

## Effect of Litter Materials on Broiler Performance

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### Abstract

### Original Research Article

Total 192 day-old broiler chicks were used on a completely randomized design in four treatments of deep litter materials namely paddy husk, chopped newspaper, coir dust and sand. This study included four treatments with four replicates, each replicate consisted of 12 birds in each cage and kept up to 42 days of age to compare the growth performance (feed intake, body weight, weight gain, feed conservation ratio, carcass weight, heart weight, gizzard weight, cecum weight, spleen weight, dressing percentage and mortality) of broiler. The moisture content in different types litter materials was significantly ( $p < 0.05$ ) increased weekly and the highest moisture content was recorded in coir dust and lowest values was recorded in sand at 6th weeks age of the litter. The pH content of different litter materials significantly declined from initial values at the end of 6 weeks. The higher value and lower value of pH were observed 2.99 in newspaper and 3.42 in coir dust respectively. Weight gain, feed intake, feed conversion, live body weight of birds were ( $p < 0.05$ ) increased with weekly in all types of litter material but the difference among the treatments was not significant in any of the weeks. Carcass weight and dressing percentage were not ( $p > 0.05$ ) changed in the litter types but weight of heart, cecum, spleen and gizzard were ( $p < 0.05$ ) varied among the litter types. Higher values of weight were recorded in heart, cecum, spleen and gizzard were 8.66 g in newspaper, 9.44g in paddy husk, 3.73 g in coir dust and 39.75g in coir dust respectively. Finally, these results suggest that the coir dust may be best litter over other litter for broiler rearing.

**Keywords:** Broilers, Carcass weight, feed conversion ratio, litter material.

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## INTRODUCTION

To obtain maximum broiler production potential, management of the poultry house is essential. One of the management practices is the proper maintenance of poultry litter. The quality of litter significantly influences the overall performance and ultimately the profit [1]. Litter plays a vital role in absorbing the fecal moisture, promoting drying by increasing surface area of the house floor, insulating chick from cooling effects of the ground and providing a protected cushion. It provides a warm, soft and spongy surface for optimum comfort of the birds. The litter should be easily available with a maximum moisture absorbing capacity, non-toxic, economical and porous. Proper level and depth of litter is important to avoid high bacterial load. A wet and caked litter emits foul smell and affects the chicken with diseases like coryza, coccidiosis, fungal infections and intestinal parasites [2]. The basic requirements of a good litter include moisture holding capacity, microbial tolerating ability, low cost, protection of birds from dirt, damp, cold floor and provide comfort for birds [3, 4].

Shaving wood and sawdust are the most common materials used as litter in commercial broiler production in many countries [5]. However, the low supplies, high cost, and unavailability of suitable materials have encouraged the search for alternative litter materials. Many alternatives local materials has been used as litter material namely wood sawdust [6], rice hulls [7], hardwood bark [8], Straw [9], rice and wheat straw [10], leaves [11], peanut hulls [12], rice hull ash [13], refused tea [14] and ground corncob, chopped corn stalk and soybean straw [15].

Identifying suitable and affordable alternative litter sources is of particular importance in developing countries, as broiler production makes a significant contribution to the livelihoods of commercial and small-scale farmers. In this study coir dust, newspaper, sand and paddy husk were used to evaluate the effect of physical properties of litter material on the performance of broiler chicken.

## MATERIALS AND METHODS

### Designing of Experiment

One hundred and ninety-two (192) day-old broiler chicks were obtained from a commercial hatchery. Then those birds were allowed to brood for one week. The chicks were grouped into four batches and each batch was contained forty-eight chicks and was randomly assigned for each treatment. Each treatment was further subdivided into four replicates of twelve chicks per replicate in each cage. The following treatments were applied: paddy husk as a control (T<sub>1</sub>), chopped newspaper (T<sub>2</sub>), coir dust (T<sub>3</sub>) and sand (T<sub>4</sub>). Each cage was measured in dimension as 0.9m by 1.2m and thereby providing a floor space of 1.08m<sup>2</sup> per 12 chicks. Initial moisture content and pH were measured of each litter and the floor was covered to a depth of 0.05m. Finally, chicks were weighed and placed into the experimental cages and exposed to the treatment. Litter was added over the existing litter for the depth of 0.01m once a week. Birds were kept for 6 weeks and the parameters were recorded in weekly intervals.

### Data collection

Samples of litter were taken in plastic bags from each replicate in weekly basis to determine the amount of moisture and pH. Litter moisture was determined by collecting litter samples from each cage and homogenizing. A 100 g sub sample was removed from each sample and dried in an oven at 105°C for 24 h to determine litter moisture. A sub sample of 5 g of sample was collected, and 10 ml of distilled water was added. The sample was agitated six times for 30 min, and pH was read using a pH meter [16].

