Research Journal of Poultry Sciences 7 (1): 1-6, 2014
ISSN: 1993-5285

Effect of Different Types of Litter on Broiler Performance

M.S.H. Mahmoud, F.N.K. Soliman, M. Bahie EL-Deen and Azza A. EL Sebai
Department of Poultry Production, Faculty of Agriculture "El-Shatby",
Alexandria Universtiy, Alexandria, Egypt

Abstract: The experiment was conducted during summer months to evaluate the effect of using different types of litter with or without alum on Ross broiler chick's performance, Body Weight (BW), Feed Consumption (FC), Feed Conversion (FCR) and Water Intake (WI). A total number of six hundred and forty eight of Ross broiler chicks 1 day old. The birds divided into six Treatments (T) of floor litter. The results of this study showed that litter type there were highly significant differences ($p \leq 0.001$) in body weight at 4, 5 and 6 weeks of age, since the birds raised on wheat straw and sand litters has heavier body weight than those raised on shaving wood litter. Also, the results of feed consumption trait indicated insignificant differences for all effects studied during 1st and 2nd weeks of age. However, it showed highly significant differences ($p \leq 0.01$) among litter types and between alum treatments during 3rd, 4th and also for the cumulative values for the whole experimental period (0-6 weeks of age). The results of FCR indicated insignificant differences for all effects studied during 1st and 5th weeks of age. However, it showed highly significant differences ($p \leq 0.01$) among litter types during 3rd, 4th weeks of age and result showed water intake as affected with litter types indicated insignificant differences during 1st and 2nd weeks of age. However, it being highly significant ($p \leq 0.01$) during the rest of the weeks of the experimental period.

Key words: Broiler, litter types, alum, FC, FCR, WI

INTRODUCTION

In general, litter need to be very absorbent. This is probably a good criterion for organic materials but might not apply to inorganic materials such as sand and clay. In order to be used as a poultry bedding material, it must be reasonably available. If the current litter material becomes difficult to obtain or has a low quality, poultry breeders may decide to use alternative litter material. Ultimately, bird performance parameters such as growth rate, feed efficiency and carcass quality as well as litter cost and availability will have priority in evaluation the usefulness and suitability of the litter material. The poultry industry used large quantities of processed solid wood residues and other materials for litter. Although, a variety of products such as wood shavings and rice hulls are used as bedding for poultry, alternative litter sources are always of interest to the poultry producer (Austic and Nesheim, 1990; Hester *et al*., 1997).

Alkis and Celen (2009) compared between four treatments: straw, sawdust (control groups), alum treated straw and alum treated sawdust litters. They found that average body weight at 6 weeks of age was significantly improved for female birds raised on alum treated litters, it weighed 2173.46, 2183.43, 2365.74 and 2383.27 g, respectively. Although, male birds raised over the alum treated straw litter were not significantly affected. Whereas, male birds raise over the alum treated sawdust litter significantly improved compared to control, male birds raised over the alum treated straw litter was slightly higher than that male birds raised over the straw litter. The corresponding values of live weights of males were 2566.69, 2503.43, 2578.68 and 2675.46 g, respectively. Toghyani *et al*. (2010) compared between four replicates for each of the following five litter treatments: no litter, wood shaving, sand, rice hulls and recycled paper roll. The results showed that at 42 days of age, feed intake of broilers reared on rice hulls was significantly lower than other litters and the highest in that respect was belonged to broilers reared on no litter or sand, since the values were 84.2, 82.3, 83.1, 78.9 and 82.1 g/bird/day, respectively.

Alkis and Celen (2009) compared between four replicates for each of the following two litter treatments control straw, control sawdust, alum treated straw and alum treated sawdust and found that the litter types had no significant effect on feed conversion ratio since it was 1.76, 1.72, 1.86 and 1.77, respectively.

