), rice and wheat straw (Sreehari and Sharma 2010), ground corn cob and soybean straw (De Avila *et al.*, 2008) have been used as substitute bedding materials with various level of success. Bedding types can significantly affect growth performance and carcass quality of broilers (Bilgili *et al.*, 1999). These materials have been used successfully due to their high performance characteristics. Sand has shown good potential as an alternative litter material for high reuse potential with de-caking. Using unconventional litter materials for rearing birds can help poultry producers to reduce pollution, improved production and lower cost.

Keeping in view the facts stated above the present investigation was planned to study the effect of different litter materials on performance of broilers to substitute conventional litter material by cheaper and unconventional to make the commercial production of broilers in more feasible way.

MATERIALS AND METHODS

Location of study

The present investigation was conducted for 6 weeks at the Poultry shed of the Department of Livestock Production Management, College of Veterinary Sciences, Lala Lajpat Rai University of Veterinary and Animal Sciences (LUVAS), Hisar with prior approval of Institutional Animal Ethics Committee.

Experimental design

For the present study 300 day-old broiler chicks of Cobb-400 strain were purchased from a reputed local hatchery. Saw dust, wheat straw, rice husk, river bed sand and sandy soil (*Balu ret*) were procured from local trader and used as litter material. Thus there were five treatments and each treatment was then offered four replicate groups of 15 chicks each. The purchased chicks were routinely vaccinated and reared under strict hygienic conditions maintaining all standard managemental practices including brooding, proper lighting, raking of litter, cleaning of feeders and drinkers *etc.* Before formulation of broiler rations (pre-starter, starter and finisher) the composition of feed ingredients were analyzed using standard method AOAC (2005) (Table 1). Based upon the proximate composition of feed ingredients, the broiler rations were formulated. The composition of the experimental diet and feed additives are presented in Table 2. The birds belonging to all the experimental groups were closely observed throughout the experiment, starting from day old till the end of experiment *i.e.* 42 days, for body weight gain. Chicks were weighed individually at the start of experiment and later on weekly to calculate gain in weight. Initial and weekly body weights of individual bird of each group were taken up to 6 weeks of age in the morning using single pan balance. Weekly gain in body weight was calculated. Group wise weekly records of the feed offered and feed left were maintained during the whole experiment

Table 1: Chemical composition (% Dry matter basis) and Metabolizable energy of feed ingredients used in formulating the experimental diets

Sl. No.	Ingredients name	Moisture %	TA	EE	CP	CF	NFE	ME*
1	Maize	11.92	2.83	3.44	9.13	2.52	82.08	3300
2	Soy bean Meal	10.52	7.34	2.98	46.07	4.67	38.94	2250
3	Ground nut cake	6.53	8.9	9.05	40.23	9.43	32.39	2400
4	Fish Meal	10.03	27.07	11.4	45.8	1.81	13.92	2180
5	Vegetable fat	—	—	99.4	—	—		8800

Reported values (kcal/kg), *BIS 2007

to calculate the feed intake. The data were compiled and summarized for statistical analysis. The feed conversion ratio (FCR) for each group was calculated as per standard formula.

Statistical analysis

The data observed during the experiment are represented as mean ± standard deviation. Data obtained were subjected to statistical analysis using Completely Randomized Design (CRD) and groups were differentiated by one way analysis of variance (ANOVA) with statistical package (IBM, SPSS version 20). The mean differences among different treatments were separated by Duncan's multiple range tests. Consequently, a level of ($P<0.05$) was used as the criterion for statistical significance (Duncan, 1955).

RESULTS AND DISCUSSION

The effect of litter types on broilers growth performance was observed in various treatments at different ages. The birds reared on different litters had no significant difference in cumulative as well as daily body weight and body weight gain; however birds reared on wheat straw litter material had numerically higher weight in comparison to all other groups' at 42 days of age followed by sand (*Balu ret*), saw dust, river bed sand and rice husk (Table 3). Similar effects were also observed for average weight gain and average daily weight gain of broilers at six weeks of age (Table 4 and 5).

These results are in accordance with the studies which also reported that body weight of broilers did not differ significantly between different litter types used (Shah *et al.,* 2013; Thirumalesh *et al.,* 2013; Sharma and Sharma (2014).

However, Malone *et al.* (1982) observed significantly higher body weight on shredded paper than saw dust and weight gain on saw dust significantly lower when compared to other litter materials. Similarly, Khosravinia and Abbasi (2006) found significant ($P<0.05$) difference in body weight during the first two weeks only under different litter materials. Huang *et al.* (2009) reported that litter types affect the body weight significantly ($P<0.05$) while Mahmoud *et al.* (2014) suggested that birds reared on wheat straw had significantly higher weight in comparison to sand and wood shavings.