The body weight gain for each bird was measured in weekly interval by subtracting the initial body weight from the weight measured at the last day of each week. The feed and water was offered *ad libitum* and the leftover feed was recorded at next morning. Feed consumption was calculated for each group by subtracting the leftover feed from the feed offered. The feed conversion ratio (FCR) for each bird was calculated weekly interval using the slandered formula as described by [17]. At the end of the experiment, the birds were kept fasting for 5-6 hours and no feed was offered during this withdrawal period to keep the crop of the bird empty at slaughtering time. Three birds were randomly selected from each replicate, weighed and immediately slaughtered. After removing feathers along with the skin, head, legs and all internal organs including heart, gizzard, liver and abdominal fat, the carcass were weighed to determine dressing percentage.

Mortality was recorded daily. The dead birds were dissected to determine the causes of death [17].

## STATISTICAL ANALYSIS

Multivariate analysis of variance (MANOVA) was performed by using SAS statistical software package and mean comparison was performed within treatment using Duncan Multiple Range Test (DMRT) at  $p < 0.05$  significant level for results of this experiment.

## RESULTS AND DISCUSSION

### Litter moisture content

Initially moisture content of coir dust, paddy husk, news pepper and sand were 0.84%, 19.35%, 12.63 and 9.53%, respectively. Similarly initial pH of coir dust, paddy husk, news pepper and sand were 6.54, 6.77, 8.34 and 6.74, respectively. These results are falling within the range as recorded by [18-20].

Moisture content increased from 0.84% to 61.08% in coir dust, 19.35 to 57.13 % in paddy husk, 12.63 to 58.62% in newspaper, and 9.53 to 40.15% in sand. Coir dust contained significantly ( $P < 0.05$ ) higher amount of moisture followed by newspaper, paddy husk and sand. These results are in partial agreement with Garces *et al.* [20] who reported that water holding capacity determines the moisture contents of the litter material. Hafeez *et al.* [18] reported that moisture increased with time. There was no sudden change in the moisture content of any of the four bedding materials. However, the moisture content increased more rapidly during week 3 to 6 in all kinds of litter material. This was the result of increased waste deposition and increased respiration of growing broilers and also it was reported that there will be an increases in moisture content of litter with time. pH contents decreased from 8.34 to 3.42 in coir dust, 6.54 to 3.18 in paddy husk, 6.77 to 2.99 in newspaper, and 6.74 to 3.01 in sand. Coir dust contained higher value of pH followed by paddy husk, sand and newspaper.

### Growth performance

There was no significant difference ( $P < 0.05$ ) among the paddy husk, newspaper, coir dust and sand in average weight gain in weekly (Table 1). However, weight gain increased during the period of 2<sup>nd</sup> week to 6<sup>th</sup> week of age of the birds. It was found that birds reared on coir dust gained the highest body weight gain followed by those on paddy husk, newspaper and sand. Feed consumption of the birds reared on different litter materials namely paddy husk, newspaper, coir dust and sand was more or less similar. This is in agreement with the findings of [21, 22].

**Table-1: Effect of different types of litter material on broiler body weight gain**

Treatment	Weight gain (g)				
	2 <sup>nd</sup> week	3 <sup>rd</sup> week	4 <sup>th</sup> week	5 <sup>th</sup> week	6 <sup>th</sup> week
Paddy husk	209.37±0.59 <sup>d</sup>	349.23±1.01 <sup>c</sup>	383.58±0.97 <sup>c</sup>	518.21±2.40 <sup>b</sup>	680.08±1.40 <sup>a</sup>
Newspaper	208.47±0.41 <sup>d</sup>	359.37±1.00 <sup>c</sup>	361.79±1.28 <sup>c</sup>	521.06±2.82 <sup>b</sup>	698.02±1.62 <sup>a</sup>
Coir dust	210.26±0.35 <sup>d</sup>	358.64±1.02 <sup>c</sup>	368.20±0.64 <sup>c</sup>	556.51±2.46 <sup>b</sup>	701.31±2.26 <sup>a</sup>
Sand	203.38±0.03 <sup>d</sup>	353.62±0.20 <sup>c</sup>	380.48±1.39 <sup>c</sup>	520.36±3.85 <sup>b</sup>	687.26±2.55 <sup>a</sup>

Values with the same letter within the same column and row are not significant ( $p < 0.05$ ) according to the Duncan Multiple Range Test at 5% significant level. Values represents means  $\pm$  standard error of 4 replication

Feed intake of birds was increased ( $p < 0.05$ ) with weekly in all types of litter material but the difference among the treatments was not significant in any of the weeks (Table 2). Similar results were obtained by [23, 5]. Birds reared on different litter materials showed no significant differences for live body weight and feed conversion ratio (FCR) at 42 days of age (Table 2). However, it was found that birds

reared on sand gained the highest body weight followed by those on coir dust, paddy husk and newspaper at the end of six weeks age. The body weight of birds reared on sand and coir dust was very close to each other. Similarly, it was also found that birds reared on newspaper gained the lower FCR followed by those on paddy husk, coir dust and sand.

