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EFFECT OF DIET FORMS AND LITTER TYPES ON THE PRODUCTIVE TRAITS OF BROILER (SASSO)

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ABSTRACT: This experiment was conducted to investigate the effect of the different form of diets and litter types on the productive traits of broiler (Sasso). A total number of 1890 one day old chicks of Sasso broiler were used. The study included nine groups of treatments, with two replicates for each treatment (18 pens); in factorial experimental design(3X 3) three diet forms (pellet, mash and crumble) by three types of litters (sand, wheat straw and wood shaving litters). Results of Sasso broiler live BW at eight weeks of age, shows significant differences ($P \leq 0.05$) was recorded among litter types and highly significant ($P \leq 0.001$) among feed forms treatments. In that chicks fed diets of pellets or crumbs forms has highly significant superiority values over the chicks fed that of mash form through the 8-week. Also a highly significant difference ($P \leq 0.001$) was attained with feed forms during period of 1-56 days of age. However, the differences among litter types of wheat straw or wood shaving in that respect were insignificant. FCR during the whole experimental period ranged between 1.69 (g feed/g gain) for the birds raised on wheat straw litter and fed pellet diet and 2.01 (g feed/g gain) for the birds raised on wheat straw litter and fed mash diet. Mortality rate of birds fed mash form diet was lower than those fed pellet or crumble form diets throughout experimental period. The performance index (PI) during the whole experimental period ranged between 54.43% (mash x wheat straw group) and 64.43 % (pellet x wheat straw group) for all combination groups studied. The Production number (PN) ranged between 375.91 (wheat straw x crumbs group) and 491.45 (wheat straw x pellet group) for all combination groups studied. The chicks fed pellet forms had significant superiority score over the chicks fed crumbs or mash forms, since the Profit margin (PM) averaged 7.33, 4.90% and 2.90 % respectively. Also, chicks raised on sand litter recorded highly significant highest PM at marketing age compared with chicks raised on wheat straw or wood shavings litters (8.79, 4.73 and 1.62 respectively).

Key Words: Diet Forms, Litter Types, Productive Traits, And Broiler (Sasso)

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INTRODUCTION

It's well known that chicken industry is one of the most dynamic of world's agribusiness trade. Global chickens and poultry meat production in 2012 were 90.9 and 103.5 million tons, respectively. Looking to 2013, global poultry meat output will likely approach 106 million tons (FAOSTAT, 2012). Egyptian poultry meat production in 2011 was 900,763 tones, which ranked 29among countries (FAOSTAT, 2011). Furthermore, poultry breeding is generally acceptable to people all over the world and provides an excellent source of protein.

Nowadays, various commercial feed mills are producing different forms of broiler feed for different age groups of birds. Pelleting is the processing method that employed by the feed manufactures to improve farm animal performance. Various feed forms pellet - mash and crumble that supplied to broiler are the most important factors which directly influence the cost of mixed feed and production performance of broilers.

Moreover, many of researchers showed that broiler growth and feed intake are significantly influenced by environmental temperature, nutrient density, and physical feed quality. Also litter influenced broiler performance where good litter and its condition-lead to obtain optimum results of final productive traits and profits. Mahmoud (2011) evaluated the effect of using different types of litter with or without alum on Ross broiler chick's performance, carcass parts and some blood parameters. The results of the first two weeks of age showed that litter type had highly significant ($P \leq 0.001$) effect on broiler body weight. In that, the average of broiler body weight at one and two weeks of age for birds raised on sand litter had the superiority score over those raised on wheat straw and wood shaving litters. 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 birds raised on wheat straw and sand litters had heavier body weight than those raised on shavings wood litter .

On the other hand, the effect of the diet forms with different levels of protein and energy on broilers performance was investigated by Jafarnejad et al. (2010). Male broiler chicks fed either the two diet forms (mash and crumble pellet) with two levels of protein (23% and 21% CP), and two levels of energy (3200 and 3000 Kcal, ME /Kg) through 1 to 21 days of age. The weight gain of broiler fed crumble-pellet diet was significantly greater than those received mash diets. Also Mirghelenj and Golian (2009) studied the effect of feed form on performance, gastrointestinal development and carcass traits of broiler chickens. He reported that there are a significant difference ($P \leq 0.05$) in weekly feed consumption among birds fed mash and those fed pelleted or crumble-pellet form diets. Toghyani et al. (2010) found that no significant differences was detected in feed conversion values of Ross 308 broiler with each of the following five litters: (1) no litter, (2) wood shaving, (3) sand, (4) rice hulls and (5) recycled paper roll which being 1.70, 1.69, 1.69, 1.69 and 1.71, respectively. As well as no significant effect of feed form on the mortality. Kim and Chung (1994) reported that production cost was almost similar between crumble and crumble-pellet treatments. Also, Garcia Pestana (1975) reported that pelleted diet decreased the production cost of meat. The economic effects of using mash and pelleted feed on Cobb 500 broilers was studied by Gadzirayi et al. (2006)who found that pelleted feed gave higher growth rate compared to