Based on the present study it could be concluded that litter types have no significant effect on body weight, body weight gain and daily weight gain of broilers up to six weeks of age. Contrary results of previous researchers might be due to significant difference in feed consumption of birds under different litter types (Anisuzzaman and Chowdhury, 1996). As birds might have used litter material for source of nutrition i.e. rice husk.

The results showed that cumulative feed consumption was not significantly different between different litter types; (Table 6) at all age intervals. Numerically feed consumption were higher for wheat straw followed by river bed sand, sand (*Balu ret*), saw dust and rice husk. Similar results were observed for daily feed intake by birds under different litter types (Table 7).

Analogous to the finding of the present study several researchers reported no significant effect of litter types on feed consumption (Khan *et al.,* 2007; Farghly, 2012; Thirumalesh *et al.,* 2013).

Contrary to the present findings Burke *et al.* (1993); Anisuzzaman and Chowdhury (1996) found that rice husk had significantly higher feed intake in comparison to sand, also Khosravinia and Abbasi (2006) observed that feed consumption was significantly ($P<0.05$) different among various litter types used. Asaniyan *et al.* (2007) found significant difference in feed consumption of birds reared on sand and wood shavings, while Huang *et al.* (2009) suggested that feed consumption significantly ($P<0.05$) differs between coconut husk and wood shavings. Atencio *et al.* (2010) found that birds on wood shavings had higher feed intake then rice husk and Mahmoud *et al.* (2014) found that feed consumption was significantly different at 3rd, 4th, 5th and 6th weeks of age between wheat straw, sand and wood shavings.

Based on the present study it could be concluded that litter types have no significant effect on feed intake and daily feed intake of broiler up to six weeks of age. Contrary results of previous researchers might be due to significant difference in weight gain of birds under different litter types (Anisuzzaman and Chowdhury, 1996). Birds may get source of nutrition from litter materials or eating litter material may depressed feed intake of birds.

The results showed that feed conversion ratio was statistically significant ($P<0.05$) between different litter

Table 2: Ingredients and chemical composition (% Dry matter basis) of the ration fed to experimental broilers

Ingredients composition	Quantity		
	PSP (0-1 week)	SP (2-3weeks)	FP (4-6 weeks)
Maize (kg)	55	55.5	60
Soybean meal (kg)	20	17	15
Groundnut cake (kg)	12.5	13.5	10
Fish meal (kg)	8	8	8
Mineral Mixture (kg)	2	2	2
Vegetable fat (kg)	2.5	4	5
Spectromix (g)	10	10	10
Spectro BE (g)	20	20	20
Cocciwin (g)	50	50	50
Cholin chloride (g)	50	50	50
Lysine (g)	50	50	50
DL-Methionine (g)	80	80	80
Total (kg)	100.26	100.26	100.26
Chemical composition (%)			
Moisture %	10.52	10.84	10.88
CP	23.03	22.04	20.08
CF	3.64	3.61	3.32
EE	6.98	8.36	8.98
TA	6.3	6.18	5.86
NFE	49.53	48.97	50.88
ME* (Kcal/kg)	2952	3056	3163

PSP=pre starter phase, SP=starter phase, FP=finisher phase, *BIS2007

Table 3: Effect of different litter types on mean body weight (g/bird) of broilers

Age (days)	Treatments				
	T_1	T_2	T_3	T_4	T_5
0	46.13±0.43	46.12±0.43	46.30±0.49	46.10±0.43	46.08±0.42
7	129.38±2.81	129.85 ±2.49	129.78 ±2.74	125.32±2.67	124.69±2.96
14	306.35±8.94	300.10±8.43	325.10±8.79	303.87±7.01	303.81±10.10
21	619.78±16.81	601.88±17.19	626.98±15.27	609.12±13.24	608.67±17.36
28	1049.47±25.34	1035.98±26.27	1071.71±24.12	1050.88±19.99	1050.54±27.98
35	1637.20±37.63	1600.86±37.69	1655.31±35.01	1622.95±28.97	1619.78±42.26
42	2192.17±49.83	2139.98±52.78	2265.72±45.23	2186.76±41.37	2199.17±55.82

Table 4: Effect of different litter types on mean cumulative weight gain (g/bird) of broilers

Time period	Treatments				
(days)	T_1	T_2	T_3	T_4	T_5
0-7	83.25±2.86	83.73±2.45	83.42±2.82	79.22±2.60	78.67±2.90
0-14	260.22±8.95	254.00±8.40	278.75±8.88	257.77±6.98	257.81±10.04
0-21	573.63±16.81	555.74±17.16	580.63±15.32	563.02±13.22	562.67±17.26
0-28	1003.32±25.32	989.84±26.23	1025.36±24.15	1004.78±19.98	1004.43±27.89
0-35	1591.05±37.58	1554.72±37.66	1608.95±35.02	1576.85±28.99	1573.65±42.18
0-42	2146.02±49.79	2093.80±52.78	2219.40±45.22	2140.71±41.39	2153.09±55.73

