Effect of Oiling and Antimicrobial Spray of Litter on Performance of Broiler Chickens Reared on Leaves and Corn Cob Bedding Materials under Heat Stress Conditions

H. Khosravinia*
Dept. of Technology of Animal products, Agriculture Faculty, Lorestan University
P.B. 465, Khoramabad-68135, Lorestan, Iran

ABSTRACT : This study was conducted to investigate the efficacy of surface spraying of antimicrobial solutions, oil and application of both on performance of broiler chicken under heat stress and reared on leaves and ground corn cobs as two alternative bedding materials. Six hundred seventy five day-old straightrun Arian broiler chicks were randomly assigned to 45 pens (at density of 0.09 m^2/ bird) in an open sided partially-controlled shed. Three bedding materials viz. wood shavings (WS), ground corn cobs (GCC) (1.5 cm in length) and leaves were subjected to surface spraying of oil (0.4 L/m^2 animal food grade sunflower oil), anti microbial solutions (3%) and mix treatment of both. Data on performance traits, incidence of breast and food pad lesions and litter characteristics were gathered and analysed in an appropriate factorial arrangements. Body weight at 56 d, feed intake up to 14 d, litter moisture at 28 d, litter pH at 14 d and litter temperature at 14 and 56 d were significantly influenced by litter type ($p<0.05$). Litter treatment revealed significant impact on body weight at 28, 42 and 56 d, feed intake during 29-42 and 1-42 d, mortality up to 56 d, litter temperature at 28 and 56 d, and litter pH at 28 and 56 d. Leaves and ground corn cobs have shown good potential as alternative bedding materials for rearing broilers. Surface spraying of antimicrobial solutions, oil and applying both were not effective tools to promote the broiler's health and performance. Meat type poultry growers and integrators are considered as primary audiences of the results achieved. ***(Asian-Aust. J. Anim. Sci. 2006. Vol 19, No. 1 : 42-47)***

Key Words : Broiler, Litter, Leaves, Corn Cobs, Oiling, Antimicrobial Spray

INTRODUCTION

Availability and cost of wood shavings has been a serious hindrance in most poultry producing areas in Iran. The fairly inexpensive by-products such as rice husk, cattle dung, shredded paper, wheat stalks (Khosravinia and Abasi, 2000), dried rumen contents, corn-based plant by products (Khosravinia and Azarfar, 2004) and Khakshir hay (Khosravinia 2004) were found to have considerable potential as local and seasonal alternative litters. Corn cobs may also be recommended as a bedding source in areas with large quantity of corn production. Smith (1956) found that corn cobs caused the birds to have more breast blisters than finer ground corn cobs. He recommended the particle size of less than 9 mm in diameter for this product as litter. Chaloupka et al. (1967) reported broilers raised on corn cob had a greater incidence of breast blisters. They, however, observed no difference in growth rate, feed efficiency and mortality between the litters used. Ruszler and Carson (1974) found that corn cobs has the highest moisture absorption capacity compared to cane, bark, shavings and shells based on grams of moisture absorbed per hour. Malone (1992) and Grimes et al. (2002) recommended that for the use of corn cobs it should be cut to a pea size to overcome the incidence of breast blisters.

The availability of leaves as a renewable resource makes it persuasive as an alternative bedding for meat poultry production. Information on using leaves for such a purpose is scanty. Willis et al. (1997) observed no significant difference regarding live weight, feed conversion, breast blisters, mortality and carcass traits between the broilers reared on leaves, wood shavings and a mix of 50% of them. Body weight gain was significantly ($p<0.05$) higher for broilers on the leaf litter.

