Effect of Different Stocking Densities as an Environmental Stressing Factor on Broiler Behavior and Performance

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A B S T R A C T

Six hundreds of unsexed Arbor Acres chicks were used and housed in symmetrical 9 pens with three levels of stocking12 bird/m^2, 15 bird/m^2 and 20 bird/m^2. Productive performance parameters were measured including, average daily Feed intake, average body weight, average weekly weight gain, feed conversion rate (FCR), mortality rate, dressing yield and visceral organs weight. Behavioral observations including feeding, drinking, leg scratching, leg -wing stretching, preening, litter eating and dust bathing were done by scan sampling, birds were observed 3 days /week. Results revealed that the growth performance within the first and second weeks, the high stocking density group (20 bird/m2) showed a high feed intake, body weight and body weight gain, followed by medium stocking density group (15 bird / m2) and the lowest performance parameters through the first two weeks were recorded in the control group. From the fourth to the fifth weeks, medium density group (15 bird / m2) showed a higher feed intake body weight and body weight gain. The moderate stocking density achieved a higher final body weight was 1954 ±1.73 g, body weight gain 1911.75 ±1.73 g, also feed intake passed in the same direction MSD consumed 3117.19 ±11.4 g/ bird. Finally, all group showing the same feed conversion ratio as all different stocking densities showing no significant differences in FCR. The results carcass characteristics showed that the moderate stocking density group (15 bird/ m2) achieve the highest dressing weight and higher dressing percentage compared with other two groups. Regarding to internal organ weight the control group showed the highest gizzard, liver, and heart weights followed by moderate and high stocking density group respectively. the results clearly showed that increasing SD significantly reduced the weights of the lymphoid organs. Behavioral Indicators showed that within the first two weeks, the feeding and drinking behavior was significantly differ, as the moderate and high density groups showing the higher feeding than control group. The final feeding and drinking behavior within the whole experimental period, there was no statistical significant difference between the different groups. The welfare behavior indicators, including leg and wing stretch, leg scratch, preening and resting behavior were recorded within five weeks and also from total means for all group it was clear that from the first week till the end of experiment the stocking density negatively

correlated to the welfare behavior indicators. Regarding to resting behavior within weeks and in allover means in the different groups although there was no significant difference between different groups as $p > 0.05$ there was a decrease in the resting behavior percentage with increased stocking density.

Key words: Broilers; Welfare, Performance, stocking density

http://www.bvmj.bu.edu.eg) **(BVMJ-34(2): 51-65, 2018)**

1. INTRODUCTION

Broilers are generally held in large groups either in environmentally controlled housing or in open naturally ventilated poultry houses and usually broilers are kept on deep litter system. Farmers around the world understand that in order to raise the birds with maximum efficiency, many conditions must be fulfilled; stress prevention, supply of good feed and water, and good sanitation. In providing these conditions, farmers ensure a basic level of animal welfare.(Jones, 1996). Stocking density has become a major issue in the debate on broiler welfare. Very high densities may impair the bird's welfare directly through physical restriction of the movement and indirectly effects through poor litter quality, high ammonia level and heat are also suggested to affect welfare(SCAHAW, 2000). Increasing stocking density is an important management practice taken by the growers to reduce the costs of poultry production Estevez, (2007). Puron *et al.*, (1995) studied the effect of different stocking density 10, 12, and 14 birds/m^2 on performance and found that there was a reduction in feed consumption at the highest stocking density compared with the lowest stocking density by 3.7 % and 3.9 % for male and female respectively and the stocking density did not affect feed conversion or mortality of broilers. Martrenchar *et al.*, (1997) studied the influence of stocking density 12, 16 and 20 birds/m^2 with a final stocking density of 27, 35 and 43 kg/m respectively on broiler welfare and found that higher final live weight and a better degree of bird welfare existed in 27 kg / m^2 and it concluded that a stocking density of 43 kg/m^2 seemed to induce poor bird welfare. Carmichael *et al.*, (1999) found that behaviors which decreased in incidence with crowding include moving, foraging and dust-bathing. Behaviors which increased with crowding include standing. Behaviors which were unaffected include resting, preening, comfort behavior and the minor behaviors. Kristensen and Wathes (2000) reviewed that at high rearing densities the litter may become easily wet as result of larger deposits of fecal content, spilled water, and inadequate ventilation. Excessive moisture, in conjunction with high temperature, promotes bacterial growth, which will decompose organic material producing ammonia in the process, which is a highly irritating and toxic gas. Marin *et al.*, (2001) reviewed that in broilers that are usually reared at a high stocking density, social factors may be more important than environmental factors in causing stress and affecting behavior patterns. Pettit-Riley and Estevez (2001) found that there is no effect of increasing stocking rate from 10 to 20 birds/m on the body weight and feed conversion ratio. Feddes *et al.*, (2002) studied the effect of 4 stocking densities of 23.8, 17.9, 14.3, and 11.9 birds/m^2 on broiler performance and found that birds grown at 23.8 birds/m2 consumed more feed, had lower body weight (1,898 g) and carcass weights (1,334 g) but the yield of broilers per unit of floor space

