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EFFECT OF LITTER TYPE AND BROILER BREEDER AGE ON BROILER PERFORMANCE DURING SUMMER SEASON

By

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Abstract: *A total of 300 one day old chicks were obtained from two broiler breeder flocking ages (26 and 43 weeks) and housed on three types of litter: sand, wheat straw and wood shavings. Body weigh, mortality, feed consumption and feed conversion were measured. At time of slaughter carcasses grading, the of breast blisters, incidence of scabby hip syndrome, vent scabs and sores were measured. At 42 days of age 5 birds of each replicate were visually assessed for the middle claw on both feet was measured.*

Using sand as litter materials resulted in significant increase in body weight and the best for feed efficiency than the two other treatments, while it had not significant effect on mortality rate. Breeder hen age had a significant effect on body weight at all ages and had no effect on mortality rate. Birds which were reared on wheat straw consumed significantly less than those reared on sand and wood shavings. Using sand led to lowering liver, spleen, heart and bursa of fabricus body weight ratio, gizzard, heart adrenal body weight ratio and increasing thyroid activity as thyroid body weight ratio.

Birds reared on sand had the shortest significant right and left claw length compared to those reared on either wheat straw or wood shavings. The incidence of vent scabs, scabby hip syndrome, sores and breast blisters were higher of birds grown on wheat straw and wood shavings compared to those reared on sand litter. Rearing broiler chicks on sand resulted in lowering total cost compared to the chicks reared on wood shavings and higher compared to which reared on wheat straw. It was higher both net revenue and economic efficiency comparing to those reared on either wheat straw or wood shavings.

INTRODUCTION

Pine shavings and wheat straw are currently the most predominant and preferred bedding materials for broiler production. At times, a number of other materials are substituted regionally in place of pine products, including hardwood shavings (Carter *et al.*, 1979), peanut hulls (Lien *et al*., 1998), bark (Dang *et al*., 1978), rice hulls (Veltmann *et al*., 1984), kenaf core (Malone et al., 1990), and straw (Hermes, 1996). Periodically, the by-products of other industries have received interest as bedding materials, primarily driven by local recycling efforts and entrepreneurship. Products such as recycled or shredded paper (Blake and McDaniel, 1998; Lien *et al*., 1992; Malone and Chaloupka, 1983), ground drywall waste (Reed and Mitchell, 1997) and particle- board residue (Hester *et al*., 1997) have been field tested successfully (Hess *et al*, 2000). Due to the current environmental concerns with the disposal of poultry litter, broiler houses containing sand as a litter source would not have to be cleaned out until every 1.5 — 2 years, which would be a substantial advantage in environmental sensitive areas (William A. Dozier**,** 2001).

Basically, two broad factors triggered our interest in sand as a bedding material for broilers: 1) the lack of availability and/or high cost of wheat straw and wood-based products, primarily due to competition from alternative value-added uses, and 2) increasing restrictions on land application or disposal of used litter arising from emerging environmental issues and regulatory oversight.

Floor-pen studies were conducted successively over a two-year period, in which sand was compared with pine shavings in terms of live production and processing performance, health, and in-house environmental factors (Alley *et al*., 1998; Bilgili *et al*., 1999a, b). They added that a better live performance (growth rate, feed conversion, and livability) of broilers grown on sand was comparable to those reared on pine shavings over a two-year period. Similar results were obtained for the processing parameters (carcass and de-boning yields, and grade). Foot pad quality of birds raised on sand was consistently better than those raised on pine shavings. Malone and Chaloupka (1983) observed that broilers reared on wood shavings had significantly larger gizzards (1.42%) than those on composted municipal garbage (1.29%). Similarly, Lien *et al*. (1998) found that gizzard weights of broiler breeder replacement pullets reared on peanut hulls reduced by 15% relative to those reared on pine shavings. Bilgili *et al*. (1999b) reported that broilers reared on sand had significantly lower gizzard yield (1.5%) than for birds reared on pine shavings (1.7%). Sorensen and Kestin (2000) showed

that litter substrate had significant effect on incidence of leg abnormality in broilers. Birds reared on wheat straw had poorer walking ability and more foot burn than those reared on wood shavings.

William A. Dozier (2001) found that foot pad quality of birds raised on sand was consistently better than those raised on pine shavings. He added that aerobic plate counts and coliforms were significantly lower for sand than pine shavings (7.25 vs. 7.62; 6.09 vs. 6.71 log 10 CFU/g). Broiler performance was similar for live weight gain (sand = 5.11 vs. pine shavings = 5.00 lb), feed conversion ratio (sand = 2.05 vs. pine shavings = 2.01), and percent livability (sand = 88.9 vs. pine shavings = 87.5%). Processing data indicated that no differences occurred with carcass yield, proportions of grade A carcasses, or paw lesions. Hess *et al*. (2001) reported that sand warms up more slowly (5.5 hr vs. 2.9 hr for shavings) and does not reach the same surface temperature (8 degrees F lower for sand).