Along with search for new alternative litters the other major field of research is treatment of litter intended to reduce ammonia levels in poultry house, promoting bird's health, and reducing pathogen population in litter. Many chemicals including aluminium sulphate (Moore et al., 1996), sodium bisulfate (Terzich et al., 1998) and formalin (Williams, 1980) as well as a number of commercial products like Litter acid® (Huff et al., 1984) and Poultry Litter Treatment® (Pope and Cherry, 2000) were shown to be effective in reducing ammonia and ammonia-related stress and this helps to reduce energy costs, as less ventilation is required when ammonia levels are reduced. Another purpose of litter treatment is reducing the dust raised from bedding materials. High concentrations of respirable dust can cause irritation of the respiratory tract due to its high protein content (Feddes et al., 1992). This

* Corresponding Author: Heshmatollah Khosravinia. Tel: +98-0661-3203714/2312851, Fax: +98-0661-4200289, E-mail: khosravi_fafa@yahoo.com
Received December 8, 2004; Accepted May 11, 2005

Table 1. Effect ($\bar{X} \pm SE$) of different litters and litter treatments on body weight, carcass weight (CW), carcass yield (CY) and mortality

Effects/levels	Body weight (g)				CW (g)	CY (%)	Mortality (%)
	14 d	28 d	42 d	56 d			
Type of litter							
WS	266±8[a]	795±15[a]	1,557±21[a]	2,080±38[ab]	1,699±27[a]	70.9±0.3[a]	5.6±2.6[b]
Leaves	261±5[a]	781±10[a]	1,556±15[a]	2,120±31[a]	1,710±23[a]	70.7±0.3[a]	5.8±1.3[b]
Corn cob	235±7[b]	758±14[b]	1,507±26[a]	2,031±33[b]	1,645±29[b]	71.0±0.4[a]	10.4±2.0[a]
Spray treatment							
AMS	258±9[a]	793±13[a]	1,563±19[a]	2,019±24[b]	1,703±20[a]	70.8±0.3[a]	5.3±1.6[b]
Oiling	253±5[a]	781±12[a]	1,540±12[ab]	2,067±30[a]	1,691±19[a]	71.1±0.4[a]	9.0±2.5[a]
Mixed	250±8[a]	758±14[b]	1,516±27[a]	2,057±47[a]	1,661±38[a]	70.8±0.3[a]	7.5±2.4[b]
SEM	4.396	7.829	12.228	19.961	15.731	0.183	0.526
	---------- Probability ----------						
Litter	0.0025	0.1444	0.2015	0.1052	0.1724	0.6468	0.2524
Treatment	0.6045	0.1492	0.2649	0.4191	0.4991	0.9645	0.7161
Block	0.1001	0.5788	0.5160	0.3291	0.6746	0.1441	0.9639
Litter×treatment	0.0421	0.1141	0.1111	0.0031	0.0090	0.0841	0.2810

[a-b] Means within a row with no common letter differ significantly ($p<0.05$).
[1] Antimicrobial spray.

irritation could adversely influence the health and performance and susceptibility to ascites in broiler chickens. McGovern et al. (1999) and McGovern et al. (2000) reported that oiling of bedding could significantly reduce the dust particles in the atmosphere of the shed. However, the final body weight of the broilers grown on oiled litter was significantly lower than those on non-oiled litters (McGovern et al., 2000).

The information on use of leaves and ground corn cobs treated with oil and antimicrobial spray, as litter for broiler chicken under heat stress condition is lacking. Hence, in the present study an attempt was made to compare the performance of broiler chicken raised on ground corn cobs and leaves compared with wood shavings while they subjected to oiling and spray of antimicrobial solutions. The experiment was carried out in heat stress condition where litter is expected to be more dry and dusty. The results would be beneficial for meat type poultry producers especially broiler growers, integrators and production managers to adjust the cost and time for taking the advantage of local/seasonally available by products as substitute materials for wood shavings.

MATERIALS AND METHODS

Experimental flock

Six hundred seventy five day-old straightrun Arian broiler chicks were obtained from a commercial hatchery and housed in a concrete floor, open sided and partially controlled shed. The chicks were randomly assigned to 45 pens (at a density of 0.09 m^2/bird). Corn and soybean based meal starter (22% CP, 3,100 kcal/kg ME, 1 to 14 d), grower (20% CP, 3,100 kcal/kg ME, 15 to 42 d), finisher (18.2% CP, 3,100 kcal/kg ME, 43 to 56 d) feed and water were provided *ad libitum*. The ambient temperature during day and night hours ranged from 28-36 and 20-25°C for the first three weeks and 32-37 and 25-30°C for the rest of the experiment. No provisional facilities were available to decline the ambient temperature. Therefore, birds were under heat stress from 21 days of age onwards.