was highest (46.0 kg/m^2).McLean et al., (2002) showed that when chickens were stocked at 28, 34, and 39 kg/m^2 there were a linear decline in food intake with increased stocking density during the last week of life (6 weeks). Mostari et al., (2002) mentioned that the profit per chicken decreases in higher stocking densities, while the total production of meat per unit of floor surface increases, which results in higher profit. Sanotra *et al*., (2002) found that the proportions of chicks drinking, eating, pecking, scratching, standing and performing vertical wing-shakes increased when the reduced stocking density were applied. Albentosa and Cooper (2004) reported that higher density housing has been associated with birds' inability to perform comfort behaviors, including wing flapping, stretching, and body shaking. Dawkins et al., (2004) mentioned that the welfare could be assessed through different indicators such as mortality, physiology, behavior and health and stated that under commercial conditions, stocking density may have less effect on welfare. El-Deek and Al-Harthi (2004) found that stocking density had no significant effect on growth of broiler chicks, feed intake and feed conversion ratio during 7-43 day of age, except for increasing stocking density of 18 bird/m during only the period from 22 to 43 day of age while reduced growth and feed intake significantly. Jones *et al*., (2005) concluded that controlling the environment particularly temperature, humidity, air and litter quality is crucial to broiler chicken welfare. This does not mean that stocking density is unimportant, but lowering stocking density on its own, without regard to the environment is not sufficient. Oliveira *et al.*, (2005) evaluated the litter characteristics and performance of broilers reared under different stocking densities and litter types and found that the feed consumption decreased, the feed: gain ratio improved and the total meat production increased with increasing stocking density. In relation to the poultry litter, the final pH was not influenced by the stocking density and/or litter type. Sosnowka-Czajka*et al.,* (2005) reported that increasing the stocking density from 15 to 19 birds/m^2 had a negative effect on feed conversion per kg, weight gain in broilers and increased their mortality by 2.88% at the highest stocking density compared to the density of 15 birds/m^2. Turner et al., (2005) reviewed that high stocking density in broiler sheds restricts the broiler chickens' behavior and causes health problems. Crowded broiler sheds lead to wet litter, increased air pollution from ammonia and dust particles and poor temperature and humidity control, all of which damage the broilers' health and welfare. Bandyopadhyay *et al., (*2006) mentioned that behaviors of bird showed more unstable social and aggressive behavior, high frequency of feeding and drinking in the higher stocking density. Bessei (2006) reviewed that stocking density is a central issue of broiler welfare as found that stocking density reduced the growth rate through its influence on air and litter quality by increasing the moisture content of the litter which enhances the microbial activity, which in turn leads to increase of temperature and ammonia in broiler houses. Dozier et al., (2005) studied the effect of different stocking density 25, 30, 35 and 40 kg of body weight /m^2 in closed housing system and found that the body weight gain, feed consumption, and feed conversion were adversely affected with increasing stocking densities by 35 day and litter moisture was higher as stocking density increased.

2. MATERIALS AND METHODS

Birds and Housing

Six hundreds of unsexed Arbor Acres chicks with initial weight of 45 ± 1.0 g were housed in symmetrical 9 pens with surface area for each 2.125 x 2 m^2, all pens were thoroughly cleaned, washed and disinfected before chicks arrival. Feed and water were