Sand has been evaluated as a potential bedding source at Auburn state, the initial pen trials indicated that sand would support equal or better broiler weight with lower litter bacterial levels (Hess *et al*., 2001). Wheat straw and pine shavings have traditionally been used as the primary bedding source for broiler production in Egypt. In recent years, expansion of the poultry industry and increasing competition either from ruminant feeding on wheat straw and its expensive price or from wood by-product markets have created shortages of pine shavings in many poultry producing areas. This shortage has resulted in an intensive search for alternative bedding materials. Previously, there has been little research as published in regards to using sand for rearing poultry. Since rearing broilers on sand is a new technique, many questions are yet to be answered. Moreover, many producer afraid from performance of broiler chicks which hatched from younger breeder age. Therefore, this study aimed to investigate the effect of breeder age and using sand as bedding materials during summer compared to wheat straw and wood shavings on broiler performance.

MATERIALS & METHODS

This study was carried out during summer season from June to August 2004 at the research poultry farm of the animal and poultry production Department, Faculty of agriculture, Sohag, South Valley University. The experiment was done at El-Kawther region in Sohag which is a desert area. This study was conducted to determine the effect of broiler breeder age and litter type on broiler performance. Live weight, feed conversion, viability, carcass weight and carcass percentage were measured.

Three hundred one day old Cobb broiler chicks hatched from two different ages (26 and 43 wk of age) were used in this study. All chicks were wing banded, weighed and distributed randomly into equal treatment combinations with two replicate pens and 25 birds per pen (300 birds) by stocking density of 10 birds per square meter. The treatments were classified as follow:

Treatment 1: Four pens prepared with sand litter of 4-6 cm deep (two pens for the chicks hatched from younger parent age (26 weeks of age) and two pens for the chicks hatch from older parent age (43 weeks of age).

Treatment 2: Four pens prepared with wheat straw litter of 4-6 cm deep (two pens for the chicks hatch from younger parent age (26 weeks of age) and two pens for the chicks hatched from older parent age (43 weeks of age).

Treatment 3: Four pens prepared with wood shavings litter of 4-6 cm deep (two pens for the chicks hatch from younger parent age (26 weeks of age) and two pens for the chicks hatched from older parent age (43 weeks of age).

Each pen was prepared with drinkers, feeders and fans to maintain adequate temperature and good ventilation. All chicks were vaccinated against the infectious diseases and maintained under continuous light with *ad libitum* water and feed. The birds received starter diet until two weeks of age, grower diet from two to four weeks of age and finisher diet from five to the end of the experiment.

Body weight, body weight gain, feed consumption, feed efficiency and mortality rate were recorded and calculated bi-weekly from 0 to 6 weeks of age.

At time of slaughter carcasses were graded in a commercial processing plant according to Canadian grade standards. The number of carcasses graded into the different grade classes was determined, and these data were used to calculate the percent Grade A carcasses originating from 5 birds from each replicate. Carcasses down-graded because of breast blisters, incidence of scabby hip syndrome, vent scabs and sores. Data on breast blisters, incidence of scabby hip syndrome (SHS), vent scabs and sores were collected by the examination of individual birds at the commercial processing plant, and individual birds showing any evidence of dermatitis were counted as having SHS.

Claws: At 42 days of age 5 birds of each experimental replicate were visually assessed for the middle claw length on both feet which was measured in cm with a dressmaker's tape (tape-line or tape measure) along the curvature of the claw.

The calculation of monetary returns over the cost of feed and chicks was based on current market prices. Feed price was 1.75 L.E/kg feed, Chick prices were 1.35L.E/chick for young breeder and 1.65 L.E/chick for old breeder and meat revenue was based on a price of 7.75 L.E/kg live weight. The economic evaluation were calculated as follow:-

Return = (market price of kg live weight – (Chick cost + feed cost))

Economic Efficiency (EE) = (Return / Total cost) *100

Statistical analysis were conducted using the General Linear Models procedure of base SAS® software (SAS Institute, 1997). Factors tested in analysis included broiler breeder age, litter materials and their interactions. Percentages data of mortality were transformed to arcsine square root before mad the statistical analysis. Means were compared using Duncan's multiple range test (Duncan, 1955). Pen data of feed consumption, feed efficiency and mortality were analyzed by a model that included breeder age and litter materials as main effects, and their two-way interaction.

RESULTS AND DISCUSSION

1- Body weight and body weight gain

The effect of broiler breeder age and litter type on body weight and body weight gain are presented in Table (1). Litter type have not any significant effect on body weight up to two weeks of age. At four weeks of age there was no significant difference in body weight between sand and wood shavings, while wheat straw treatment was significantly lower in body weight. At marketing age, the birds raised on sand and wood shavings had significantly higher body weight as compared to wheat straw treatment. This may be due to the foot pad lesion which was observed in this treatment. Martland, (1985) and Ekstrand and Alger (1997) reported that broilers with severe foot lesions pain had slower weight gain. Bilgili *et al*. (2001) reported that birds reared on sand have performed equal to or better than sister flocks reared at the same farm on pine shavings. They attributed that to the fact that caked litter is removed and fresh litter is added between the successive grow-outs in pine shavings houses. They added that usually, very little caked sand is removed and no top dressing is employed with sand litter houses. Foot pad quality of birds raised on sand was consistently better than those raised on pine shavings (Alley *et al*., 1998; Bilgili *et al*., 1999a, b).

Table 1 shows that body weight gain was lower significant for the birds read on wheat straw compared to the birds reared on sand and wood shavings.

Broiler breeder age had significant effect on body weight and body weight gain of broiler offspring (Table 1) this may be due to the significant difference of hatch weight of broiler chicks from different breeder age. The results are in agreement with the previous research on the relationship between hatching weight and body weight at subsequent ages, Wilson (1991) stated that the consensus is that larger hatching eggs result in larger chicks that therefore result in larger broilers at market age. However, it should be noted that differences in management, environment and disease could greatly influence the weight of a broiler at market age.