Atapattu and Wickramasinghe (2007) determine the suitability of refused tea as a litter material for broiler chickens. They used 150 chicks were randomly allocated

Corresponding Author: M.S.H. Mahmoud, Department of Poultry Production, Facalty of Agriculture "El-Shatby", Alexandria Universtiy, Alexandria, Egypt

into 6 deep litter pens. The result at 6 weeks of age showed that water intake was not affected by the type of the litter used.

MATERIALS AND METHODS

The present experiment was planned to evaluate the effect of using different types of litter with or without alum on Ross broiler chick's performance, carcass parts and some blood parameters, under the prevailing environmental summer conditions in Alexandria. It was performed at the Poultry Research Center, Faculty of Agriculture, Alexandria University, during the period from July to August 2009. A total number of six hundred and forty eight of Ross broiler chicks 1 day old with an average initial weight 40.0±2.0 g were used in this experiment. All birds were randomly divided into six Treatments (T) of floor litter: T_1 birds were raised on wood shavings litter, T_2 birds were raised on wood shavings litter with alum, T_3 birds were raised on wheat straw litter, T_4 birds were raised on wheat straw litter with alum, T_5 birds were raised on sand litter and T_6 birds were raised on sand litter with alum. Each treatment included one hundred and eight birds which were divided into two equal replicates (each of 54 birds). Birds in each replicate were kept in a partition (pens) of 5 m^2, 2.5 m long and 2 m width (10 bird/1 m^2), provided with 6 cm height of special certain litter. Alum was added at 0.091 kg/bird for treatments T2, T4 and T6 and their replicates. It been grind and mixed with treatments litter. The experiment extended to 42 days of age. Feed and water were available *ad libitum* also all birds were kept under similar management conditions. The studied traits (live body weight, feed consumption, feed conversion were measured weekly and water intake was recorded for each pen one time weekly at the middle of the week during the experimental period. Chicks in each replicate were provided with a certain amount of water in that day. The residuals in drinkers were obtained at the end of the day and the amount of individual water consumed was calculated by dividing the amount consumed over the number of chicks in that day.

RESULTS AND DISCUSSION

Body weight: Least square means and standard errors of broiler live body weights at 4, 5 and 6 weeks of age as affected by the experimental litter types and their analysis are presented in Table 1. In respect to litter type, there were highly significant differences ($p \leq 0.001$) in body weight at 4, 5 and 6 weeks of age, since the birds raised on wheat straw and sand litters has heavier body weight than those raised on shaving wood litter. The final body weight at 6 weeks of age (Table 1) averaged 1647.6, 1714.9 and 1331.6 g, respectively.

Table 1: Least square means and standard errors ($\bar{X}$±SE) of broiler live body weight at 4, 5 and 6 weeks of age as affected by litter types and treatments

		Treatments		
Time duration	Litter types	Without Alum	Alum (0.091 kg/bird)	Litter type mean
4 weeks	Wheat straw	1050.5±55.4^{a}	856.3±48.3^{b}	953.4±39.5^{A}
	Sand	992.5±68.5^{b}	1084.8±37.8^{a}	1038.6±39.2^{A}
	Wood shavings	664.5±35.5^{c}	662.5±37.2^{c}	663.5±25.4^{B}
	Treatment mean	902.5±38.2	867.8±32.5	885.2
Sig.	SOV		MS	
	Litter (L)		***	
	L×T		NS	
	Treatment (T)		*	
5 weeks	Wheat straw	1454.5±41.4^{b}	1243.5±44.1^{d}	1349.0±34.3^{B}
	Sand	1373.0±49.1^{c}	1510.0±47.3^{a}	1441.5±35.4^{A}
	Wood shavings	1002.2±42.2^{e}	1017.0±53.7^{e}	1009.6±33.7^{C}
	Treatment mean	1276.6±35.9	1256.8±38.0	1266.7
Sig.	SOV		MS	
	Litter (L)		***	
	Treatment (T)		NS	
	L×T		**	
6 weeks	Wheat straw	1694.8±65.5^{b}	1600.5±42.3^{c}	1647.6±39.2^{A}
	Sand	1615.5±54.2^{c}	1814.3±59.1^{a}	1714.9±42.6^{A}
	Wood shavings	1312.3±56.3^{e}	1351.0±77.3^{d}	1331.6±47.3^{B}
	Treatment mean	1540.8±39.7	1588.6±42.6	1564.7
Sig.	SOV		MS	
	Litter (L)		***	
	Treatment (T)		NS	
	L×T		*	