Three litter materials viz. wood shavings (WS), ground corn cobs (GCC; of 9 mm size) and leaves (mixed from various trees and collected form roads) spread out in 1×2 m pens at depth of 5-6 cm. The animal food grade sunflower oil warmed and blended with hot water was sprayed on the litters using a low-pressure backpack sprayer twice a week. A total of 0.4 L/m^2 of oil was applied over the 8-wk period of study. Anti microbial spraying was done by mixing three locally available antimicrobial solutions, each of which with certain effect on bacteria or fungi, thrice a week. The solutions were applied one at a time in a rotation schedule. As the mixed treatment, oil and antimicrobial solutions were separately sprayed in rotation twice a week.

Taking into consideration each pen as an experimental unit, data on feed intake, feed conversion ratio (FCR) and mortality were recorded biweekly up to 42 d. Body weight, litter moisture, pH, dustiness and temperature (at 3 cm depth) were evaluated for all pens biweekly up to 56 d. A metal plate of 10×20 cm was hanged up in all pens at the same location. The dust lied on plates was collected biweekly to allocate an objective score (10, 20, ···, 60) for dustiness. All birds were scarified to evaluate the carcass weight and carcass yield at 56 d of age. Frequency of breast and footpad injuries based on visible swelling or injuries along the breastbone and on footpad were studied objectively on 220 randomly selected birds (5 from each pen).

Statistical analysis

The data recorded on the performance traits and litter

Table 2. Effect ($\bar{X} \pm SE$) of litter kind and litter treatment on feed intake and feed conversion ratio

Effect/level	Feed intake (g)				Feed conversion ratio (g feed/g gain)			
	1-14 d	15-28 d	29-42 d	1-42 d	1-14 d	15-28 d	29-42 d	1-42 d
Type of litter								
WS	408±7.8[a]	1,125±26[a]	1,841±21[a]	3,374±40[a]	1.85±0.1[ab]	2.14±0.1[a]	2.45±0.1[a]	2.20±0.1[a]
Leaves	399±7.4[ab]	1,080±20[a]	1,840±18[a]	3,318±31[ab]	1.85±0.0[b]	2.15±0.0[a]	2.04±0.0[a]	2.23±0.0[a]
Corn cob	375±15[b]	1,122±26[a]	1,781±19b	3,274±34[b]	2.06±0.0[a]	2.16±0.0[a]	2.43±0.1[a]	2.19±0.0[a]
Spray treatment								
AMS[1]	391±14[a]	1,094±21[a]	1,794±22[b]	3,275±31[b]	1.84±0.0[a]	2.15±0.0[a]	2.35±0.0[a]	2.25±0.3[a]
Oiling	396±8.6[a]	1,121±31[a]	1,850±17[a]	1,821±19[ab]	1.95±0.0[a]	2.16±0.1[a]	2.44±0.0[a]	2.23±0.1[a]
Mixed	395±9.5[a]	1,107±20[a]	1,821±19[ab]	3,323±34[ab]	1.96±0.0[a]	2.24±0.0[a]	2.46±0.1[a]	2.36±0.0[a]
SEM	6.325	13.761	11.591	27.573	0.025	0.031	0.027	0.040
	---------- Probability ----------							
Litter	0.1196	0.2484	0.0167	0.6922	0.0550	0.6179	0.6714	0.2192
Treatment	0.8181	0.4360	0.0100	0.0740	0.0628	0.1263	0.1380	0.0363
Block	0.7121	0.2776	0.0093	0.8782	0.0908	0.2263	0.2642	0.0635
Litter× treatment	0.3209	0.1191	0.1578	0.2430	0.2119	0.1613	0.3362	0.0686

[a-b] Means within a row with no common letter differ significantly ($p<0.05$).
[1] Antimicrobial spray.