mash feed though there is no significant difference between the two forms of feed in terms of economic returns to real resources. They indicated that broiler producers can use either pelleted or mash feed since there is no significant economic gains obtained from changing from one feed form to the other. Because of the most economic forms of feed, litter types and ideal environment give the highest returns per pound invested, the present study aimed to evaluate the effect of diet forms and litter types on the productive and physiological traits of broiler (Sasso), under the prevailing environmental conditions in Alexandria city.

MATERIALS AND METHODS

The present study was carried out at the Poultry Research Center, Faculty of Agriculture, Alexandria University. The experiment was planned to evaluate the effect of diet forms and The studied traits are live body weight (LBW) in grams at 1, 4 and 8week of age and some productive traits during 1- 56 days of age for different litter types and feed forms studied (Body Gain, Feed Intake, Feed Conversion, Mortality Rate).The Sasso broiler economic performance at 8-week of age was also calculated. Data of the performance index (PI) and production number (PN) were calculated from the following formula (Euribrid 1994):

Performance index (PI) $=\frac{\boldsymbol{Liveweight\ (g)}}{\boldsymbol{Feedintake\ (g)}}\times 100$

Production number (PN) = Average live weight (g) $\times\frac{\boldsymbol{Survivability}\ (\%)}{\boldsymbol{Days}}\times\frac{\boldsymbol{FCR}}{\mathbf{10}}$

Profit margin (PM) was estimated using the following equations (Hoffman1963):

Profit margin (PM) $=\frac{\boldsymbol{Profit}}{\boldsymbol{Revenue}}$X100

RESULTS AND DISCUSSION

Broiler Performance:

litter types on the productive traits of broiler (Sasso), under the prevailing environmental conditions in Alexandria city. A total number of 1890 one day old chicks of Sasso broiler, with an average initial weight was 42.6 ± 0.152 g., were used in this experiment. The study included nine groups of treatments, (18 pens), in factorial experimental design 3X 3 (three diet forms by three types of litters). All birds were randomly divided with 105 chicks in each pen. The birds fed commercial diets: starter diet during the period 1-20 days of age, grower diet during the period 21-40 days of age and finisher feed during the period 41-56 days of age (Table, 1). The fresh water was provided with round automatic drinker. The feed and water provided ad libtum, and management conditions were similar for all treatments throughout the experimental period.

1. Body Weight (BW)

Results of Sasso broiler live BW at eight weeks of age (Table, 2), shows significant differences ($P \leq 0.05$) among broilers of litter types and highly significant ($P \leq 0.001$) among those of feed forms treatments. The chicks fed pellets or crumbs forms has highly significant superiority score over the chicks fed mash throughout the 8-week old. In that, BW averaged 1771.3, 1700.8 and 1664.7 g., respectively. On the other hand chicks raised on shavings wood litter gave significant highest 8-week BW compared with those raised on wheat straw or sand litters (1719.4, 1718.5 and 1707.1 g. respectively).However, the BW of Sasso broiler at 8-week of age for all group combinations studied ranged between 1773.9 and 1634.9 g..

The present results confirms the previous results by Jafarnejad et al. (2010), and Zohair et al. (2012), who observed the superiority score of

weights for broiler chicks fed pellet or crumbs diets over those fed mash diet during different stages of fattening period. Kim and Chung (1994) showed that chicks fed mash-diet recorded lower body weight at 41 days than birds fed on crumble and pellet.

Chicks raised on shaving wood or wheat straw litters gave better BW than those raised on sand litter. These results are in agreement with findings of(El-Sagheer et al.,2004; Toghyani et al.,2010andDavis et al., 2010).Mahmoud (2011),who found that highly significant differences in broiler body weight, when birds raised on wheat straw and broilers of sand litters had least body weight than those raised on shavings wood litter.