provided ad libitum via trough feeders one feeder /25 bird and bell drinker 4 liters/ 25 bird during the first week then replaced later by 8 liters shaped drinking/50 bird till the end of rearing period. The floor of all pens was covered by a uniform layer of wood shaving with depth about 5 cm. The chicks were brooded at 35 °C during first week and thereafter; the temperature was reduced by 3°C every week until the temperature reached to the room temperature at three weeks' age. The relative humidity was ranged from 50-70 % during the experimental period. The basal broiler starter, grower and finisher diets were formulated to meet the NRC (1994) nutrient requirements for broilers and feeding was ad libitum feeding. Measuring parameters Average Daily Feed intake**.** The daily feed intake / bird / day in grams was calculated by subtracting the weight of feed left from the amount of feed offered each day with attention to collect any spilled feed **(**Dagaas and Claveria, 2008).Average body weight according to **(**Lei and Beek,1997).Average weekly weight gain was measured according to (Yalcin et al., 1998).Feed conversion rate (FCR) weekly measured **(**Dagaas and Claveria**,** 2008)Dressing yield and visceral organs weight were calculated at the end of the treatment to determine **a**verage carcass yield and also weight of heart, liver, spleen, heart and gizzard were weighed and their percentages to live body weights were calculated (Petek, 2000 and Amina et al., 2008)**.**

The mortality rate was recorded weekly throughout the experimental period **(Novel et** al., 2009). For behavior indicators birds were observed as scan samples (Sandilands et al., 2006) the number of birds performing feeding, drinking, leg scratching, leg wing stretching, litter pecking, dust bathing, preening and resting behaviors was recorded each minute for 10 minutes / period / replicate/ day (3 days weekly).

3. RESULTS

Productive performance: The growth performance within the first and second weeks, (Table 1 & 2) the high stocking density group (20 bird/m2) showed a high feed intake 139.705±0.85 g, body weight 161.3 ±0.40 g and body weight gain 119.05 ± 0.40 gm in the first week, while in the second week it was 386.31 ±2.51 g 469.95 ± 1.93 g and 308.65 ±1.52 g respectively, followed by group two of medium stocking density (15 bird / m2) and the lowest performance parameters with the first two weeks were recorded in the control group.

- The performance, within fourth to fifth weeks (Table 4&5), medium density group (15 bird / m2) showed a higher feed intake 989.33 ±6.15 g, body weight 1508.5 ±51.09 g and body weight gain 609 ±53.11 gm while in the fifth week it was 804 ±5.19 g, 1954 ±1.73g and 445.5 ±49.36 g for feed intake, body weight and average body weight gain respectively.

-The final productive performance (Table 5), the moderate stocking density achieved a higher final body weight was 1954 ±1.73 g, body weight gain 1911.75 ±1.73 g, also feed intake passed in the same direction MSD consumed 3117.19 ±11.4 g/ bird. Finally, all group showing the same feed conversion ratio as all different stocking densities showing no significant differences in FCR.

-The results carcass characteristics showed that the moderate stocking density group (15 bird/ m2) achieve the highest dressing weight 1498.3 g and higher dressing percentage 76.7 %, compared with other two groups. Regarding to internal organ weight the control group showed the higher gizzard, liver, and heart weight 46.7 g, 48.9 g and 9.7 g respectively followed by moderate stocking density group 44.3 g, 48.1 g and 9 g

respectively. Bursa and spleen in control group bursa weight was 2± 0.23 g, while moderate and high density grouped showed 1.2 ± 0.15 and 1 ±0.0 gm respectively. Also the spleen weight was 3.4 ±0.23 g, 2 ±0.0 and 1.6 ±0.11 g in control, moderate and high density group respectively. the results clearly showed that increasing SD significantly reduced the weights of the lymphoid organs.

Behavioral Indicators:

Within the first two weeks, the feeding and drinking behavior was significantly differ, as the moderate and high density groups showing the higher feeding 16.6 ± 0.14 %, 16.56±0.62 and drinking percentage10.84 ± 0.39 %, 8.58 ±0.54 % than control group 7.08± 0.62 %, 70.06 ±0.54.

The final feeding and drinking behavior within the whole experimental period, there was no statistical significant difference between the different groups. The welfare behavior indicators, including leg and wing stretch, leg scratch, preening and resting behavior were recorded within five weeks and also from total means for all group it was clear that from the first week till the end of experiment the stocking density negatively correlated to the welfare behavior indicators. Regarding to resting behavior within weeks and in allover means in the different groups although there was no significant difference between different groups as $p > 0.05$ there was a decrease in the resting behavior percentage with increased stocking density.