$^{a-e}$Means of litter×treatment effect having different superscript letters are significantly different ($p \leq 0.05$); $^{A-C}$Means of litter type effect column having different superscript letters are significantly different ($p \leq 0.05$); ^{A,B}Means of treatment effect row having different superscript letters are significantly different ($p \leq 0.05$); *$p \leq 0.05$, **$p \leq 0.01$, ***0.001. NS = Not Significant

In consider of alum treatment, the body weight results at 4-6 weeks of age showed insignificant differences. The bird's body weight at 4-6 weeks of age raised on litter without alum or with alum averaged 902.5 and 867.8, 1276.6 and 1256.8 and 1540.8 and 1588.6 g, respectively.

The interaction (litter type x alum) results indicated significant differences in body weight at 4-6 weeks of age. Generally, the birds raised on sand with alum litter had the heaviest body weight at 4-6 weeks of age (1084.8, 1510.0 and 1814.3 g, respectively) among different treatments studied. The shaving wood litter with or without alum established a lower body weight values. The results of the study are in agreement with (McWard and Taylor, 2000; Moore *et al*., 1997; Moore Jr. *et al*., 1999). Researchers determined that body weight for broilers raised over the alum were significantly better than the control group. Also, the findings of Alkis and Celen (2009) compared between four treatments: straw, sawdust (control groups), alum treated straw and alum treated sawdust litters. They found that average body weight at 6 weeks of age was significantly improved for birds raised on alum treated litters than the control group. The present results of body weight as affected by litter types are most likely to be

caused by indirect influence of litter type on poultry house environment, including air quality. These results are in agreement with the findings of Popolizio *et al.* (1979). Also, EL-Sagheer *et al.* (2004) indicated that broilers, raised on sand litter had the heaviest body weight as compared with those raised on wheat straw or saw dust. On the other hand, Biswas *et al.* (2001), Lien *et al.* (2008) and Davis *et al.* (2010) found that the litter types had no significant effect of litter types on body weight of broilers in their studies. However, Anisuzzaman and Chowdhury (1996) found that rice husk was the best litter material for rearing broilers with better growth. Also, the obtained results disagreement with the findings of Al Homidan and Robertson (2007) found that wood shavings were associated with significantly heavier body weights of hybro broilers as compared with those raised on both of chopped straw and chopped straw with sand based litters at 6 weeks of age, since the body weight amounted 1933 vs. 1870 g.

Feed consumption: Least square means and standard errors of broiler feed consumption during the different week intervals studied with the cumulative values as affected by the experimental litter types and their analysis are presented in Table 2. The results of feed consumption trait indicated insignificant differences for all effects studied during 1st and 2nd weeks of age (Table 2).

The obtained results during 1st and 2nd weeks are in agreement with EL-Sagheer *et al.* (2004) showed insignificant differences in feed consumption of broilers, raised on sand or wheat straw or saw dust. However, it showed highly significant differences ($p \leq 0.01$) among litter types and between alum treatments during 3rd, 4th and also for the cumulative values for the whole experimental period (0-6 weeks of age). Meanwhile, the results observed significant differences ($p \leq 0.05$) in that respect among litter types during 5th and 6th weeks and also between treatments only during 6th week of age.