The interaction results indicated that the superiority trend of BW among all groups studied goes to the chicks fed pellet form and raised on any of litter types studied. In conclusion, the results suggested a recommendation that crumbs form of diet is better for Sasso until 4 weeks of age followed by that of pellet form to the end of fattening period. Generally, chicks raised on sand litter and fed crumbs or pellet forms showed better BW at 8-week over those fed mash form.

2. Daily weight gain (DWG)

Results of Sasso broiler DWG during 1-56 days of age (Table, 3) shows highly significant differences ($P \leq 0.001$) was seen among chicks of feed forms. However, the differences among litter types or interaction in this respect were not significant, so chicks fed diet of pellet form has the superiority score over those fed crumbs and mash forms, being 30.93, 29.70 and 29.03 g., respectively. Meanwhile, the differences between birds fed pellet or crumble forms have insignificant differences in this respect. Generally, the DWG per day of Sasso broiler ranged between 28.47 and 30.99 g. for all combination groups studied. While, birds fed diet of pellet form had highest DWG (30.93g.), which did not significantly differed by those fed diet of crumbs form (29.70g.), the opposite was true with birds received mash diet (29.03 g) where was seen in this respect.

The DWG results confirms the previous results (Gadzirayi et al., 2006; Jahan et al., 2006; Jafarnejad et al., 2010 and Zohair et al., 2012),who observed that the superiority value of DWG for broiler chicks fed pellet or crumbs diets over those fed mash diet during different stage of broiler fattening period. Serrano et al (2013) noted that broilers fed mash diet had lower ($P< 0.001$) average DWG than broilers fed crumbles or pellets Also, nearly similar performance in this respect among litter types studied, where DWG of chicks raised on either sand, wheat straw or shaving wood litters averaged 29.77, 30.02 or 30.02 g./day, respectively and without significant differences among them.

In connection, the results of litter types in literatures obviously showed differences in broiler performance which raised on different litter types (Al-Homidan and Robertson (2007) and Lien et al. (2008)). However, Bilgili et al., (2000) showed that broilers raised on sand performed better than those raised on shavings. Asaniyanet al. (2007) found that better performance of the broiler chickens seems to favour the sand litter group. Also, Mahmoud (2011) showed that the cumulative results of Rossbody weight gain was highly significant as the result of litter type, since the birds raised on wheat straw or sand litters gained more significantly body weight over those birds raised on shavings wood litter.

3. Feed Consumption (FC)

Results of Sasso broiler FC during period of (1- 56) days of age (Table, 3) shows highly significant differences (P

≤ 0.01) among feed forms treatments, whereas the litter types differences and the interaction effect in this respect found to be not significant. Chicks fed diet of pellets or crumbs forms consumed highly significant amount over those fed mash form ones, (86.54, 81.13 and 72.32 g./bird/day), respectively. Generally, the FC of Sasso broiler ranged between 69.52 g./bird/day for birds raised on wheat straw litter and fed mash diet and 87.48 g./bird/day for the birds raised on shaving wood litter and fed pellet diet. Meanwhile, the results of FC showed that birds consumed pellet form diet recorded the highest values in this respect over those fed crumbs or mash form diets. This superiority for pellet form was insignificant with crumbs forms. The results, in general, are in agreement with other findings obtained by Gadzirayi et al. (2006), Mirghelenj and Golian (2009), Cerrate et al. (2009) and Zohair et al. (2012), who reported an obvious superiority of consumption for the pellet form diets over the crumble or mash forms diets during different growth intervals. However, Jahan et al. (2006) showed that crumble group of broiler chicks recorded high trend of feed consumption compared with those of mash, pellet and crumble diets in the age duration of 21 to 56 days.

It is worth to note that highly significant increase in FC for birds of pellet or crumbs diets over those of mash diet throughout the experimental period, which resulted to highly significant increase in body weight of Sasso chicks received pellet (1771.3 g.) or crumble (1700.8 g.) diets over those fed mash (1664.7 g.) diet (Table 2). Along the same line, Moran (1990), Bertechini et al. (1992), and Nir et al. (1995) showed that feeding pellet diet increase feed intake in broiler. Jean-Jacques (2005) stated the positive effects of pelleting are well documented with higher feed density, no feed ingredient separation, better bacteriological quality, easier ingestion, improved growth and feed conversion ratio. Moreover, these observed results explained by recent broiler behavioral studies, since they reported that broilers respond to pelleted feed by spending less time to eat the same or more feed. This decreased the time spent eating is more than the time spent for resting, which decreases animal energy expenditure leaving more energy available for gain (Aviagen, 2005 and Wiernusz, 2012).