Table (1) Showing the productive performance of broiler chickens in the first week in different stocking densities

	Gp. / Parameters	Control	MSD	HSD
First week	Initial weight (g)	42.25± 0.0^{a}	42.25 ± 0.0^{a}	42.25± 0.0^{a}
	Feed Intake (g)	129.95±0.72^{b}	128.69 ± 0.31^{b}	139.705±0.85^{a}
	Body weight (g)	148.3 ±0.57^{b}	148.3 ± 0.57^{b}	161.3 ±0.40^{a}
	Bwt gain (g)	106.05 ± 0.57^{b}	106.05 ± 0.57^{b}	119.05 ± 0.40^{a}
	FCR	1 ± 0.01^{b}	1.2 ± 0.002^{a}	1.17± 0.002^{a}
	Mortality %	4 ± 1.15^{a}	0 ± 0.0^{b}	1.735 ± 0.32^{ab}

Control group with stoking density 12 bird/m^2, MSD group with stocking density 15 bird/m^2, HSD group with stocking density 20 bird/m^2.

Result expressed as Mean ±Stander error.

a, b, c : Different Letter within the column means significantly differ at $p \leq 0.05$ between the groups.

Table (2) Showing the productive performance of broiler chickens in the second week in different stocking densities

	Gp. / Parameters	Control	MSD	HSD
second week	Initial weight (g)	171.8 ±2.19[a]	148.3 ±0.57[c]	161.3 ±0.40[b]
	Feed Intake (g)	336.44±20.09[b]	348.32 ± 3.94[b]	386.31 ±2.51[a]
	Body weight (g)	445.1±2.02[b]	423.95 ±0.37[c]	469.95 ± 1.93[a]
	Bwt gain (g)	296.8±1.44[b]	275.65 ±0.20[c]	308.65 ±1.52[a]
	FCR	1.17±0.04[b]	1.26 ±0.01[ab]	1.245 ±0.00[a]
	Mortality %	1±0.57[a]	2.3 ±1.32[a]	1.195 ±0.00[a]

Control group with stoking density 12 bird/m^2, MSD group with stocking density 15 bird/m^2, HSD group with stocking density 20 bird/m^2.

Result expressed as Mean ±Stander error.

a, b, c: Different Letter within the column means significantly differ at $p \leq 0.05$ between the groups.

Table (3) Showing the productive performance of broiler chickens in the third week in different stocking densities

	Gp. / Parameters	Control	MSD	HSD
Third week	Initial weight (g)	445. ±2.02[b]	423.95 ±0.37[c]	469.95 ± 1.93[a]
	Feed Intake (g)	907.475 ±2.90[a]	846.84 ±4.18[b]	700.78 ± 16.93[c]
	Body weight (g)	934.3 ±9.64[a]	899.5 ±2.02[b]	894.95 ±11.74[b]
	Bwt gain (g)	489.2± 7.62[a]	475.55 ±1.64[a]	425 ±13.68[b]
	FCR	1.85 ±0.02[a]	1.775 ±0.01[ab]	1.655 ±0.09[b]
	Mortality %	0 ±0[a]	1.6 ±0.92[a]	1.2 ±0[a]

Control group with stoking density 12 bird/m^2, MSD group with stocking density 15 bird/m^2, HSD group with stocking density 20 bird/m^2

Result expressed as Mean ±Stander error

a, b, c : Different Letter within the column means significantly differ at $p \leq 0.05$ between the groups

Table (4) Showing the productive performance of broiler chickens in the fourth week in different stocking densities

	Gp. / Parameters	Control	MSD	HSD
Fourth week	Initial weight (g)	934.3±9.64^{a}	899.5 ±2.02^{b}	894.9 ± 11.74^{b}
	Feed Intake (g)	900.875 ±16.12^{b}	989.33 ±6.15^{b}	881.75 ±5.83^{b}
	Body weight (g)	1492.5 ±2.02^{ab}	1508.5 ±51.09^{a}	1398 ±12.70^{b}
	Bwt gain (g)	558.2±7.62^{ab}	609 ±53.11^{a}	503.05±24.45^{b}
	FCR	1.615 ±0.04^{a}	1.66 ±0.15^{a}	1.76±0.07^{a}
	Mortality %	0 ±0^{b}	0.8 ±0.46^{ab}	2.48 ±0.73^{a}

Control group with stoking density 12 bird/m^2, MSD group with stocking density 15 bird/m^2, HSD group with stocking density 20 bird/m^2 Result expressed as Mean ±Stander error

a, b, c : Different Letter within the column means significantly differ at p≤ 0.05 between the groups