Breeder hen age had a significant effect on day old chick weight. Chicks from the oldest breeder flock weighed 9.9 g more than the chicks from the younger breeder flock (Table 1). The data coincides with research conducted by Proudfoot *et al*., (1982), where two sized eggs resulted in day old chick weights that were significantly different. Chicks from the larger eggs had significantly heavier body weight at market age (42 d).

2- Mortality rate

As shown in Table (2) it could be observed that there were no significant differences in mortality rat between the types of litter. This result is in agreement with the findings of Lien *et al*. (1998 and) Bilgili *et al*., (1999a,b). During the periods from 2 to 6 weeks of age, mortality rat was lower in the chicks which reared on sand litter compared to the other two treatments this may be due to lowering temperature of the sand by about 2˚ f compared to wheat and wood shavings as mentioned by Bilgili *et al*., (2001) who found that a 2°F temperature differential with sand, warmer in winter and cooler in summer, as compared to pine shavings litter. This is an interesting observation and may actually be beneficial in reducing heat stress mortality.

No significant differences in mortality rate were noticed between the chicks from younger and older breeder flock (Table 2). However, mortality rate was lower for chicks from the younger breeder flock until 4 weeks of age compared to birds from the older flock and then the stituation was reversed thereafter. Hearn (1986) found significantly higher mortality from very young breeder flocks, while Proudfoot and Hulan (1985) found no difference in mortality between chicks from different age breeder flocks.

3- Feed consumption and feed efficiency

The effect of litter type on feed consumption and feed efficiency are presented in Table (3). It could be noticed that no significant differences in either feed consumption or feed efficiency between the three types of litter during the periods from 0-2 weeks of age. While during the period from 2-4, 4-6 as well as 0-6 weeks of age, birds which were reared on wheat straw consumed significantly less feed than the birds reared on sand and wood shavings, and the birds reared on wood shavings were consumed significantly more than either which reared on sand or on wheat straw during the periods from 4-6 and 0-6 weeks of age. Moreover, the birds which were reared on sand was the best for feed efficiency than the other two treatments. The differences were significant during the periods from 2-4, 4-6 and 0-6 weeks of age. These results are disagreement with the findings of Bilgili *et al*., (1999 a,b) who found that no significant differences in feed conversion ratio between broilers reared on sand and those on pine shavings.

When evaluated by age of breeder flock, there was significant effect during the periods from 2 to 6 weeks of age (Table 3). Proudfoot *et al*., (1982) found better efficiency in chicks from larger eggs, while others found either no effect or the converse effect (Proudfoot and Hulan, 1985; Wyatt et al., 1985, and Hearn 1986). It should be noted that breeder flock, breeder age, and egg size effects are all confounded statistically and can't be separated in this study. More research is needed to support this effect as being important in the study.

4- Internal organs

The effect of broiler breeder age and litter type on adrenal, thyroid, bursa, liver, heart and spleen percentage of live body weight are presented in Table (4). It could be observed that the birds which reared on sand had lower adrenal relative weight ratio. Similar observations in layer birds have been made by Clark and Das (1974) and Ghodasara *et al*. (1990). The lower adrenal body weight ratio for birds reared on sand compared to which reared on wheat straw and wood shavings in our study during summer may be due to the lower sand temperature by about 8ºF. Hess *et al*. (2001) reported that sand warms up more slowly (5.5 hr vs. 2.9 hr for shavings) and does not reach the same surface temperature (8 degrees F lower for sand). Relative weight of adrenal gland increased during summer season. It also increased in the afternoon hours during summer (Ghodasara, et al., 1990**)**.

Results are presented in Table (4) showed that thyroid activity as thyroid body weight ratio increased significantly with using sand litter

compared to wood shavings. Heninger *et al*. (1960) reported that the thyroid gland of birds decreased in size and activity when birds exposed to high environmental temperature. In the current study the increasing of thyroid activity during summer may be due to the lower temperature of sand compared to other treatments.

Liver, spleen and heart relative weights were lower in the birds which were reared on sand litter compared to wheat straw and wood shavings. Moreover, burs of fabricus for sand and wheat straw treatments were lower as a percentage of body weight compared to wood shavings treatment, this my be due to their higher immunity. Broiler breeder age had not significant effect on internal organs and glands (adrenal and thyroid). This may be due to increasing body weight (Table 1).

5- Meat yield and carcass composition

The effect of broiler breeder age and litter type on carcass cut up parts are resented in Table (5). It could be observed that litter type had not significant effect on carcass composition. Willis *et al* (1997) found that there were no significant differences in carcass weight and carcass yield percentages between broiler reared on pine shavings or leaves and those reared on litter mixed of leaves and pine shavings. The same trend was observed by Lien *et al*. (1992). While there were significant differences on dressed carcass weight, it was 1269, 1087 and 1328 gram for the birds reared on sand, wheat straw and wood shavings, respectively. However, there were no significant differences on carcass percentage due to litter materials.