Table 3. Effect of litter kind and litter treatment on incidence (frequency) of breast blisters and footpad lesions[1]

	Litter type (%)			Treatment manner (%)		
	W.S.	Leaves	Corn cob	AMS	Oiling	Mixed
Breast blister scores[2]						
0	18.1±3.3	23.1±3.0	14.8±2.7	21.3±3.2	15.7±3.3	19±2.8
1	10.0±2.8	4.1±2.0	7.6±2.2	7.6±2.7	9.5±2.4	7.6±1.8
2	4.3±1.6	2.7±1.3	7.6±2.4	3.6±1.8	6.2±2.03	4.8±1.8
3	0.95±0.7	0.44±0.4	2.4±1.5	0.9±0.61	1.9±1.5	0.95±0.7
Total	33.35±6.4[a]	30.34±6.1[a]	32.40±5.4[a]	33.40±6.4[a]	33.30±6.6[a]	32.30±5.6[a]
Food pad lesions score[3]						
0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0
1	1.9±1.09	0.3±0.6	3.3±1.3	1.7±1.2	1.9±0.84	2.3±1.1
2	26.7±1.7	26.7±1.6	21.4±1.4	25.3±1.8	23.3±1.4	26.2±1.9
3	4.8±1.1	6.1±1.4	3.0±1.8	6.2±1.1	5.6±1.6	5.3±1.6
Total	33.40±4.4[a]	33.10±3.2[a]	27.70±2.8[a]	33.20±3.4[a]	30.80±2.9[a]	33.80±3.1[a]

[1] Frequency analysis was conducted using frequency procedure of SAS software (SAS, Institute, 1998).
[2] Breast blisters severity scores: 0 = no defect, 3 = a breast blister trim.
[3] Footpad lesions severity score: 0 = no defect, 1 = mild, 2 = medium, 3 = severe.

characteristics were analysed in a 3×3 factorial arrangement using two-way classification or random block design with litter kind and litter treatment as two fixed effects in the model used. General Linear Models Procedure of SAS® software (SAS Institute, 1998) was used to analyze the data and treatments were separated by Duncan's multiple test. Frequency analysis was conducted for the data on the incidence of foot and breast injuries, using Frequency Procedure of SAS software (SAS, Institute, 1998).

RESULTS

Effect of litter kind

The mean Body weight at 14 and 56 d was significantly affected by the type of litter ($p<0.01$; Table 1). The birds grown on GCG were 29 g lower in body weight than those on WS and leaf litters at 14 d. Final body weight (56 d) of the birds grown on leaf litter was the highest followed by those on WS and GCC. The birds on GCC showed 65 and 46 g lower carcass weight than those on leaf and WS, respectively. Mortality was not significantly influenced by litter kind. However, the recorded mortality was 4% more for GCC litter at 42 d (Table 1). The mean values for feed intake and FCR did not significantly differ for the type of litter ($p>0.05$) except for 14 d, where birds on WS had maximum feed intake with minimum FCR. In general, birds on GCC had less feed intake with approximately similar FCR than others (Table 2). The incidence of breast blisters was not affected by litter type. However, the frequency of medium and severe damages on breast was higher for GCC litter. Similar result was obtained for food pad lesions but the pattern of frequency was reversed in such a way that frequency of medium and severe lesions was higher in birds grown on WS and leaf litters (Table 3).

Litter materials showed significant differences in

Table 4. Effect ($\bar{X} \pm SE$) of litter kind (L), treatment manner (T) on litter moisture, pH, dustiness score, temperature and nitrogen content (N %)