Table (5) Showing the productive performance of broiler chickens in the fifth week in different stocking densities

	Gp. / Parameters	Control	MSD	HSD
fifth week	Initial weight (g)	1492.5 ±2.02^{ab}	1508.5 ±51.09^{a}	1398 ±12.70^{b}
	Feed Intake (g)	788.5 ±13.56^{a}	804 ±5.19^{a}	714.5 ±7.79^{b}
	Body weight (g)	1891 ±34.21^{ab}	1954 ±1.73^{a}	1818 ±30.02^{b}
	Bwt gain (g)	398.5 ±32.23^{b}	445.5 ±49.36^{a}	420 ±42.72^{ab}
	FCR	2.00 ±0.13^{a}	1.8 ±0.19^{b}	1.73 ±0.16^{b}
	Mortality %	0 ±0^{a}	0 ±0^{a}	0.53 ±0.53^{a}

Control group with stoking density 12 bird/m^2, MSD group with stocking density 15 bird/m^2, HSD group with stocking density 20 bird/m^2

Result expressed as Mean ±Stander error

a, b, c : Different Letter within the column means significantly differ at p≤ 0.05 between the groups

Table (6) Showing the final productive performance in broiler chickens in different stocking densities

Gp. Parameters	Group one (Control)	Group two (MSD)	Group three (HSD
Initial weight (g)	42.25 ± 0.0 [a]	42.25 ± 0.0 [a]	42.25 ± 0.0 [a]
Feed Intake (g)	3063.24 ± 51.9 [a]	3117.19 ±11.4 [a]	2823.05 ±18.3 [b]
Body weight (g)	1891 ± 34.2 [ab]	1954 ±1.73 [a]	1818 ±30 [b]
Bwt increase (g)	1848.75 ± 34.2[ab]	1911.75 ±1.73[a]	1775.75 ± 30[b]
FCR	1.65 ± 0.0[a]	1.63 ±0.0[a]	1.59 ± 0.03[a]
Mortality %	5 ± 1.7[a]	4.7 ± 1.78[a]	7.2 ± 0.9[a]

Control group with stoking density 12 bird/m2, MSD group with stocking density 15 bird/m2, HSD group with stocking density 20 bird/m2Result expressed as Mean ±Stander error a, b,and c : Different Letter within the column means significantly differ at p≤ 0.05 between the groups

Table (7) Showing Final dressing yield of broiler in different stocking densities.

Gp. Parameters	Group one	Group two	Group three
Live wt (g)	1905 ± 21.3[a]	1954 ±1.37[a]	1818 ± 30.02[b]
Dressing wt (g)	1426.7 ± 14.1[b]	1498.3 ± 7.21[a]	1375.3 ± 17.03[b]
Dressing %	75.0 ± 1.58[a]	76.7 ± 0.3[a]	75.7 ± 0.31[a]
Liver wt (g)	48.9 ± 0.4[a]	48.1 ± 1.09[a]	44.1 ± 0.98[b]
Gizzard wt (g)	46.7 ± 0.75[a]	44.3 ± 1.09[b]	38.6 ± 0.0[c]
Spleen wt (g)	3.4 ± 0.23[a]	2 ± 0.0 [b]	1.6 ± 0.11[b]
Heart wt (g)	9.7 ± 0.28[a]	9 ± 0.11[a]	7.1 ± 0.28[b]
bursa wt (g)	2 ± 0.23[a]	1.2 ± 0.15[b]	1 ± 0.0[b]

Control group with stoking density 12 bird/m2, MSD group with stocking density 15 bird/m2, HSD group with stocking density 20 bird/m2 Result expressed as Mean ±Stander error a, b, c : Different Letter within the column means significantly differ at p≤ 0.05 between the groups

Table (8) Total Mean for behavior Patterns within different stocking densities Represented as percentage represented as percentage