In respect of litter forms, the results of Sasso FC were insignificant, with ranking order here throughout the experimental period (1-56 days of age) where Sasso chicks raised on shaving wood consumed 82.44 g./day, sand 79.72 g./day and wheat straw 77.83g./day forms. The literatures in this respect had different directions, Swain and Sundaram (2000), El-Sagheer etal. (2004), Lien et al. (2008) and Sharnam et al. (2008) found no significant effect on FC with different litter forms studied. However, Anisuzzaman and Chowdhury (1996) found that the rice husk was the best litter materials (among rice husk, sawdust, paddy straw and sand) depend on FC results. Al- Homidan and Robertson (2007) revealed that the average FC of Hybro broilers raised on wood shavings had significantly exceeded when broilers raised on straw based litters by 8.6 % through 6 weeks of age. These differences may be due to the different of litter material or intervals of age or type of broiler chicks studied.

In regard to the interaction between the two main effects studied, insignificant difference was seen in this respect. However, the Sasso broiler raised on any of the litter types studied and fed pellet form diet recorded higher FC during 1-56 days of age (overall mean

86.54 g). On the other hand, the Sasso broiler raised on wheat straw and fed mash diet consumed insignificantly lowest (69.52 g.) feed intake during (1-56) days of age.

4. Feed conversion ratio (FCR)

The results of Sasso broiler FCR during 1- 56 days of age (Table 3) had, in general, insignificant differences among litter types, feed forms and their interaction. However, the FCR of Sasso broiler during the whole experimental period ranged between 1.69 (g.feed/g.gain) for the birds raised on wheat straw litter and fed pellet diet and 2.01 (g.feed/g.gain) for the birds raised on wheat straw litter and fed mash diet. Generally, the FCR of birds fed pellet form averaged 1.77 g. feed/ g. gain. The birds fed crumbs or mash diets ranked second and third, respectively.

These results are in agreement with other findings obtained by Kim and Chung (1996) Jahan et al. (2006) and Mohamed et al. (2012), who reported an obvious superiority score of pellet form diets over the crumble or mash forms diets. In this respect, during the different growth intervals. Serrano et al (2013) reported that broilers fed mash had poorer feed-to-gain ratio than broilers fed crumbles or pellets. On the other hand, Asha Rajini et al. (1998a, b) reported that pelleted diet had better feed efficiency up to six- week age of birds. Zohair et al. (2012) reported better (0.786) FCR value was recorded by birds fed mash diet than those received pellet ones indicated low feed efficiency during (1-28) days of age.

In respect of litter forms, the ranked order here throughout the experimental period (1-56 days of age) were for Sasso chicks raised on wheat straw (1.84 g. feed/g. gain), shaving wood (1.87 g. feed/g. gain) and sand (1.89 g. feed/g. gain) litters.

The literatures in this respect had different directions, Al-Homidan and Robertson (2007), Lien et al. (2008), Alkis and Celen (2009) and Toghyani et al. (2010) found no significant effect on FCR with different litter forms studied. On the other hand, some other authors showed that the best FCR of broiler obtained with rice husk (Anisuzzaman and Chowdhury, 1996), sawdust (Biswas et al., 2001) or wheat straw and sand(Mahmoud ,2011)litters**.**

5. Mortality rate (MR)

Results of Sasso broiler MR during 1-56 days of age (Table 3) shows highly significant differences ($P \leq 0.001$) were seen among litter types and feed forms treatments, whereas the interaction in that respect found to be not significant. In regard to feed forms, chicks fed mash forms has highly significant lowest MR percentage than those fed pellets or crumbs forms, since it averaged 5.10, 8.09 and 9.80 %, respectively. In respect of litter types, chicks raised on sand litter had highly significant lowest MR during (1-56) days of age, with no significant differences with the corresponding value for chicks raised on wheat straw litter, than chicks raised on wheat straw or shavings wood litters (4.86, 6.63 and 11.50 % respectively). With respect to chick's combination groups, the MR of Sasso broiler ranged between 3.33% for chicks raised on sand litter and fed mash diet and 13.51% for chicks raised on shaving wood and fed crumbs diet.