	Litter type			Treatment manner			Effects		
	WS	Leaves	Corn cob	AMS[1]	Oiling	Mixed	L	T	L×T
Litter moisture (%)									
14 d	17.7±0.9^{a}	20.1±0.9^{a}	16.8±0.8^{a}	18.1±0.7^{a}	16.8±0.9^{a}	19.6±0.9^{a}	NS	NS	NS
28 d	27.6±1.4^{ab}	28.9±1.9^{a}	26.3±1.5^{b}	27.5±1.5^{a}	26.8±2.2^{b}	28.4±1.2^{a}	*	NS	NS
42 d	29.4±1.7^{a}	32.6±1.7^{a}	29.4±1.6^{a}	31.3±1.4^{a}	31.7±1.9^{a}	28.6±1.7^{a}	NS	NS	NS
56 d	15.8±1.3^{a}	17.7±1.3^{a}	17.7±1.6^{a}	16.1±1.2^{a}	19.1±1.9^{a}	16.3±0.7^{b}	*	NS	NS
Litter pH									
14 d	4.9±0.1^{b}	4.9±0.1^{b}	5.4±0.1^{a}	5.1±0.1^{a}	5.1±0.1^{a}	4.9±0.1^{a}	***	NS	NS
28 d	5.4±0.1^{a}	5.3±0.2^{a}	5.3±0.2^{a}	5.6±0.1^{a}	5.3±0.1^{ab}	5.1±0.2^{b}	NS	NS	NS
42 d	6.4±0.1^{a}	6.0±0.1^{b}	6.3±0.1^{a}	6.3±0.1^{a}	6.2±0.1^{a}	6.3±0.1^{a}	*	NS	NS
56 d	6.2±0.1^{b}	6.4±2.0^{b}	6.2±0.0^{b}	6.4±2.0^{a}	6.2±0.1^{b}	6.2±0.1^{b}	**	**	***
Litter dustiness score									
14 d	27.1±4.4^{a}	34.3±4.3^{a}	28.0±4.9^{a}	24.0±4.0^{a}	27.9±4.5^{a}	27.9±4.6^{a}	NS	NS	NS
28 d	39.1±5.1^{a}	38.6±4.3^{a}	30.0±4.1^{a}	33.1±5.1^{a}	39.2±4.5^{a}	34.6±4.0^{a}	NS	NS	NS
42 d	26.4±4.3^{a}	28.0±3.8^{a}	39.2±4.0^{a}	28.6±4.0^{a}	32.1±3.9^{a}	32.1±4.8^{a}	NS	NS	NS
56 d	28.9±3.8^{a}	35.7±4.1^{a}	36.7±4.8^{a}	26.6±3.8^{a}	30.7±4.6^{a}	35.0±3.9^{a}	NS	*	NS
Litter temperature (°C)									
14 d	28.9±0.4^{a}	27.7±0.4^{b}	29.0±0.4^{a}	27.8±0.4^{b}	28.8±0.5^{ab}	29.0±0.4^{a}	*	NS	NS
28 d	27.7±0.3^{a}	28.2±0.9^{a}	27.5±0.3^{a}	28.0±0.5^{a}	27.7±0.5^{a}	27.8±0.8^{a}	*	NS	NS
42 d	29.8±0.4^{a}	30.1±0.5^{a}	30.3±0.3^{a}	30.1±0.5^{a}	30.1±0.4^{a}	29.9±0.4^{a}	NS	NS	**
56 d	32.9±0.4^{a}	24.2±3.2^{b}	32.5±0.5^{a}	25.0±3.5^{b}	32.8±0.5^{a}	31.6±0.4^{a}	***	***	***
N%	4.3±0.1^{a}	4.4±0.0^{a}	4.0±0.1^{b}	4.2±0.1^{a}	4.3±0.1^{a}	4.2±0.1^{a}	**	NS	NS

$^{a-b}$ Means within a row with no common letter differ significantly ($p<0.05$).
* $p<0.05$, ** $p<0.01$, *** $p<0.001$, NS = Non significant. [1] Antimicrobial spray.

moisture level at 28 d, pH value at 14 d and temperature at 14 and 56 d ($p<0.05$). Leaves and GCC litters were of highest and lowest levels of moisture at all ages, respectively. In spite of more moisture content, leaf litter showed higher dustiness score at 56 d, while it found to be cooler than GCC and WS by 6-7°C at the same time. No significant differences were observed for dustiness scores for litters at all ages recorded ($p>0.05$). Litter nitrogen content measured at 56 d significantly diverged in favor of leaves ($p<0.05$) (Table 4).