Gp. Parameters	Group one (Control)	Group two (MSD)	Group three (HSD)
Feeding	9.80 ± 0.89 [a]	10.062± 1.38[a]	14.0 ± 2.52 [a]
Drinking	9.57 ± 0.65[a]	8.58 ± 0.96[a]	10.37 ± 2.0[a]
Leg and wing stretch	5.91± 0.37[a]	5.36 ± 0.46[a]	4.14 ± 0.50 [b]
Leg scratch	3.08 ±0.44[a]	1.77 ± 0.18[b]	1.46 ± 0.12[b]
Litter pecking	5.99 ± 1.23[a]	3.89 ± 0.70[a]	4.7 ± 0.76[a]
Preening	10.67 ± 0.81[a]	9.44 ± 0.89[a]	6.65 ± 0.77[b]
Dust Bathing	1.12 ±0.26[a]	0.74 ± 0.17[ab]	0.43 ± 0.17[b]
Rest	67.04 ±2.08[a]	64.13 ± 3.9[a]	63.9 ±0.88[a]

Control group with stoking density 12 bird/m2, MSD group with stocking density 15 bird/m2, HSD group with stocking density 20 bird/m2

Result expressed as Mean ±Stander error, mean represent the percentage of behavior act. a, b, c : Different Letters within the column means significantly differ at p≤ 0.05 between the groups

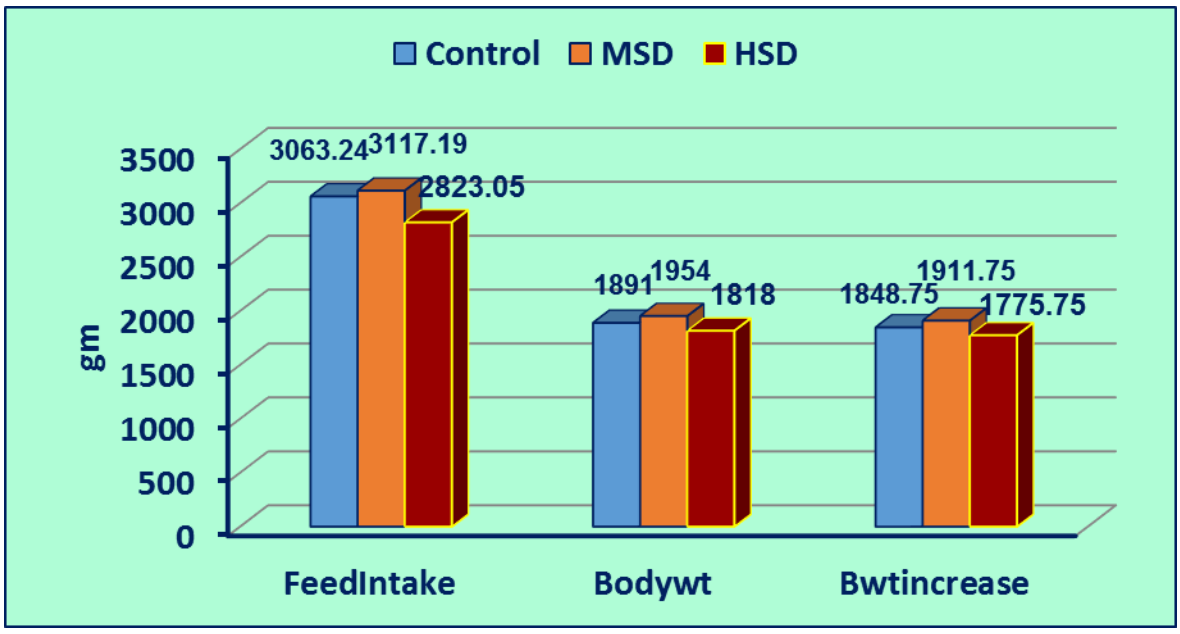

Figure (1) Showing Final Feed intake, Final body weight and average body weight increase in different Stocking densities

Control group with stoking density 12 bird/m2, MSD group with stocking density 15 bird/m2, HSD group with stocking density 20 bird/m2.