The superiority of mash diet in that respect may be due to ascites as reported by Zohairet al. (2012).The present results are in line with the findings of Jahan et al. (2006) and Cerrate et al. (2009), who showed significant differences in MR of broiler fed different forms of feed. However, Zakaria et al. (2013) found insignificant differences between straight-run Lohmann broiler chicks

groups fed mash (4.79%) or pelleted (5.65%) diets during 1-28d of age.

Also, the literatures had different trends of litter types on mortality rate, since it found to has insignificant (Hester et al. 1997; Toghyani et al.,2010 and Davis et al. ,2010)or noted to be significant was found by(Lien et al.,2008; and Mahmoud ,2011),however El-Sagheer et al. (2004) found that mortality rate of broilers raised on sawdust were significantly higher than those raised on sand and wheat straw, since it amounted 20, 6.7, and 16.7 %, respectively.

These differences may be due to the differences of litter material, intervals studied, type of broiler chicks or management practices.

In general, the sand litter gives excellent mortality rate through the experimental period which confirmed and /or supported by recent behavior study by Toghyani et al. (2010), who found that broiler chicks raised from 1 to 42 days of age, when given choice, spent 49% of their time in the sand side, 19% in the wood shavings, 18% in the paper roll and 13% in the rice hulls. Moreover, they indicated that the broilers performed a greater proportion of their behaviors on sand litter.

In regard to the interaction results, the Sasso broiler raised on sand and fed mash diet had lowest MR averaged 3.33% during 1-8 weeks of age. However, the Sasso broiler combination groups of (shaving wood x crumbs) or (shaving wood x pellet) had highest MR averaged 13.51 and 13.37% throughout the whole experimental period, respectively.

Economic Performance:

The results of Sasso broiler performance index (PI) during (1- 8) weeks of age (Table 4), in general, shows an insignificant differences as the result of different feed forms and litter types and their interactions. The PI of Sasso broiler during the whole experimental period ranged between 54.43 (mash x wheat straw group) and 64.43 % (pellet x wheat straw group) for all combination groups studied.

The Concerning Sasso broiler production number (PN) during 1- 8 weeks of age (Table 4), in general, was not significant different as result of different litter types and feed forms and their interactions. The PN of Sasso broiler during (1- 8) weeks of age ranged between 375.91 (wheat straw x crumbs group) and 491.45 (wheat straw x pellet group) for all combination groups studied.

Regarding the Sasso broiler Profit margin (PM) at 56 days of age (Table 4) shows significant differences ($P \leq 0.05$) among feed forms and among litter types ($P \leq 0.01$) treatments, whereas the interaction in this respect found to be not significant. The chicks fed pellets diet recorded significant superiority over those fed crumbs or mash forms, since the PM averaged 7.33, 4.90 and 2.90 %, respectively. On the other hand, the chicks raised on sand litter recorded significant highest PM at marketing age than those raised on wheat straw or shavings wood litters (8.79, 4.73 and 1.62 respectively).Moreover, the PM of Sasso broiler ranged between 12.88 (Sand x Pellet group) and 0.44 % (Wheat straw x crumbs group) for all combination groups studied.

Generally, the results showed better values for all economics indexes studied(PI, PN, and PM) for the Sasso broiler chicks fed pellet form diet, since they averaged 62.27%, 469.22, and 7.33%,respectively.However, the PM values showed the superiority for the birds fed mash diet over those fed crumbs diet in that respect.

The results of PI and PN values among litter types showed insignificant superiority of Sasso broiler chicks raised on shaving wood (60.15%) and

sand (451.61) litters, respectively. The Sasso broiler chicks raised on sand, wheat straw or shaving wood litter has PM values averaged 8.79, 4.73 and 1.62%, respectively. The better economic indexes (PI, PN and PM) of the present study for the birds raised on sand could be due to the lowest mortality rate observed for them (Table 4), which outperform that for the birds raised on wheat straw or shaving wood, especially for PN (451.61) and PM (8.79%) values.

These results are in agreement with the findings of Jahan et al. (2006), Mirghelenj and Golian (2009) who showed that performance index and production number were significant better in birds received pellets or crumble diets over those of mash diet. Jahan et al. (2006) found that the performance index data of chicks fed diet of pellet (47.15) and crumble (47.58) were statistically similar whereas was significantly differed from those of mash group (36.17), which were low at all the weeks of age. Also, they observed the same trend with the production number values. Similar results were obtained By Garcia Pestana (1975) who reported that pelleted diet decreased production cost of meat. Also, Kim and Chung (1994) reported that production cost almost similar between crumble and crumble-pellet treatments.