Effect of the manner of treatment

The final body weight of the birds grown on antimicrob-sprayed litters was significantly higher than those on oiled and mixed-treated litters by 23 and 47 g, respectively. Mortality (up to 42 d) on oiled litters was significantly higher than antimicrob- and mixed-sprayed litters by 3.7 and 1.5%, respectively (Table 1). Feed intake during 29-42 and 1-42 d was significantly influenced by litter treatment. In both the periods, birds on oiled litter consumed more feed followed by those on mixed treated litters. Feed conversion ratio was non- significantly higher for birds grown on oiled litters for all periods concerned ($p>0.05$). Neither total incidence of breast blisters and food pad lesions nor distribution of different scores assigned to severity of them was affected by treatment of litter. Nevertheless, the incidence on footpad injuries was 3% lower for birds grown on oiled litters. The interaction between the litter type and litter treatment was significant for total incidence of both breast and food pad injuries. The birds raised on oiled as well as antimicrob-sprayed GCC litters observed to be more suffered from either injury.

The mean litter temperature at 28 and 56 d significantly affected by the manner of treatment ($p<0.05$). Although no particular trend in litter moisture change could be drawn, the oiled litters were found to be dryer up to 21 d. The antimicrobial sprayed litters showed significantly higher pH values at 28 and 56 d followed by oiled and mixed treated litters. There was no clear cut trend of change for pH values over the experiment period. The mean values for dustiness score did not significantly differ for the effect of litter treatment (Table 4). Antimicrobial spraying resulted in lower values for litter temperature (Table 4). No significant effect of treatment manner on nitrogen content of the litters was found.

DISCUSSION

Leaves (Willis et al., 1997) and corn cobs (Chaloupka et al., 1967; Ruszler and Carson, 1974) are frequently recommended as litter source for broiler. While there is no specific hindrance for application of leaves, many researches pointed out a potential problem with corn cobs as it may cause higher incidence of barest blisters and

footpad lesions (Chaloupka et al., 1967; Ruszler and Carson, 1974). Smith (1956), Malone (1992) and Grimes et al. (2002) reported that crude corn cobs caused the birds to have more breast blisters than finer ground corn cobs and recommended pea size or 9 mm in diameter as optimum particle size. In present study the particle size for GCC was 9 mm. No significant difference for incidence on breast and foofpad injuries was observed. Nevertheless the frequency of medium and sever scores of footpad lesions were higher for birds grown on GCC which could be attributed to the rough surface of the GCC particles.

Corn cob is recognized as a bedding material with high capacity of moisture absorption and low preference to release it (Ruszler and Carson, 1974). There is no report at hand where corn cob is compared with leaves as bedding material for broiler. The results from the present study showed that leaves have a higher capacity to absorb water compared to WS and GCC. Leaves with initial coarse appearance smashed and trampled to a compost-like texture with fine particles by 3 weeks. This characteristic might be the cause for lower temperature due to higher potential to hold moisture. The fine texture could encourage the birds to scratch and take dustbath, which might be the reason for higher dustiness score in leaf litters despite of higher moisture levels. Chavan et al. (1993) recognized wood shavings as a litter with higher contents of nitrogen, which could be attributable with lower pH, and consequently lower microbial activity to degrade the nitrogen components in litter. Comparison studies with leaves, GCC and WS for nitrogen content are lacking. In the current study, the nitrogen content of leaf litter was significantly higher than WS and GCC.