In respect to the cumulative results, the broiler chicks raised on wheat straw, sand and shaving wood litters consumed 3201.3, 3151.2 and 2814.0 g, respectively. Also, the broiler chicks raised on litter without alum consumed more feed (3176.6 g) than those raised on litter with alum (2934.3 g). The interaction (litter type x alum) results of the whole experimental period showed significant differences ($p \leq 0.05$), since the birds raised on wheat straw without alum litter consumed the highest amount of feed (3390.2 g) while those raised on shaving wood with alum litter consumed the lowest amount of feed (2775.3 g). The results of feed consumption as affected by litter types reported in the present study are in agreement with. Swain and Sundaram (2000) revealed insignificant differences in feed consumption of Ross broilers raised on straw when compared to those of birds raised on saw dust and rice husk, since they amounted 2626, 2789 and

Table 2: Least square means and standard errors ($\bar{X} \pm SE$) of broiler feed consumption as affected by litter types and treatments (g/bird/week) during the different weeks interval studied with the cumulative values

	1st week			2nd week			3rd week			4th week		
Litter types	Without alum	Alum (0.091 kg/bird)	Litter type mean	Without alum	Alum (0.091 kg/bird)	Litter type mean	Without alum	Alum (0.091 kg/bird)	Litter type mean	Without alum	Alum (0.091 kg/bird)	Litter type mean
Wheat straw	121.2	139.7	130.5	150.1	149.60	149.4	546.6	486.5	516.6^{A}	686.2^{a}	553.8^{c}	620.0^{A}
Sand	117.7	136.2	126.9	156.2	161.00	158.6	456.1	362.3	409.2^{C}	651.9^{b}	539.3^{c}	595.6^{A}
Wood shavings	140.9	121.1	131.0	166.6	179.40	173.0	459.3	443.3	451.3^{B}	532.0^{cd}	519.4^{d}	525.6^{B}
Treatment mean	126.2	132.3	129.4	157.0	163.30	160.3	$487.3^{A'}$	$430.7^{B'}$	459.0	$623.3^{A'}$	$537.5^{B'}$	580.4
Pooled SE	2.9			6.10			16.5			19.4		
SOV	MS			MS			MS			MS		
L	NS			NS			**			**		
T	NS			NS			**			**		
L×T	NS			NS			NS			*		

	5th week			6th week			Total 0-6 weeks		
Litter types	Without alum	Alum (0.091 kg/bird)	Litter type mean	Without alum	Alum (0.091 kg/bird)	Litter type mean	Without alum	Alum (0.091 kg/bird)	Litter type mean
Wheat straw	872.9	786.6	829.8^{A}	1013.2	896.1	954.7^{B}	3390.2^{a}	3012.3^{c}	3201.3^{A}
Sand	850.3	851.6	850.9^{A}	1054.8	964.9	1010.0^{A}	3287.0^{b}	3015.3^{c}	3151.2^{A}
Wood shavings	663.7	600.4	632.1^{B}	890.3	911.7	901.0^{C}	2852.7^{d}	2775.3^{e}	2814.0^{B}
Treatment mean	795.6	746.2	770.9	$986.1^{B'}$	$924.2^{A'}$	955.2	$3176.6^{A'}$	$2934.3^{B'}$	3055.5
Pooled SE	31.1			18.7			63.9		
SOV	MS			MS			MS		
L	*			*			**		
T	NS			*			**		
L×T	NS			NS			*		

[a-e]Means of litter x treatment effect having different superscript letters are significantly different ($p \leq 0.05$) *$p \leq 0.05$; ** $p \leq 0.01$; NS = Not Significant; [A-C]Means of litter type effect column having different superscript letters are significantly different ($p \leq 0.05$); T = Treatment; L = Litter; [A', B']Means of treatment effect row having different superscript letters are significantly different ($p \leq 0.05$)