On the other hand, Gadzirayi et al. (2006) found that there no significant difference between the two forms of feed (mash and pellet forms) in terms of economic returns to real resources. Moreover, they indicated that broiler producers can use either pelleted or mash feed since there is no significant economic gains obtained from changing from one feed form to the other.

The differences of economics indexes values among studies, in general, may be due to the broiler strain and their potential of growth rate, experimental period, the diet form specifications, qualities, and prices, etc.

Table (1): Composition of the experimental diets and their calculated analysis.

Ingredients,%	Starter Diet	Grower Diet	Finisher Diet
Yellow corn	59.90	61.00	66.20
Soybean meal (48%)	28.10	00.00	00.00
Soybean meal (44%)	00.00	24.90	19.80
Corn gluten meal (60%)	7.00	6.60	6.50
Di-Calcium phosphate	2.00	2.30	1.96
Limestone	1.30	1.20	1.20
Salt	0.50	0.40	0.40
Oil	0.20	2.3	2.56
Premix*	0.40	0.30	0.30
Methionine	0.19	0.13	0.14
Lysine	0.38	0.37	0.44
Anti Coccidian	0.03	0.30	0.30
Anti Toxin	0.00	0.20	0.20
Total	100.00	100.00	100.00
Calculated Analysis**:			
ME, Kcal/Kg	2984	3097	3181
Crude Protein (%)	22.8	20.1	18.1
Calcium (%)	1.09	1.08	1.1
Phosphorus (%)	0.57	0.63	0.55
Crude Fiber (%)	1.19	1.22	1.32
Methionine (%)	0.63	0.54	0.52
Lysine (%)	1.35	1.24	1.16

*Each kg of premix provided: Vit. A, 12 000 IU, vit. E (dl-a-tocopheryl acetate) 20 mg, menadione 2.3 mg, Vit. D3, 2 200 ICU, riboflavin 5.5 mg, calcium pantothenate 12 mg, nicotinic acid 50 mg, Choline 250 mg, vit. B12 10 mg, vit. B6 3 mg, thiamine 3 mg, folic acid 1 mg, d‑biotin 0.05 mg, Mn 80 mg, Zn 60 mg, Fe 35 mg, Cu 8 mg, Selenium 0.1 mg.

**diets were provided as recommended by (NRC, 1994).

Table (2): Least square means and standard errors (X± SE) and analysis of variance of Sasso broiler live body weight in grams at 1, 4 and 8-week of age for different litter types and feed forms.

Treatments	1-week		4-week		8-week	
Among feed forms						
Mash (M)	129.8^{A}±0.58		644.7^{C}±6.01		1664.7^{C}±15.42	
Crumbs (C)	129.8^{A}±0.67		689.2^{A}±7.52		1700.8^{B}±16.30	
Pellets (P)	127.2^{B}±0.59		664.1^{B}±5.21		1771.3^{A}±18.38	
Among litter types						
Sand (S)	131.4^{A}±0.63		654.5^{C}±8.21		1707.1^{B}±17.65	
Wheat straw (Ws)	127.0^{B}±0.60		665.5^{B}±5.40		1718.5^{A}±17.39	
Shaving wood (Sw)	128.5^{B}±0.60		677.8^{A}±5.49		1719.4^{A}±16.76	
Interactions						
M x S	130.2^{c}±1.23		613.9^{e}±11.59		1634.9^{f}±28.47	
M x Ws	128.0^{d}±0.88		639.2^{d}±9.52		1702.9^{c}±26.33	
M x Sw	131.2^{b}±0.91		678.3^{b}±8.65		1655.0^{e}±24.86	
C x S	131.6^{b}±0.98		691.1^{a}±19.37		1707.9^{c}±27.48	
C x Ws	129.9^{c}±1.36		681.0^{b}±9.48		1673.0^{d}±29.32	
C x Sw	128.4^{d}±1.13		696.4^{a}±9.46		1723.4^{b}±27.70	
P x S	132.7^{a}±1.03		660.7^{c}±8.33		1770.0^{a}±32.52	
P x Ws	123.6^{f}±0.87		671.7^{b}±8.58		1770.0^{a}±32.52	
P x Sw	126.2^{e}±1.04		658.6^{c}±10.03		1773.9^{a}±30.89	
	df	MS	Df	MS	df	MS
Analysis of Variance						
Feed forms	2	1120.79**	2	112247.87***	2	559521.73***
Litter types	2	2688.39***	2	30400.24*	2	85831.55*
Interactions	4	1006.25***	4	29630.70**	4	502978.80
Error	1662	205.38	674	8889.51	533	52189.51

Means heaving different letters in each effect are significantly different ($P \leq 0.05$)

A,and Bamong feed forms.