The lower body weight at 14, 28 and 42 d for the birds grown on oiled litter are in agreement with the results obtained by McGovern et al. (1999) where 0.8 L/m^2 canola oil resulted in lower body weight at 3 and 4 weeks and McGovern et al. (2000) where application of 1.1 L/m^2 of canola oil over 6 weeks caused lower body weigh for all ages. Two possible explanations offered for the reduction in the final weights of the birds raised on oiled litter were litter consumption and heat loss (McGovern et al., 2000). In the present study 0.4 L/m^2 animal food grade sunflower oil was sprayed directly to the surface of the litters and bird's feathers could naturally get oily as they touched litter. Oily feathers cause a decline in thermoregulatory ability of the birds due to failure in normal coverage of the body by feathers during the brooding period. In the present study the ambient temperature was almost less than recommended level for chicks during the first two weeks, thus cool temperature along with the adverse effect of oily feathers can discuss the lower body weight of the birds grown on oiled litters. To overcome such an adverse effect of oiling, increased ambient temperature or to apply oil after 3 weeks of age are suggested. Any failure in isolation of body by feather coverage increases the energy needs of the bird to compensate the heat loss. Higher records for feed intake along with low performance for FCR increase the possibility of the effect of oily feathers in heat loss particularly in the first two weeks.

The mean values for mortality did not differ significantly for oiled and non-oiled litters (McGovern et al., 1999; McGovern et al., 2000). No significant change in mortality was observed by Enos (1972), Veloso et al. (1974) as well as Pope and Cherry (2000) by treating the litter of meat type birds using propionic acid, formaldehyde flakes in 1 and 3% and Litter Acid®, respectively. The results of the current study as regards treating of litters by oil, spray of antimicrobial solutions and mix of them were fairly concord with these reports. Slight increase in mortality on oiled litter might be caused by application of warm oil mixed with hot water under the circumstances where birds were suffered from heat stress.

Physical appearance, particle size, compactness and wetness are the effective litter characteristics in severity and incidence of breast and footpad injuries (Tilley et al., 1990). Treating of litter is expected to somewhat alter such quality parameters. However, treating of fresh pine sawdust with various levels of volatile fatty acids (Parkhurst et al., 1974), application of Litter-acid® (Huff et al., 1984) and Poultry Litter Treatment® (PLT®) (Terzich et al., 1997) had no significant effect on these features. The results from the current study are not in agreement with these reports with respect to impact of litter treatments on incidence of breast and footpad lesions. It has been revealed that Litter treatment almost has an effective influence on litter pH and consequently nitrogen content (Pope et al., 2000; Line, 2002). Since most of the treatments used in the previous studies are acidic compounds, it is logical that proper application could significantly decline the pH, condition that directly affects the survivability of micro flora in the litter. In the current study, surface spraying of oil, antimicrobial agents and both did not influence the litter pH and other changes allied including nitrogen content. In contrast to other acidic compounds, applying oily compounds like volatile fatty acids may not result in significant change in nitrogen content despite of imposing change in pH (Parkhurst, 1974).

Respirable dust in poultry house can negatively influence poultry performance (Feddes et al., 1992). Application of canola oil 1.1 L/m^2 over a 6-week trail reduced the respirable dust in the pens to a maximum concentration of 2.5 particles/mL (McGovern et al., 2000). Oiling the litter (0.8 L/m^2 over 6-weeks) did not affect dust level for the first 2 wk, but afterward air quality (based on

dust particles per millilitre) significantly improved (McGovern et al., 1999). McGovern et al. (2000) mentioned that to prevent heat loss and its deleterious effects on growth, the maximum rate of canola oil application should not exceed 0.8 L/m^2. Low rate (0.4 L/m^2) of animal food grade sunflower oil applied in the present study along with dry environmental condition and consequently dry litters might be the reasons for nonsignificant effects of oiling on dustiness scores of the litters.

Taking into consideration the time, cost and labour required, litter treatment approaches used did not reveal a considerable positive change in performance traits studied. Under heat stress condition, which usually is accompanying with dry environment as well as litter, oiling of litter is expected to reduce the dust and promote the poultry health. Such a potential was not experienced in this study.

ACKNOWLEDGEMENTS

The author expresses his gratitude to the research department and council members, Lorestan University, Khoramabad, Iran, for financial support of the project and to Dr. M. H. Gharoni, Veterinary Faculty, Lorestan Unversity, Iran, for his assistance in certain phases of the study.