**Table-2: Performance of broilers reared on four types of litters up to 42 days of age**

Types of litter	Feed intake (g)	Feed conversion ratio	Live Body weight (g)
Paddy husk	923±0.00 <sup>a</sup>	1.79±0.07 <sup>a</sup>	1652.9±0.90 <sup>a</sup>
Newspaper	923±0.00 <sup>a</sup>	1.78±0.09 <sup>a</sup>	1641.5±1.98 <sup>a</sup>
Coir dust	923±0.00 <sup>a</sup>	1.82±0.04 <sup>a</sup>	1682.5±1.52 <sup>a</sup>
Sand	923±0.00 <sup>a</sup>	1.83±0.09 <sup>a</sup>	1687.8±1.79 <sup>a</sup>

Values with the same letter within the same column and row are not significant ( $p < 0.05$ ) according to the Duncan Multiple Range Test at 5% significant level. Values represents means  $\pm$  standard error of 4 replications.

Broiler Carcass weight and dressing percentage showed non-significant difference among different type of litter material (Table 3). Carcass weight and dressing percentage were recorded in the birds reared on coir dust (1147.08 g, 68.15±0.38%),

newspaper (1144.83 g, 69.75±0.14%), paddy husk (1144.58 g, 69.25±0.11%) and sand (1117.45g, 70.03±0.09), respectively. These values were fallen within the normal range [24].

**Table-3: Effect of different types of litter material on broiler carcass weight**

Treatment	Carcass Weight (g)	Dressing %	Heart Weight (g)	Cecum Weight (g)	Spleen Weight (g)	Gizzard Weight (g)
Paddy husk	1144.58±0.58 <sup>a</sup>	69.25±0.11 <sup>a</sup>	6.61±0.34 <sup>c</sup>	9.44±0.50 <sup>a</sup>	1.20±0.27 <sup>b</sup>	36.95±0.64 <sup>b</sup>
Newspaper	1144.83±1.74 <sup>a</sup>	69.75±0.14 <sup>a</sup>	8.66±0.71 <sup>a</sup>	8.80±0.48 <sup>b</sup>	1.24±0.22 <sup>b</sup>	30.28±0.50 <sup>c</sup>
Coir dust	1147.08±0.78 <sup>a</sup>	68.15±0.38 <sup>a</sup>	7.79±0.28 <sup>b</sup>	8.54±0.22 <sup>b</sup>	3.73±1.40 <sup>a</sup>	39.75±0.83 <sup>a</sup>
Sand	1117.45±2.24 <sup>a</sup>	70.03±0.09 <sup>a</sup>	8.62±0.44 <sup>a</sup>	8.41±0.87 <sup>b</sup>	1.70±0.54 <sup>b</sup>	33.17±0.59 <sup>c</sup>

Values with the same letter within the same column are not significant ( $p < 0.05$ ) according to the Duncan Multiple Range Test at 5% significant level. Values represents means  $\pm$  standard error of 4 replications

The broiler heart weight and cecum weight were significantly varied among the different types of litter material. The heart weight from the newspaper (8.66g), sand (8.62), coir dust (7.79) and paddy husk (6.61) were reported at slaughtering time (Table 3). Similarly, cecum weight from paddy husk (9.44g), newspaper (8.88g), coir dust (8.54g) and sand (8.41g) were recorded (Table 3). It could be a physiological variation among the birds during rearing period.

The results exhibited that spleen weight of chicks in coir dust were showed a significantly higher value among other treatments at 6<sup>th</sup> week of slaughtering. But between paddy husk, newspaper and sand there were no significant difference in the spleen weight of broiler (Table 3). Similarly, showed the gizzard weight was significantly varied among the

different types of litter materials. At the 6<sup>th</sup> week of slaughtering period highest mean of gizzard weight was recorded in coir dust (39.75g), followed by paddy husk (36.95g), sand (33.17g) and lowest one was given by newspaper (30.28g). The results agreed with those of earlier report by [25] and [26]. Throughout this experiment there was no mortality occurred even though there were several changes in litter in treatment.

## CONCLUSION

The present experiment conducted on broiler chicks to evaluate the effect of different type litter material (paddy husk, chopped newspaper, coir dust, sand) on litter moisture content, litter pH, and performance of broiler chick. In the present study when consider moisture absorption in different litter, coir dust

showed higher moisture content when compare with other litter. When consider pH of litter, newspaper showed lowest values of pH when compare to other types of litter. Weight gain, feed intake, and feed conversion, live body weight of birds increased with week in all types of litter material but the difference among the treatments was not significant in any of the weeks. Carcass weight and dressing percentage did not change significantly in the litter types but weight of heart, cecum, spleen and gizzard varied among the litter types. Finally, these results suggest that the coir dust may be best litter over other litter for broiler rearing.

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