In spite of litter type had not significant on cut up parts, there were significant differences on gizzard and heart body weight ratio between the three treatments. Birds which were reared on sand had lower gizzard and heart compared to the birds which were reared on wheat straw and wood shavings. This results are in agreement with the findings of Malone and Chaloupka (1983) observed that broilers reared on wood shavings had significantly larger gizzards (1.42%) than those on composted municipal garbage (1.29%). Similarly, *Lien et al*. (1998) found that gizzard weights of broiler beeder replacement pullets reared on peanut hulls reduced by 15% relative to those reared on pine shavings. Bilgili *et al*. (1999b) reported that broilers reared on sand had significantly lower gizzard yield (1.5%) than for birds reared on pine shavings (1.7%).

6- Claw length

As shown in Table (6) it could be concluded that the birds reared on sand had the shortest significant right and left claw length compared to those reared on either wheat straw or wood shavings. These results explain the improving carcass quality for birds reared on sand litter because claw length can cause skin scratches in the vent region, back and abdominal skin, so the carcass grading will be affected.

In recent years the commercial breeding companies have selected against birds with both long claws and sharp claws (B Verrall, Hy-Line Australia Pty. Ltd., personal communication). Nevertheless the claws still grow to about 3 cms and despite many birds being reared on the floor, claws can still get quite sharp and will inflict injury on other birds and handlers (Glatz, 2002). Death of the pecked bird usually results. In addition, if the wound does occur around the lower abdominal region where the skin is very thin (Glatz and Lunam, 1996) death of the bird from pecking occurs rapidly. Picking of the abdominal region several inches below the vent is the severest form of cannibalism. After birds have tasted blood they will continue their cannibalistic habits without provocation. Cannibalistic pecking is responsible for at least 80% of all vent pick-out cases (Smith, 1982).

Broiler breeder age had not significant effect on claw length and carcass grading. There were no interactions between breeder age and litter material on either claw length or carcass quality (Table 6).

7- **Carcass quality**

Scabby hip syndrome (SHS) is a dermatitis or inflammation of the skin, which appear to originate as a scratch around the lumbar and sacral regions of the back in broiler chickens. This skin condition is frequently associated with scab formation, which detracts from the appearance of the carcass at the time of slaughter and usually requires the removal of areas of skin containing the lesion. Although this skin removal does not result in carcass condemnation, it does result in downgrading.

As shown in Table (6) it could be observed that the incidence of vent scabs, scabby hip syndrome, sores and breast blisters were higher of birds grown on wheat straw and wood shavings compared to those reared on sand litter. It was observed that birds located in the wheat straw and wood shavings litter had longer claws and tended to walk over the backs of other reclined birds when moving about the house area, thus providing evidence that the scratches were caused, at least in part, by clawed feet slipping and

sliding down the hips and sides of birds in the reclined position. It is concluded that using sand litter can play a significant role in decreasing the incidence of scabby hip syndrome that can also be associated to with increased and improving carcass quality carcass quality. This finding is in agreement with the findings of Proudfoot and Hulan (1985) and Frankenhuis *et al*. (1991). Harris (1977) suggested that stocking density might be play a role in incidence of scabby hip syndrome. He added that litter bedding material in the higher stocking density pens became damp and compacted during the last two weeks of the growing period, resulting in the production of ammonia which may have contributed to irritation of the scratched skin surfaces. Table (6) also shows that the grade A of carcass quality was higher significant ($P<0.01$) of birds grown sand litter compared to the other two groups. These due to the lower incidence of vent scabs, hip scabs, sores and breast blisters of the groups grown on sand litter. This findings may be as a result of decreasing claw length of those birds reared on sand compared to the other groups. The percentage of Grad A carcass, were significantly affected by litter material $P<0.001$. The percent of birds graded down because of breast blisters increased linearly as stocking density increased (Proudfoot et al., 1979). El-Sheikh (2002) found that the incidence of vent scabs, scabby hip syndrome, sores and breast blisters were higher significant ($P<0.01$) during summer season compared to winter season. So the down carcass grade was higher during summer (48.2%) compared winter (29.6%). The current results were obtained during summer season and are in agreement with the findings of Harris (1977) who found that the scabby hip syndrome occurring in the southern regions of the United States during periods of high temperature.

With respect to the effect of breeder age on carcass quality, Table (6) shows that the incidence of vent scabs, scabby hip syndrome, sores and breast blisters were not significant between the birds were hatch from young breeder and those from old breeder. So the differences of down carcass grade was not significant it was (59%) for the younger breeder compared to (57%) for older breeder.

No significant interactions between breeder age and litter materials of the incidence of vent scabs, scabby hip syndrome, sores and breast blisters and the grade of carcasses (Table 6).

It is concluded that using sand resulted in reduced claw length, has an adverse effect on carcass quality, decreasing the incidence of breast blisters scabs and sores, and increasing monetary returns base on live body weight and carcass quality.

8- Economics traits

The total cost of feed consumed and the total revenue as well as the economical efficiency of meat production as affected by type of litter and breeder ages are shown in Table 7. It should be pointed out that economic efficiency values were calculated according to the prevailing market price of one kilogram live body weight at the end of experimental period which was 7.75 Egyptian L.E. The economic efficiency evaluation showed that rearing broiler chicks on sand resulted in lowering total cost compared to the chicks reared on wood shavings and higher compared to which reared on wheat straw. It was higher both net revenue and economic efficiency comparing to those reared on either wheat straw or wood shavings. It is interesting to note that monetary returns, over the cost of feed, chicks and litter materials were significantly differences with different litter materials, it were 4.929, 3.378 and 4.408 L.E per bird reared on sand, wheat straw and wood shavings, respectively. These results are in agreement with the findings of Mohamed (2003) who found that the birds which reared on sand were the highest net revenue values as compared to which reared on wheat straw and wood shavings.