REFFERENCES

Chaloupka, G. W., R. W. Loyd, J. F. Gordy and L. M. Greene. 1967. Evaluation of litter materials for broiler production. Poult. Sci. 46(Suppl. 1):91.

Enos, H. L. 1972. Propionic acid effects on litter aflatoxin levels and breast blisters in turkey. Poult. Sci. 51:1809 (Abst).

Feddes, J. J. R., H. Cook and M. J. Zuidhof. 1992. Characterization of airborne dust particles in turkey housing. Can. Agric. Eng. 34:273-280.

Grimes, J. L., J. Smith and C. M. Williams. 2002. Some alternative litter materials used for growing broilers and turkeys. World's Poult. Sci. J. 58:515-525.

Huff, W. E., G. W. Malone and G. W. Chaloupka. 1984. Effect of litter treatment on broiler performance and certain quality parameters. Poult. Sci. 63:2167-2171.

Khosravinia, H. 2004. Performance of the broiler chicken grown on Khakshir hay litter. Research report, Lorestan University, Khoramabad, Iran.

Khosravinia, H. and A. Azarfar. 2004. Evaluation of corn-based plant by-products and dried rumen contents as broiler litter under heat stress condition. In: CD-ROM of the Proceeding of 22nd international poultry conference, Istanbul, Turkey.

Khosravinia, H. and M. Abasi. 2000. Effect of various litter materials on performance and health of broiler chicken. Research report, Lorestan University, Khoramabad, Iran.

Malone, G. W. 1992. Evaluation of litter materials other than wood shavings. Proceeding of the National Poultry Waste Management Symposium. National Poultry Waste Management Commitee, Auburn, AL. 274-282.

McGovern, R. H., J. J. R. Feddes, F. E. Robinson and J. A. Hanson. 2000. Growth, carcass characteristics and incidence of ascites in broilers exposed to environmental fluctuations and oiled litter. Poult. Sci. 79:324-330.

McGovern, R. H., J. J. R. Feddes, F. E. Robinson and J. A. Hanson. 1999. Growth, carcass characteristics and incidence of ascites in broilers in response to feed restriction and oiling litter. Poult. Sci. 78:522-528.

Moore, Jr. P. A., T. C. Daniel, D. R. Edwards and D. M. Miller. 1996. Evaluation of chemical amendments to reduce ammonia volatilization from poultry litter. Poult. Sci. 75:315-320.

Parkhurst, C. R., B. P. Hamilton and G. R. Baughman. 1974. The use of volatile fatty acids for the control of micro organisms in pine sawdust litter. Poult. Sci. 53:801-806.

Pope, M. J. and T. E. Cherry. 2000. An evaluation of the presence of pathogens on broilers raised on Poultry Litter Treatment-treated litter. Poult. Sci. 79:1351-1355.

Ruszler, P. L. and J. R. Carson. 1974. Methods of evaluating the potential usefulness of selected litter materials. Poult. Sci. 53:1420-1427.

SAS Institute, 1998. SAS® User's Guide: Statistics. Version 6.0 Edition. SAS Institute, DC.

Smith, J.C. 1956. Kind of litter and breast blisters on broilers. Poult. Sci. 35:593-595.

Terzich, M., C. Quarles, M. A. Goodwin and J. Brown. 1998. Effect of Poultry Litter Treatment (PLT) on death due to ascites in broilers. Avian Disease 42:385-387.

Tilley, B. J., H. J. Barnes, D. V. Rives and T. M. Gerig. 1990. Effect of litter type on focal ulcerative dermatitis (breast buttons) in male turkeys. Poult. Sci. 69 (Suppl. 1):195(Abst.).

Veloso, J. R., B. P. Hamilton and C. R. Parkhurst. 1974. The use of formaldehyde flakes as an antimicrobial agent in built-up poultry litter. Poult. Sci. 53:78-83.

Williams, J. E. 1980. Formalin destruction of salmonellae in poultry litter. Poult. Sci. 59:2717-2724.

Willis, W. L., C. Murray and C. Talbott. 1997. Evaluation of leaves as litter material. Poult. Sci. 76:1138-1140.