2711 g/bird, respectively. Also, EL-Sagheer *et al.* (2004) found insignificant differences in feed consumption of Arbor Acres broilers, raised on sand or wheat straw or saw dust. El-Lethey and Zaki (2005) found that the litter type had no significant effect on feed consumption at 6 weeks of age of Hubbard broiler raised on wood shavings, wheat straw and a 50/50 wood shavings with wheat straw. Finally, Lien *et al.* (2008) found that the litter type had no significant effect on feed consumption of Ross broiler raised on sand or pine shavings litter at 8 weeks of age, since it were 5.31 and 5.40 kg/bird, respectively. Similarly, Sharnam *et al.* (2008) found that the litter type had no significant effect on feed consumption of Cobb broilers raised on rice husk and wheat straw with sawdust. However, Anisuzzaman and Chowdhury (1996) which compared among rice husk saw dust, straw and sand on the averages litters. They found that rice husk was the best litter material for rearing broilers which had the best feed consumption as compared with the other three tested litters. Toghyani *et al.* (2010) showed that feed intake of broilers at 42 days of age reared on rice hulls was significantly lower than other litters and the highest in that respect was belonged to broilers reared on no litter or sand.

Feed conversion ratio: Least square means and standard errors of broiler feed conversion ratio during the different weeks interval studied with the cumulative values as affected by the experimental litter types and their analysis are presented in Table 3. The results indicated insignificant differences for all effects studied during 1st and 5th weeks of age (Table 3).

The results in this period are agreement with El-Lethey and Zaki (2005), Lien *et al.* (2008) and Toghyani *et al.* (2010). They found the different litter types studied had insignificant effect on feed conversion ratio of Ross broiler. However, it showed highly significant differences ($p \leq 0.01$) among litter types during 3rd, 4th weeks of age. Meanwhile, the results observed significant differences ($p \leq 0.05$) in that respect during 2nd and 6th weeks of age. The overall means of feed conversion ratio were 1.44, 1.83, 2.15, 1.58, 2.05 and 3.28 during 1st, 2nd, 3rd, 4th, 5th and 6th weeks of age, respectively.

In consider of treatment with alum, the results of Table 3 showed insignificant differences for this effect on feed conversion ratio during 1st, 4th and 5th weeks of age. However, this treatment being significant ($p \leq 0.05$) during the rest of weeks studied. The feed conversion ratio of birds raised on litter without or with alum averaged 1.55, 2.11; 2.33, 1.98 and 3.75, 2.80 during 2nd, 3rd and 6th weeks of age, respectively.

The interaction (litter type x alum) results showed significant differences on feed conversion trait during 2nd, 4th and 6th weeks of age, since wheat straw and

Table 3: Least square means and standard errors ($\bar{X} \pm SE$) of broiler feed conversion as affected by litter types and treatments (g feed/g gain)

	1st week			2nd week			3rd week			4th week		
Litter types	Without alum	Alum (0.091 kg/bird)	Litter type mean	Without alum	Alum (0.091 kg/bird)	Litter type mean	Without alum	Alum (0.091 kg/bird)	Litter type mean	Without alum	Alum (0.091 kg/bird)	Litter type mean
Wheat straw	1.49	1.88	1.69	1.32^{d}	2.37^{a}	1.84^{B}	2.07	2.1	2.08^{B}	1.25^{c}	1.24^{c}	1.24^{B}
Sand	1.08	1.23	1.16	1.37^{d}	1.60^{c}	1.49^{C}	2.55	2.12	2.34^{A}	1.19^{c}	1.08^{d}	1.13^{C}
Wood shavings	1.50	1.45	1.47	1.96^{b}	2.35^{a}	2.15^{A}	2.37	1.71	2.04^{B}	2.16^{b}	2.58^{a}	2.37^{A}
Treatment mean	1.36	1.52	1.44	$1.55^{B'}$	$2.11^{A'}$	1.83	$2.33^{A'}$	$1.98^{B'}$	2.15	1.53	1.63	1.58
Pooled SE	0.08			0.25			0.07			0.16		
SOV	MS			MS			MS			MS		
L	NS			*			**			**		
T	NS			*			*			NS		
L×T	NS			*			NS			**		