Whit respect to the effect of broiler breeder age on economic evaluation, Table (7) shows that the broiler chicks from the younger breeder was significantly lowering total cost compared to oldest breeder age. However, neither net revenue nor economic efficiency were significant differences between the two breeder age.

The effect of interaction between breeder age and litter type are presented in Table (8). The total cost of birds from younger breeder and reared on sand, wheat straw and wood shavings were 6.03,5.71 and 6.56 L.E respectively and the differences were significantly at $P<0.05$. The corresponding values with birds from older breeder were 6.58, 6.36 and 6.68 L.E. The total cost of birds from young breeder which reared on sand were lower significantly compared to other treatments, while with birds from old breeder and reared on sand have not significant differences with either birds reared on wheat straw or on wood shavings. The net revenue for sand and wood shavings were higher with birds hatch from old breeder compared which were hatch from young breeder the opposite tend was observed with straw. The economic efficiency of birds from either young or old breeder and reared on sand was higher significantly compared with other two treatments. Moreover, the economic efficiency of birds which reared on wheat straw was higher for birds from young breeder than which from old breeder, it was 61.58 vs. 50.87, respectively.

In conclusion, evidence shows no problem for using chicks hatch from younger broiler breeder age (26 weeks of age). Based on the results obtained from this experiment, it could be concluded that using sand as a litter during summer season for broiler chicks is better for their performance, carcass quality and economic efficiency than both wheat straw and wood shavings. The using sand as a litter for broiler is better during winter too (Mohamed , 2003).

Table (1) Effect of broiler breeder age and litter type on body weight and body weight gain.

Variables	Body weight (g)				Body weight gain (g)			
	0	2	4	6	0-2	2-4	4-6	Hatch-6
				weeks				
Litter type								
Sand	38.5	271.8	804.8^{a}	1411^{a}	233.3^{a}	541.9^{a}	596.5^{a}	1372.9^{a}
Wheat straw	38.6	261.2	729.9^{b}	1177^{b}	222.5^{a}	468.8^{b}	447.6^{b}	1138.8^{b}
Wood shavings	38.6	267.4	797.7^{a}	1384^{a}	228.7^{a}	529.9a	586.7^{a}	1346.2^{a}
Std. Error ±	**0.25**	**4.73**	**14.2**	**17.7**	**4.77**	**10.75**	**17.30**	**18.13**
Breeder age								
26 weeks	33.6^{b}	228.2^{b}	701.3^{b}	1294^{b}	194.4^{b}	473.2^{b}	596.0^{a}	1260.9^{b}
43 weeks	43.5^{a}	305.3^{a}	850.9^{a}	1357^{a}	261.8^{a}	551.5^{a}	495.1^{b}	1313.8^{a}
Std. Error ±	**0.21**	**3.38**	**11.3**	**14.6**	**3.84**	**8.88**	**14.0**	**14.4**
Interactions								
26wk sand	33.5^{b}	222.6^{c}	736.6^{bc}	1343^{b}	188.8^{c}	514.6^{b}	606.8^{b}	1309.7^{b}
26wk wheat straw	33.7^{b}	231.3^{c}	669.2^{d}	1152^{c}	197.6^{c}	437.9^{c}	494.7^{d}	1118.9^{c}
26 wk wood shaving	33.7^{b}	230.5^{c}	702.3^{cd}	1374^{b}	196.6^{c}	472.1^{bc}	674.9^{a}	1340.5^{b}
43wk sand	43.5	320.9^{a}	867.3^{a}	1479^{a}	277.7^{a}	566.9^{a}	586.2^{b}	1436.2^{a}
43 wk wheat straw	43.6^{a}	291.1^{b}	790.8^{b}	1200^{c}	247.4^{b}	499.7^{b}	404.7^{d}	1157.0^{c}
43 wk wood shaving	43.4^{a}	304.4^{ab}	896.9^{a}	1395^{b}	260.9^{ab}	590.2^{a}	498.5^{c}	1351.9^{b}
Std. Error ±	**0.35**	**6.69**	**19.73**	**25.1**	**6.75**	**15.35**	**24.45**	**25.01**
Probability								
Litter	NS	NS	***	***	NS	***	***	***
Breeder age	***	***	***	**	***	***	***	**
Litter * Brage	NS	**	NS	*	**	*	*	*

^{a,b,c} Means within a column for each effect with no common superscripts differ significantly.
* P<0.05 **P<0.01 ***P<0.001, NS= not significant

Table (2) Effect of broiler breeder age and litter type on mortality rat.