A and,B among litter types.

a,b nd c interaction litter types by feed forms.

* $P \leq 0.05$ …… ** $P \leq 0.01$ …….*** $P \leq 0.001$

Table (3). Least square means and standard errors (X± SE) and analysis of variance of Sasso broilers for some productive traits during 1- 56 days of age for different litter types and feed forms studied.

Treatments	Body Gain		Feed Intake		Feed Conversion		Mortality Rate	
Among feed forms								
Mash (M)	$29.03^{B} \pm 0.47$		$72.32^{B} \pm 5.20$		1.96 ± 0.20		$5.10^{A} \pm 0.10$	
Crumbs (C)	$29.70^{AB} \pm 0.50$		$81.13^{A} \pm 6.00$		1.87 ± 0.19		$9.80^{B} \pm 1.35$	
Pellets (P)	$30.93^{A} \pm 0.57$		$86.54^{A} \pm 6.29$		1.77 ± 0.17		$8.09^{B} \pm 1.68$	
Among litter types								
Sand (S)	29.77 ± 0.53		79.72 ± 5.82		1.89 ± 0.18		$4.86^{A} \pm 0.71$	
Wheat straw (Ws)	30.02 ± 0.52		77.83 ± 5.67		1.84 ± 0.18		$6.63^{A} \pm 1.09$	
Shaving wood (Sw)	30.02 ± 0.55		82.44 ± 6.18		1.87 ± 0.20		$11.50^{B} \pm 1.52$	
Interactions								
M x S	28.47 ± 0.51		71.75 ± 5.04		1.93 ± 0.21		3.33 ± 0.56	
M x Ws	29.73 ± 0.47		69.52 ± 4.99		2.01 ± 0.20		4.35 ± 0.54	
M x Sw	28.86 ± 0.44		75.68 ± 5.58		1.95 ± 0.21		7.62 ± 1.11	
C x S	29.79 ± 0.49		81.57 ± 5.92		1.89 ± 0.20		6.73 ± 0.57	
C x Ws	29.24 ± 0.52		77.64 ± 5.87		1.83 ± 0.19		9.17 ± 1.14	
C x Sw	30.09 ± 0.50		84.17 ± 6.27		1.88 ± 0.22		13.51 ± 0.98	
P x S	30.89 ± 0.58		85.81 ± 6.35		1.85 ± 0.18		4.52 ± 0.41	
P x Ws	30.92 ± 0.58		86.34 ± 5.97		1.69 ± 0.16		6.37 ± 0.83	
P x Sw	30.99 ± 0.55		87.48 ± 6.63		1.77 ± 0.20		13.37 ± 1.49	
	df	MS	df	MS	df	MS	df	MS
Analysis of Variance								
Feed forms	2	177.216***	2	8661.82**	2	0.226	2	135.92***
Litter types	2	3.931	2	902.36	2	0.012	2	283.76***
Interactions	4	15.536	4	143.98	4	0.03	4	12545
Error	533	16.645	495	1929.70	63	0.311	64	6.66

Means heaving different letters in each effect are significantly different ($P \leq 0.05$)
A,and B among feed forms.
A and,B among litter types.
a,b nd c interaction litter types by feed forms.
** $P \leq 0.01$ …….*** $P \leq 0.001$

Table (4): Least square means and standard errors (X± SE) and analysis of variance of Sasso broiler economic performance at 8-week of age for different litter types and feed forms studied.