	5th week			6th week			Total 0-6 weeks		
Litter types	Without alum	Alum (0.091 kg/bird)	Litter type mean	Without alum	Alum (0.091 kg/bird)	Litter type mean	Without alum	Alum (0.091 kg/bird)	Litter type mean
Wheat straw	2.16	2.03	2.09	4.22^{a}	2.51^{d}	3.37^{B}	2.05^{b}	1.93^{c}	1.99^{B}
Sand	2.23	2.00	2.12	4.35^{a}	3.17^{b}	3.76^{A}	2.08^{b}	1.70^{d}	1.89^{B}
Wood shavings	2.20	1.69	1.95	2.68^{c}	2.73^{c}	2.70^{C}	2.39^{a}	2.12^{b}	2.26^{A}
Treatment mean	2.20	1.91	2.05	$3.75^{A'}$	$2.80^{B'}$	3.28	$2.17^{A'}$	$1.92^{B'}$	2.05
Pooled SE	0.05			0.22			0.06		
SOV	MS			MS			MS		
L	NS			*			*		
T	NS			*			*		
L×T	NS			*			*		

$^{a-d}$Means of litter x treatment effect having different superscript letters are significantly different ($p \leq 0.05$); *$p \leq 0.05$; **$p \leq 0.01$; NS = Not Significant; $^{A-C}$Means of litter type effect column having different superscript letters are significantly different ($p \leq 0.05$); L = Litter; T = Treatment; $^{A'-B'}$Means of treatment effect row having different superscript letters are significantly different ($p \leq 0.05$)

sand litters both without alum showed better feed conversion ratio during 2nd week of age, sand with alum litter during 4th week of age and wheat straw with alum litter during 6th week of age.

In respect to the cumulative results of feed conversion ratio, it was showed that all effects studied were significant ($p \leq 0.05$), since the birds raised on wheat straw (1.99) and sand (1.89) litters has better values than those raised on shaving wood (2.26) litter. The birds raised on litter with alum (1.92) have better value than those raised on litter without alum (2.17). Also, the birds raised on sand with alum has the superiority feed conversion value (1.70) among all treatments studied (Table 3).

The obtained results of significant feed conversion ratio as affected by litter types are in agreement with Anisuzzaman and Chowdhury (1996), they found that rice husk was the best litter material for rearing broilers to 6 weeks of age which had the best feed conversion ratio values as compared with the other three tested litters (sawdust, paddy straw and sand). Similar results were also found by Swain and Sundaram (2000). However, El-Lethey and Zaki (2005), Lien *et al.* (2008) and Toghyani *et al.* (2010) found that the different litter types studied had no significant effect on feed conversion ratio of Hubbard, Ross 308 and Ross 308 broilers, respectively.

Water intake: Least square means and standard errors of broiler water intake during the different weeks interval studied with the cumulative values as affected by the experimental litter types and their analysis are presented in Table 4. The results of water intake as affected with litter types indicated insignificant differences during 1st and 2nd weeks of age (Table 4). However, it being highly significant ($p \leq 0.01$) during the rest of the weeks of the experimental period. The birds raised on shaving wood litters drink significantly lower amount of water when compared with those birds raised on other two types of litters studied, they drink amount averaged 172.0, 228.7, 244.8 and 270.4 (mL/bird/day) during the 3rd, 4th, 5th and 6th weeks of age, respectively.

In consider of treatment with alum, the results observed significant differences ($p \leq 0.05$) between alum treatments only during 2-6 weeks of age. The birds raised on litter without alum drink more amount of water than those raised on litter with alum during 2-4 weeks of age while the contrast trend was showed during 5 and 6 weeks of age.

The interaction (litter type x alum) results showed significant differences on the amount of water intake only during 2-6 weeks of age. The birds raised on the wheat straw without alum litter drink more amount of water (mL/bird/day) than other litter treatments during 2 (154.1), 3 (250.0), 4 (343.9) and 5 (416.3) weeks of age. However, the results showed that the birds raised on wheat straw or sand litters with or without alum treatments drink significantly more water than those raised on shaving wood litter with or without alum treatments during the 6th week of the experimental period.