	Mortality % during			
	0-2 weeks	2-4 weeks	4-6 weeks	0-6 weeks
Litter type				
Sand	2.0±1.29	2.00±1.30	2.08±1.71	6.0±2.45
Wheat	2.0±1.29	2.04±1.30	4.21±1.71	8.0±2.45
Wood shavings	1.0±1.29	3.04±1.30	4.17±1.71	8.0±2.45
Breeder age				
26 weeks	1.33±1.05	2.00±1.06	4.13±1.40	7.33±2.0
43 weeks	2.00±1.05	2.72±1.06	2.84±1.40	7.33±2.0
Interactions				
26wk sand	2.00±184	2.00±1.84	2.08±2.43	6.0±3.46
26wk wheat straw	2.00±184	2.00±1.84	4.16±2.43	8.0±3.46
26 wk wood shavings	0.00	2.00±1.84	6.16±2.43	8.0±3.46
43wk sand	2.00±184	2.00±1.84	2.08±2.43	6.0±3.46
43 wk wheat straw	2.00±184	2.09±1.84	4.26±2.43	8.0±3.46
43 wk wood shavings	2.00±184	4.09±1.84	2.17±2.43	8.0±3.46
Probability				
Litter	NS	NS	NS	NS
Breeder age	NS	NS	NS	NS
Litter * Brage	NS	NS	NS	NS

NS= not significant

Table (3) Effect of broiler breeder age and litter type on daily feed consumption (FC) and feed efficiency (FE)

Variable	F.C. (G feed/bird/day)				F.E. (g feed/g weight)			
	0-2	2-4	4-6	0-6	0-2	2-4	4-6	0-6
				weeks				
Litter								
Sand	25.35	74.9^{a}	94.8^{b}	65.0^{b}	1.54	1.76^{b}	2.22^{c}	1.99^{b}
Wheat straw	25.72	66.2^{b}	88.0^{c}	59.9^{c}	1.63	1.90^{ab}	2.43^{b}	2.21^{a}
Wood shavings	28.97	78.6^{a}	100^{a}	69.2^{a}	1.78	2.09^{a}	2.78^{a}	2.16^{a}
Std. Error ±	1.04	2.31	1.36	0.77	0.08	0.05	0.03	0.02
Breeder age								
26 weeks	24.36^{b}	73.0	94.7	63.8	1.75	1.73^{b}	2.23^{a}	2.13
43 weeks	29.00^{a}	73.0	93.9	65.9	1.55	2.10^{a}	2.72^{b}	2.10
Std. Error ±	0.85	1.89	1.12	0.63	0.07	0.04	0.02	0.02
Interactions								
26wk sand	22.00^{c}	72.3^{abc}	95.6^{ab}	63.3^{bc}	1.64	1.66^{c}	2.21^{cd}	2.03^{cd}
26wk wheat straw	24.95^{bc}	64.1^{c}	83.7^{c}	57.6^{d}	1.76	1.81^{bc}	2.37^{c}	2.16^{ab}
26 wk wood shavings	26.15^{bc}	82.8^{a}	102.3^{a}	70.4^{a}	1.86	1.72^{c}	2.12^{d}	2.21^{ab}
43wk sand	28.70^{ab}	77.5^{ab}	94.1^{b}	66.8^{ab}	1.45	1.85^{bc}	2.24^{cd}	1.95^{d}
43 wk wheat straw	26.50^{ab}	68.3^{bc}	92.3^{b}	62.4^{c}	1.51	2.36^{a}	3.19^{a}	2.26^{a}
43 wk wood shavings	31.80^{a}	74.4^{abc}	97.7^{ab}	68.0^{a}	1.71	2.09	2.74^{b}	2.11^{cd}
Std. Error ±	1.47	3.27	1.93	1.09	0.13	0.08	0.05	0.03
Probability								
Litter	NS	**	**	**	NS	**	***	***
Brage	**	NS	NS	NS	NS	***	***	NS
litter* Brage	NS	NS	*	*	NS	NS	***	*

[a,b,c] Means within a column for each effect with no common superscripts differ significantly.
* P<0.05 **P<0.01 ***P<0.001, NS = not significant

Table (4) Effect of broiler breeder age and litter type on internal organs weight as a percentage of live body weight (%).

Variables	Litter type			Breeder age		Probability		
	Sand	Wheat straw	Wood shavings	26 weeks	43 weeks	Breeder age	Litter type	litter * Breeder
Adrenal	0.0076[b]	0.0079[b]	0.0105[a]	0.0088	0.0084	NS	***	**
Thyroid	0.007[ab]	0.0063[b]	0.0076[a]	0.007	0.006	NS	NS	NS
Bursa	0.068[b]	0.065[b]	0.081[a]	0.074	0.068	NS	*	**
Intestine	4.22	3.68	3.64	3.53[b]	4.16[a]	*	NS	NS
Liver	2.29	2.33	2.29	2.19[b]	2.41[a]	*	NS	NS
Heart	0.44[b]	0.52[a]	0.46[b]	0.46	0.48	NS	**	*
Spleen	0.064	0.075	0.072	0.066	0.074	NS	NS	**

[a,b,c] Means within a raw for each effect with no common superscripts differ significantly
. * P<0.05 **P<0.01, NS= not significant

Table (5) Effect of broiler breeder age and litter type on live body weight and cut up parts weight (g) or percentage of carcass.