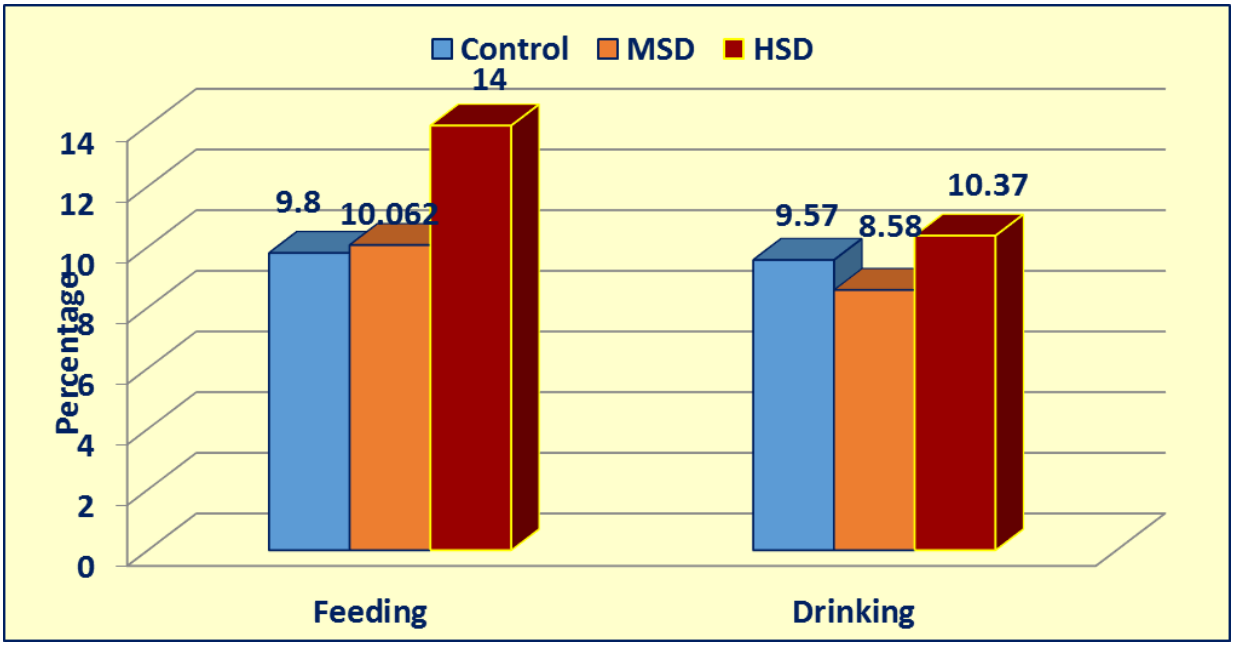

Figure (2) showing of feeding and drinking percentage within different stocking densities

Control group with stoking density 12 bird/m2, MSD group with stocking density 15 bird/m2, HSD group with stocking density 20 bird/m2

Result represent the percentage of behavior act.

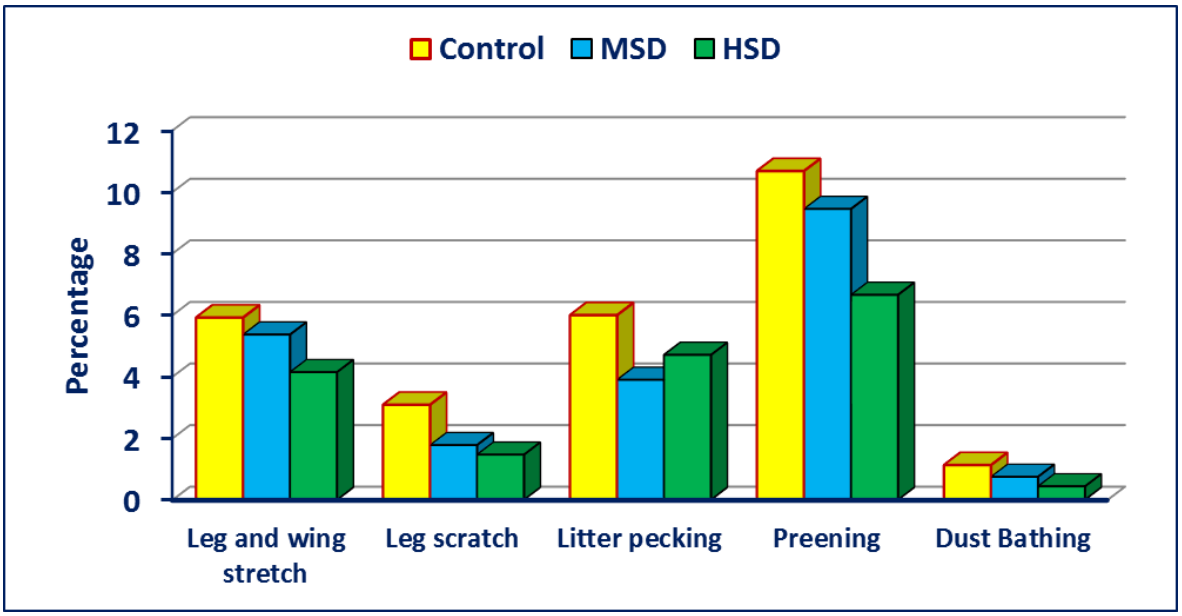

Figure (3) showing welfare behavior indicators within different stocking densities represented as percentage

Control group with stoking density 12 bird/m2, MSD group with stocking density 15 bird/m2, HSD group with stocking density 20 bird/m2

result represent the percentage of behavior act.