Treatments	**Performance Index (%)**		**Production Number**		**Profit Margin (%)**	
Among feed forms						
Mash (M)	56.40 ± 7.48		413.29 ± 64.73		4.90^{B} ± 2.45	
Crumbs (C)	59.51 ± 7.77		417.75 ± 68.15		2.90^{C} ± 2.57	
Pellets (P)	62.27 ± 7.98		469.22 ± 77.36		7.33^{A} ± 3.73	
Among litter types						
Sand (S)	58.41 ± 7.54		451.61 ± 73.21		8.79^{A} ± 2.58	
Wheat straw (Ws)	59.63 ± 7.55		423.12 ± 68.08		4.73^{B} ± 3.09	
Shaving wood (Sw)	60.15 ± 8.24		425.53 ± 70.78		1.62^{C} ± 0.97	
	df	MS	df	MS	df	MS
Analysis of Variance						
Feed forms	2	206.85	2	23188.63	2	29.530^{*}
Litter types	2	19.23	2	5990.52	2	77.636^{**}
Interactions	4	35.61	4	6804.15	4	14.08
Error	63	523.41	63	42712.92	9	5.839

Means heaving different letters in each effect are significantly different ($P \leq 0.05$)
A,B and C among feed forms.
A,B and C among litter types.
* $P \leq 0.05$ ** $P \leq 0.01$

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الملخص العربى

تأثير شكل العلف ونوع الفرشة على الأداء الإنتاجي لكتاكيت اللحم (ساسو)

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أجريت التجربة لدراسة تأثير شكل العلف ونوع الفرشة المختلفة على الصفات الإنتاجية لكتاكيت اللحم (ساسو) (1890 كتكوت عمر يوم) ساسو. وشملت الدراسة تسع مجموعات من المعاملات، وكررت كل معاملة مرتين باجمالى (18) مكررة ، في تصميم (3X 3) ثلاثة أشكال علف(محبب، مفتت وناعم) و ثلاثة أنواع من الفرشة (الرمل، التبن ،نشارة الخشب) . اظهرت النتائج وجود فروق معنويه فى وزن الجسم الحى لكتاكيت اللحم ساسو عند عمر ثمانية أسابيع ، أظهرت فروق معنويه ($P \leq 0.05$)بين أنواع الفرشة المختلفةو فروق معنويه جدا ($P \leq 0.001$)بين أشكال العلف . الكتاكيت التى غذيت على شكل العلف المحبب والمفتت تفوقت فى الوزن على الكتاكيت التى تغذت على العلف الناعم خلال 8 أسابيع .النتائج أظهرت اختلافات معنويه جدا ($P \leq 0.001$) بين أشكال العلف خلال (1- 56 أيام) من العمر. ومع ذلك، فإن الاختلافات بين أنواع الفرشة أو التفاعل لم تكن معنويه. نتائج الكفاءة التحويليه للعلف خلال فترة التجربة كلها تراوحت بين 1.69 (g.gain /g.feed) للطيور المرباه على فرشة التبن وغذيت على علف محبب و 2.01 (g.gain /g.feed) للطيور المرباة على فرشة التبن وغذيت على العلائق الناعمة. عموما، FCR الطيور التى غذيت على شكل العلف المحبب متوسطها (g.gain /g.feed) 1.77بينما الطيور التى غذيت على شكل العلف المفتت أو الناعم يأتيان فى الترتيب الثاني والثالث على التوالي. عموما، أظهرت النتائج ان معدل نفوق كتاكيت اللحم ساسو التى غذيت على شكل العلف الناعم لديها أقل القيم و الافضل في هذه الصفة عن تلك التى غذيت على شكل علف محبب او مفتت خلال فترة التجربة.

دليل الأداء (PI) خلال فترة التجربة كلها تراوحت بين 54.43 % لمجموعة(غذيت على علف ناعم ومرباة على التبن) و43.64٪ لمجموعة (غذيت على علف محبب ومرباه على التبن). تراوحت قيمة الكفاءة الإنتاج (PN) بين 375.9 لمجموعة (التبن X العلف المفتت) و 491.45لمجموعة (التبن X العلف المحبب). الخلاصة ان كتاكيت اللحم ساسو التى غذيت على شكل العلف المحبب كان لها تفوقا معنويا على الكتاكيت التى تم تغذيتها على شكل العلف المفتت أو شكل العلف الناعم، لأن متوسط هامش الربح (PM) 7.33، 4.90و 2.90٪ على التوالي. الكتاكيت المرباة على فرشة الرمل لها بالغ الأهمية فلقد حققت أعلى هامش ربح (PM) في عمر التسويق عن الكتاكيت المرباة على فرشة التبن أو نشارة الخشب (8.79، 4.73 ،1.62) على التوالي.