Table 4: Least square means and standard errors ($\bar{X} \pm SE$) of broiler daily water intake as affected by litter types and treatments (mL/bird/day)

	1st week			2nd week			3rd week		
Litter types	Without alum	Alum 0.091 kg/bird)	Litter type mean	Without alum	Alum (0.091 kg/bird)	Litter type mean	Without alum	Alum (0.091 kg/bird)	Litter type mean
Wheat straw	69.4	74.1	71.8	154.1^{a}	94.5^{d}	124.3	250.0^{a}	204.3^{b}	227.1^{A}
Sand	78.7	67.1	72.9	112.5^{c}	139.2^{b}	125.7	176.5^{cd}	189.0^{c}	182.8^{B}
Wood shavings	62.6	67.1	64.8	136.1^{b}	112.5^{c}	124.3	184.4^{c}	159.6^{d}	172.0^{c}
Treatment mean	70.2	69.5	69.9	$134.2^{A'}$	$115.4^{B'}$	124.8	$203.7^{A'}$	$184.2^{B'}$	193.9
Pooled SE	1.6			4.0			6.1		
SOV	MS			MS			MS		
L	NS			NS			**		
T	NS			*			*		
L×T	NS			**			*		
	4th week			5th week			6th week		
Litter types	Without alum	Alum (0.091 kg/bird)	Litter type mean	Without alum	Alum (0.091 kg/bird)	Litter type mean	Without alum	Alum (0.091 kg/bird)	Litter type mean
Wheat straw	343.9^{a}	276.8^{b}	310.3^{A}	416.3^{a}	345.9^{b}	381.1^{A}	470.0^{a}	461.5^{a}	465.7^{B}
Sand	288.5^{b}	276.8^{b}	282.7^{B}	293.7^{c}	351.6^{b}	322.6^{B}	474.7^{a}	473.5^{a}	474.1^{A}
Wood shavings	229.1^{c}	231.9^{c}	228.7^{C}	235.9^{e}	253.7^{d}	244.8^{C}	224.3^{b}	316.4^{b}	270.4^{C}
Treatment mean	$287.2^{A'}$	$261.9^{B'}$	273.9	$315.3^{B'}$	$317.0^{A'}$	316.2	$389.6^{B'}$	$417.1^{A'}$	403.4
Pooled SE	9.7			18.7			24.6		
SOV	MS			MS			MS		
L	**			**			**		
T	*			*			*		
L×T	*			*			*		

$^{a-e}$Means of litter x treatment effect having different superscript letters are significantly different ($p \leq 0.05$); *$p \leq 0.05$; **$p \leq 0.01$; NS = Not Significant; $^{A-C}$Means of litter type effect column having different superscript letters are significantly different ($p \leq 0.05$); L = Litter; T = Treatment; $^{A', B'}$Means of treatment effect row having different superscript letters are significantly different ($p \leq 0.05$)

Generally, the birds raised on wheat straw, sand and shaving wood litters drink 11.062, 10.225 and 7.735 L/bird for the whole experimental period (42 days), respectively. Meanwhile, the birds raised on litter without or with alum treatments drink 9.801 and 9.556 L/bird/42 days.

There were a few results indicated the impact of different types of litter on water intake. Benabdeljelil and Ayachi (1996) studied six different litter materials and showed that litter material did not affect water consumption at 57 days of age. Similarly, Atapattu and Wickramasinghe (2007) used refused tea as a litter material for broiler chickens and reported that at 6 weeks of age the water intake was not affected among replicates.