4. DISCUSSION

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Results showing the weekly growth performance of different treatment groups. It was clear that there were a great significant differences between the groups as p≤ 0.05, within the first and second weeks old the high stocking density group (20 bird/m^2) showed in the first and second weeks a high feed intake followed by group two of medium stocking density (15 bird / m^2) while the lowest performance parameters within the first two weeks were recorded in the control group. this attributed to the chicks intended to live in aggregates, so that within the high-density group (20 bird/ m2) there is increasing evidence that birds exhibit a high feed intake and high body weight increase. These results may be related to the social interaction of the newly hatched chicks, these agree with Alaeldein., et.al (2013) who concluded that during the starter period, BWG, FI and FCR had influenced as stocking density increases from medium to high rates. And disagree with Puron et al. (1995) who referred that WG, FI and FCR of broilers were all improved as density rate decreased during the starter period, the fourth to fifth weeks' performance. The medium density group (15 bird / m^2) showed a higher significant difference at P<0.05in the productive performance than other groups, within the fourth week the feed intake gain 609 ±53.11 gm while in the fifth week it was 804 ±5.19 g, 1954 ±1.73g and 445.5 ±49.36 g for feed intake, body weight and average body weight gain respectively. This may be related to the fact that with increase the bird size; it will need more feeding space and physical access to feeders was probably limited due to increased stocking density as well as the bird need more effort to get to the feeder so the level of growth decreased with the increase of stocking density ,this come in accordance with Shanawany (1988)who referred that feed intake and body weight in broilers at 5 weeks showed a linear declined with the increase in bird density, and disagree with Alaeldein., et.al (2013) who concluded that no significant differences in BWG, FI among densities groups during the finisher period. Final Productive performance show that MSD is significantly better than control group and HSDasp≤ 0.05.in final body , body weight and feed intake and all different stocking densities showing no significant differences in FCR. These results parallel with results obtained by Turkyilmaz (2008)and Ventura *et al* (2010) conversion not affected by stocking density, and disagree with Sosnowka *et al.*, (2005)and Ravindran et al., (2006)who reported that the stocking density had a negative effect on feed conversion per kg, It was clear that within first two weeks, the feeding and drinking behaviors were significantly differ between groups as the moderate and high density groups showing the higher feeding %, and drinking percentage than control group, this result gives an explanation to the obtained performance results in the brooding period. As in the high stocking density the chicks stimulate each other for feeding and drinking. From the third week to the fifth week, control group showing high feeding and drinking percentage than two other groups this related to the access for feeder and drinker more limited in high stocking density groups in old age which reflected on the feeding and drinking behavior.

While in the final feeding and drinking behavior within the whole

experimental period there was no statistical significant difference between the different groups. The increase in % of feeding and drinking beviours in HSD was attributed to the increase in size of birds, leading to overcrowding which was reflected on the high increase in feeding and drinking behaviours. this result com in accordance with Reiter and Bessei (2000), Iyasere et al. (2012) and Son (2013)

The welfare behaviour indicators, including leg and wing stretch, leg scratch, preening and resting behaviour were recorded within five weeks and also from total means for all group it was clear that from the first week till the end of experiment the stocking density negatively correlated to the welfare behaviour indicators, this came in accordance with the findings of Hall (2001), Dawkins et al. (2004) and Dozier et al. (2006), where they all observed a reduction of broilers welfare in stocking density rates higher than 35 kg/m^2.

5. CONCLUSION

From the economic point of view it very important to housing a large number of bird per unit of space to maximize returns.

Moderate stocking density 15 birds/ m2 that equivalent to 30 kg/ m2, achieved the maximum performance, optimum broiler welfare through optimum behavior patterns and minimal stress on broiler.

To Maximize the total production and the net profit we recommended to start in the first 2 weeks of boiler cycle with the high density 20 birds/ m2 and from the third week we use culling method, to exclude the weak individuals and reach to the moderate density 15 birds/ m2. this is to achieve the maximum performance within the first two weeks and at the end of production cycle.

6. REFERRENCES

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