Table 5: Effect of different litter types on daily weight gain (g/bird) of broilers

Time period	Treatments				
(days)	T_1	T_2	T_3	T_4	T_5
0-7	11.89±0.22	11.96±0.56	11.93±0.38	11.32±0.27	11.26±0.43
0-14	18.59±0.48	18.12±0.66	19.92±0.78	18.41±0.12	18.44±1.06
0-21	27.31±0.21	26.42±0.57	27.65±0.69	26.81±0.22	26.81±0.82
0-28	35.83±0.57	35.30±0.70	36.63±1.05	35.89±0.34	35.87±1.22
0-35	45.46±0.77	44.36±0.59	45.99±1.29	45.05±0.39	44.90±1.29
0-42	51.10±1.52	49.78±0.48	52.87±1.52	50.95±0.29	51.22±1.27

Table 6: Effect of different litter types on mean cumulative feed consumption (g/bird) of broilers

Time period	Treatments				
(days)	T_1	T_2	T_3	T_4	T_5
0-7	110.00±4.30	111.67±8.33	111.72±4.23	109.50±3.93	114.90±1.70
0-14	416.67±11.39	437.66±7.48	440.48±7.53	398.33±21.96	402.41±32.44
0-21	1105.28±6.48	1142.38±2.33	1146.65±19.99	1081.67±20.12	1109.84±40.01
0-28	1948.40±6.45	1994.97±13.88	2029.78±35.16	1931.67±21.62	1961.08±61.63
0-35	3133.04±15.66	3152.39±28.19	3244.90±57.58	3116.67±23.45	3115.13±93.54
0-42	4535.92±79.31	4503.60±54.08	4708.58±93.80	4546.19±40.58	4539.50±126.18

Table 7: Effect of different litter types on daily feed consumption (g/bird) of broilers

Time period	Treatments				
(days)	T_1	T_2	T_3	T_4	T_5
0-7	15.71±0.61	15.95±1.19	15.96±0.60	15.64±0.56	16.41±0.24
0-14	29.76±0.81	31.26±0.53	31.46±0.54	28.45±1.57	28.74±2.32
0-21	52.63±0.31	54.40±0.11	54.60±0.95	51.51±0.96	52.85±1.91
0-28	69.59±0.23	71.25±0.50	72.49±1.26	68.99±0.77	70.04±2.20
0-35	89.52±0.45	90.07±0.81	92.71±1.65	89.05±0.67	89.00±2.67
0-42	108.00±1.89	107.23±1.29	112.11±2.23	108.2±0.97	108.08±3.00

Table 8: Effect of different litter types on mean cumulative feed FCR of broilers

Time period (days)	Treatments				
	T_1	T_2	T_3	T_4	T_5
0-7	1.32±0.06	1.34±0.10	1.34±0.02	1.38±0.04	1.47±0.08
0-14	1.61±0.08	1.73±0.05	1.59±0.05	1.55±0.08	1.55±0.05
0-21	1.93^{a}±0.02	2.06^{b}±0.04	1.98^{ab}±0.06	1.92^{a}±0.03	1.97^{ab}±0.03
0-28	1.94^{ab}±0.02	2.02^{b}±0.03	1.98^{ab}±0.04	1.92^{a}±0.02	1.95^{ab}±0.03
0-35	1.97±0.03	2.03± 0.01	2.02±0.02	1.98±0.02	1.98±0.02
0-42	2.12±0.03	2.15±0.01	2.12±0.03	2.12±0.01	2.11±0.03

Means bearing different superscripts in a row differ significantly (P<0.05) from each other.

types only during the 3rd and 4th weeks only (Table 8). During 3rd week saw dust and river bed sand have shown significantly better FCR from rice husk and in 4th week only river bed sand was significantly better from rice husk. Results were non-significant for other growing intervals under different litter types.

The results of present study were partially comparable to findings of Chakma *et al.* (2012) and Mahmoud *et al.* (2014) who found significant (P<0.05) difference in feed conversion ratio of birds during different growth intervals under different litter types.

Diverging from this study Skrbic *et al.* (2012); Thirumalesh *et al.* (2013); Sharma and Sharma (2014) found no significant difference in feed conversion ratio of birds reared on different types of litter materials at all age groups.

The significant improvement in FCR of broilers reared on different litters could be attributed to the fact that the birds reared on rice husk might not utilized the feed efficiently in comparison to river bed sand and saw dust during the 3rd and 4th weeks of age because of high moisture content of rice husk litter.

Based on the present study it could be concluded that litter types have significant effect on feed conversion ratio of broiler during the 3rd and 4th weeks of age. Results of this study are in partial agreement with most of the findings of the earlier researchers. Contrary results of previous researchers might be due to insignificant difference in moisture level of litter materials and biased feed utilization by birds under different treatments.

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