CONCLUSION

- Based on the results obtained from this experiment, it could be concluded that using sand or wheat straw as a litter during rearing broiler chicks up to 6 weeks of age is better for their performance than wood shavings
- Alum applications exhibited significantly better mortality rate in comparison to birds raised over untreated litter
- In general, the sand litter with or without alum is most benefit for broiler performance

REFERENCES

Al Homidan, A. and J.F. Robertson, 2007. The effect of stocking density and litter type on ammonia, dust, carbon dioxide concentrations and broiler performance. Egypt. Poult. Sci. J., 27: 37-51.

Alkis, E. and M.F. Celen, 2009. Effects of alum treatment of two litter materials on growth performance of broiler chicken. Afr. J. Agric. Res., 4: 518-521.

Anisuzzaman, M. and S.D. Chowdhury, 1996. Use of four types of litter for rearing broilers. Br. Poult. Sci., 37: 541-545.

Atapattu, N.S.B.M. and K.P. Wickramasinghe, 2007. The use of refused tea as litter material for broiler chickens. Poult. Sci., 86: 968-972.

Austic, R.E. and M.C. Neshiem, 1990. Poultry Production. 13th Edn., Lea and Febiger, USA.

Benabdeljelil, K. and A. Ayachi, 1996. Evaluation of alternative litter materials for poultry. J. Applied Poult. Res., 5: 203-209.

Biswas, S.K., M.A. Wahid, M.J. Karim, M.A.H. Pramanik and M. Rokonuzzaman, 2001. Evaluation of different litter materials for broiler performance, coccidial oocyst population and level of N, P and K during winter. Pak. J. Biol. Sci., 4: 1565-1567.

Davis, J.D., J.L. Purswell, E.P. Columbus and A.S. Kiess, 2010. Evaluation of chopped switchgrass as a litter material. Int. J. Poult. Sci., 9: 39-42.

EL-Sagheer, M., M.N. Makled and M.A. Mohamed, 2004. Effect of type litter on broiler performance. Egypt. J. Anim. Prod., 24: 411-422.

El-Lethey, H.M. and M.M. Zaki, 2005. The effect of different types of litter material on broilers performance. Egypt. J. Exp. Biol. Zool., 1: 103-106.

Hester, P.Y., D.L. Cassens and T.A. Bryan, 1997. The applicability of particleboard residue as a litter material for male turkeys. Poult. Sci., 76: 248-255.

Lien, R.J., K.S. Macklin, J.B. Hess, W.A. Ill Dozier and S.F. Bilgili, 2008. Effects of early skip-a-day feed removal and litter material on broiler live and processing performance and litter bacterial levels. Int. J. Poult. Sci., 7: 110-116.

McWard, G.W. and D.R. Taylor, 2000. Acidified clay litter amendment. J. Applied Poult. Res., 9: 518-529.

Moore Jr., P.A., T.C. Daniel and D.R. Edwards, 1999. Reducing phosphorus runoff and improving poultry production with alum. Poult. Sci., 78: 692-698.

Moore, P.A., B.E. Haggard, T.C. Daniel, D.R. Edwards, B.R. Shreve and T.J. Sauer, 1997. Demonstration of nutrient management for poultry litter using alum precipitation of soluble phosphorus. Final Report to U.S. EPA for Federal Assistance Project No. 9006749920.

Popolizio, E.R., H.R. Ricci, H.F. Castellote and L.A. Pailhe, 1979. Use of different materials for poultry litter. Agronomica Zootecnica, 75: 14-14.

Sharnam, K.S., K.N. Wadhwani, K. Khanna and A.M. Patel, 2008. Effect of quality feeds and litter materials on broiler performance under hot humid climate. Int. J. Poult. Sci., 7: 14-22.

Swain, B.K. and R.N.S. Sundaram, 2000. Effect of different types of litter material for rearing broilers. Br. Poult. Sci., 41: 261-262.

Toghyani, M., A. Gheisari, M. Modaresi, S.A. Tabeidian and M. Toghyani, 2010. Effect of different litter material on performance and behavior of broiler chickens. Applied Anim. Behav. Sci., 122: 48-52.