Variables	Litter materials			Breeder age		Probability		
	Sand	Wheat straw	Wood shavings	Young breeder	Old breeder	Breeder age	Litter materials	Breeder *litter
Live body weight	1562[a]	1300[b]	1546[a]	1409.3[b]	1529.7[a]	*	***	NS
Legs	21.78[ab]	22.95[a]	21.21	21.02[b]	22.94[a]	**	NS	NS
slaughter wt	96.51	95.64	95.92	96.32[a]	95.72	NS	NS	***
D-feathering	91.55	92.18	90.46	90.56	92.24	NS	NS	NS
Breast wt	18.91	19.98	18.57	18.49	19.81	NS	NS	NS
Bach wt	11.44	11.59	11.31	10.59[a]	12.29[b]	*	NS	**
Neck wt	4.11[ab]	4.31[a]	3.90[b]	4.08	4.13	NS	NS	NS
Wings wt	8.26	8.66	8.13	8.256	8.450	NS	NS	NS
Gizzard	1.91[a]	1.96[a]	1.70[b]	1.92[a]	1.78[b]	*	**	NS
Liver	2.29	2.33	2.29	2.19[b]	2.41[a]	*	NS	NS
Heart	0.44[b]	0.52[a]	0.46[b]	0.46	0.48	NS	**	*
PADFAT	0.897	0.841	0.996	0.814[b]	1.008[a]	*	NS	NS
Dis edible	6.41	7.38	7.26	7.91[a]	6.13[b]	***	NS	NS
Head wt	2.92	3.08	3.02	3.029	2.99	NS	NS	NS
Shank wt	4.89	5.29	4.86	5.205	4.83	NS	NS	NS
Intestine wt	4.22	3.68	3.64	3.53[b]	4.16[a]	*	NS	NS
Feather%	7.83	7.13	7.12	7.07	7.66	NS	NS	NS
Blood%	3.48	4.29	4.51	3.44	4.75	NS	NS	NS
Ready to cock	1269.5[a]	1087.6[b]	1328.4[a]	1186.4	1270.6	NS	0.01	NS
Dressed %	81.9	83.5	82.9	83.4	82.1	NS	NS	NS

[a,b,c] Means within a raw for each effect with no common superscripts differ significantly.
* P<0.05 **P<0.01 ***P<0.001, NS= not significant

Table (6) Effect of broiler breeder age and litter type on claw length (cm), carcass quality and grading %.

Treat	Vent Hip	Scappy Hip	back	soars	grad A	Right claw	Left claw
litter type							
Sand	11.66	3.33^{B}	2.5^{B}	8.33^{B}	77.5^{A}	1.16^{b}	1.10^{b}
Wheat straw	13.33	16.66^{A}	13.33^{A}	23.33^{A}	52.5^{B}	1.21^{ab}	1.18^{a}
Wood shavings	9.17	10.83^{AB}	14.17^{A}	12.50^{AB}	45.0^{B}	1.25^{a}	1.23^{a}
Std. Error ±	3.22	4.03	2.41	4.64	4.44	±0.022	±0.023
Breeder age							
26 weeks	12.8	9.44	8.33	14.44	59.44	1.19	1.16
43 weeks	10.0	11.11	11.66	15.00	57.22	1.22	1.18
Std. Error ±	2.63	3.28	1.96	3.78	3.62	±0.017	±0.019
Interactions							
26wk sand	10.00	5.00	1.66^{c}	8.33	81.66^{a}	1.156	1.090^{b}
26wk wheat straw	15.00	15.00	10.00^{abc}	23.33	50.00^{c}	1.182	1.172^{ab}
26 wk wood shaving	13.33	8.33	13.33^{ab}	11.66	46.66^{c}	1.252	1.238^{a}
43wk sand	13.33	1.66	3.33^{bc}	8.33	73.33^{ab}	1.170	1.126^{b}
43 wk wood shaving	11.66	18.33	16.66^{a}	23.33	55.00^{bc}	1.250	1.192^{a}
43 wk wheat straw	5.00	13.33	15.00^{a}	13.33	43.33^{c}	1.156	1.140^{ab}
Probability							
Litter	NS	NS	**	NS	***	*	**
Breeder age	NS	NS	NS	NS	NS	NS	NS
litter* Brage	NS	NS	NS	NS	NS	NS	NS

[a,b,c] Means within a raw for each effect with no common superscripts differ significantly
* P<0.05 **P<0.01 ***P<0.001, NS= not significant

Table (7) Effect of broiler breeder age and litter type on some economic traits.

Variables	**Breeder age**		**Litter typ**			**Probability**		
	Young	**Old**	**sand**	**Straw**	**Wood**	**Age**	**Litter**	**L*A**
Costs:								
Body weight	1294^{b}	1357^{a}	1411^{a}	1177^{b}	1384^{a}	**	***	*
F.C (kg/bird)	2677.5	2758.9	2730.4^{b}	2518.9^{c}	2905.4^{a}	NS	***	*
Litter cost	0.066	0.066	0.03^{c}	0.130^{a}	0.04^{b}			
Feed cost L.E	4.685	4.827	4.777^{b}	4.407^{c}	5.084^{a}	NS	***	*
Chicks price	1.35^{b}	1.65^{a}	1.500	1.500	1.500			
Total cost	6.102^{b}	6.544^{a}	6.308^{b}	6.038^{c}	6.624^{a}	***	**	*
Income:								
Meat yield at 6 wk	9.997^{b}	10.527	10.937^{a}	9.116^{b}	10.732^{a}	**	***	*
Manure yield	0.300	0.300	0.300	0.300	0.300	***	***	***
Total income	10.358^{b}	10.827^{a}	11.237^{a}	9.508^{b}	11.032^{a}	**	***	*
Net revenue	4.194	4.282	4.929^{a}	3.378^{c}	4.408^{b}	NS	***	NS
Economic efficiency	68.68	65.29	78.13^{a}	56.23^{c}	66.60^{b}	NS	***	NS

Chick price = 1.35L.E. for younger broiler breeder, and 1.65 L.E. for older broiler breeder
Meat price /kg live weight = 7.75 L.E.
[a,b,c] Means within a raw for each effect with no common superscripts differ significantly
. * P<0.05 **P<0.01 ***P<0.001, NS= not significant

Table (8) Effect of the interaction between broiler breeder age and litter type on some economics traits.

Variables	Young breeder			Old breeder		
	Sand	Straw	Wood	Sand	Straw	Wood
Costs:						
Body weight (g)	1343^{b}	1152^{c}	1374^{b}	1479^{a}	1200^{c}	1395^{b}
F.C (g/bird)	2657.2^{bc}	2418.5^{d}	2956.8^{a}	2803.9^{ab}	2919.4^{c}	2853.9^{a}
Litter cost (L.E)	0.030^{c}	0.13^{a}	0.040^{b}	0.030^{c}	0.13^{a}	0.040^{b}
Feed cost (L.E)	4.649^{bc}	4.232^{d}	5.174^{a}	4.905^{b}	4.583^{c}	4.994^{a}
Chicks price (L.E)	1.35^{b}	1.35^{b}	1.35^{b}	1.65^{a}	1.65^{a}	1.65^{a}
Total cost	6.030^{c}	5.712^{d}	6.564^{ab}	6.586^{ab}	6.364^{b}	6.684^{a}
Income:						
Meat yield at 6 wk	10.411^{b}	8.929^{c}	10.650^{b}	11.464^{a}	9.303^{c}	10.813^{b}
Manure yield	0.300	0.300	0.300	0.300	0.300	0.300
Total income	10.711^{b}	9.413^{c}	10.950^{b}	11.764^{a}	9.603^{c}	11.113^{b}
Gain	4.681^{ab}	3.517^{c}	4.386^{b}	5.177^{a}	3.239^{c}	4.429^{b}
Economic efficiency	77.63^{a}	61.58^{b}	66.82^{b}	78.64^{a}	50.87^{c}	66.37^{b}

Chick price = 1.35L.E. for younger broiler breeder, and 1.65 L.E. for older broiler breeder

Meat price /kg live weight = 7.75 L.E.

^{a,b,c} Means within a raw for each effect with no common superscripts differ significantly.

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الملخص العربي

تأثير عمر امهات كتاكيت اللحم ونوع الفرشة على الاداء الانتاجى لكتاكيت اللحم اثناء الصيف تحت ظروف الصيف

طلعت مصطفى الشيخ

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اجريت التجربة بغرض دراسة تأثير عمر الامهات ونوع الفرشة على الاداء الانتاجى لكتاكيت اللحم من سلالة الكوب من عمر يوم حتى عمر ٦ أسبوع . تم تقسيم الكتاكيت الى مجموعتين حسب عمر الامهات (عمر ٢٦ أسبوع وعمر ٤٣ أسبوع) وكل مجموعة تم تقسيمها الى ثلاثة معاملات لكل منها مكررتين. ففى المعاملة الاولى استخدمت فرشة من الرمل والثانية فرشة من نشارة الخشب والثالثة فرشة من التبن (كنترول). وقد تم اخذ وزن الجسم عند الفقس وكل أسبوعين ومعدل الزيادة فى الوزن واستهلاك الغذاء ومعدل تحويله وجودة الذبيحة وقياس اجزائها وبعض الاعضاء الداحلية وحساب نسبة النفوق والعائد الاقتصادى. وكانت النتائج المتحصل عليها كالتالى:

تفوقت الطيور التى ربيت على فرشة من الرمل فى وزن الجسم عن مثيلاتها التى ربيت على فرشة من التبن أو نشارة الخشب. كما تفوقت معنويا الكتاكيت الفاقسة من بيض امهات كبيرة على مثيلاتها التى من امهات صغيرة فى العمر. هذا ولم توجد فروق معنوية فى نسبة النفوق سواء بين الطيور التى ربيت على انواع الفرشة المختلفة ولا بين الطيور المتحصل عليها من امهات كبيرة او صغيرة فى العمر. كذلك لم توجد فروق معنوية فى استهلاك خلال الفترة من ٠-٢ أسبوع بينما خلال الفترات من ٢-٤, ٤-٦ شدي ٠-٦ أسبوع من العمر استهلكت الطيور التى ربيت على تبن القمح اقل من مثيلاتها التى ربيت على نشارة الخشب أو الرمل. بينما كانت الطيور على نشارة الخشب اكثر المجمعات استهلاكا للعلف. بينما كانت المجموعة التى ربيت على فرشة من الرمل اعلى فى الكفاءة الغذائية.

واوضحة النتائج ان الطيور التى ربيت على الرمل كان وزن غدو الادرينال اقل والغدة الدرقية اعلى وزنا ايضا لمساهمة الرمل فى تقليل الاجهاد الحرارى على هذه الطيور. هذا بالاضافة الى انخفاض وزن كل من القلب والقونصة والطحال والكبد للطيور التى ربيت على فرشة الرمل مقارنة بالتى ربيت على التبن او نشارة الخشب. كما ان الطيور التى ربيت على فرشة من الرمل كانت اظافرها اقصر معنويا عن مثيلاتها التى ربيت على النشارة او التبن. كذلك ادى استخدام الرمل كفرشة الى انخفلض التكاليف الكلية وزيادة الربح الصافى مقارنة بالمجموعات الاخرى. كذلك لم يكن لعمر الامهات تأثير على العائد الاقتصادى او الكفاءة الاقتصادية وكذلك جودة الذبائح.