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PRODUCTIVE PERFORMANCE OF BOVANS BROWN AND HY-SEX BROWN LAYING HENS AS AFFECTED BY BODY WEIGHT AT 20 WEEKS OF AGE

By

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Abstract: *Two hundred and fifty two from Bovans brown (BV) and Hy-sex brown (HS) pullets at 20 weeks of age were used in this experiment. Each strain included one hundred and twenty six of hens were classified according to body weight (X); into three category groups (42 hens of each) being heavy body weight averaged (1440 and 1740 g), medium body weight (standard body weight, 1323 and 1647 g) and light body weight (1236 and 1547 g) in Bovans brown and Hy-sex brown pullets, respectively. The hens of each group divided into six replicates (7 birds each). Each replicate was kept in wire cage (7 hens per cage) for 68 weeks of age.*

The obtained results could be summarized as follows:

The medium birds of Bovans Brown strain (MBV) showed significantly (P≤0.05) higher hen day egg production (HDP) by 4.0 and 5.4%, hen housed egg production (HHP) by 4.0 and 12.3%, eggs number (EN) by13.4 and 18.4 eggs and egg mass by 0.90 and 1.38 kg/hen and exceeded economical efficiency by 17.5 and 16.2% as compared with those of heavy and light birds of Bovans brown (HBV and LBV), respectively. The HBV showed a significantly (P≤0.05) higher egg weight (EW) by about 1.8 and 2.4% and feed consumption by 2.5 and 4.4% as compared with that of MBV and LMV, respectively.

The heavy and medium birds of Hy-sex brown strain (HHS and MHS, respectively) showed significantly (P≤0.05) higher HDP by 5.0 and 5.2%, HHP by 8.6 and 8.8%, EN by 16.9 and 17.6 eggs, EW by 1.8 and 1.5%, EM by 1.26 and 1.16 Kg/hen, FC by 2.1 and 1.1% and EE by 14.9 and 18.3%, respectively as compared with that of light birds of Hy-sex brown (LHS).

There were no significant differences in cumulative feed conversion (g feed/ g egg mass or g feed/ 12 eggs) among three body weight categories of both BV and HS strains. No deaths occurred of high and medium birds of *both BV and HS strains at all ages, while the mortality rate was 8.0 and 4.8% for LBV and LHS, respectively.*

It could be concluded that, the medium birds (standard body weight) of BV and medium and heavy birds of HS recorded the best EE value as compared with the other body weight categories.

INTRODUCTION

Body weight at onset of egg production and throughout the production year influences the efficiency of egg production. Birds with lighter body weights produce lighter eggs, consume less feed per day, and convert feed to egg mass more efficiently in comparison with heavier birds (Ruiz *et al.,* 1983; Summers and Leeson, 1983). Also, Robinson and Robinson, (1991) reported that low body weight birds in a flock found to commence lay later and lay fewer eggs than medium- or high-weight hens. However, Kader *et al*., (1981) and Bish *et al*., (1985) showed that heavy birds produced fewer number of eggs, heavier eggs, consumed more feed per hen /day and consumed more food per dozen eggs than the medium and light birds, while the medium birds had greater means of these traits than the light birds. Nofal *et al*., (2004) reported that heavy birds significantly ($P \leq 0.01$) had lower egg number and hen day percentage compared with the medium and light body weight, but egg weight and feed intake were increased. Nordskog (1960) showed that intermediate in body weight of laying type produced the highest average income; while heavy type chickens from lower third in body weight produced the highest mean income. Dickerson and Hughes (1964) reported that egg production declined 5 to 10 eggs per pullet housed for each one-tenth of a pound that hens were below an optimum body weight. Also, the lighter birds reached sexual maturity more slowly and had higher adult mortality. Nordskog and Briggs (1968) reported that the increase of 0.1 Kg in housing body weight was expected to delay sexual maturity (age at 50 percent production) by 2.17 days, decrease hen–day egg production by 5.82 eggs and decrease hen-housed egg production by 6.19 eggs. Thus, body weights, above the average on the genetic scale, delay sexual maturity and decrease egg production. However, Spies *et al.,* (2000) showed that body weight of broiler breeder hens did not affect egg production. Therefore, the study reported was carried out to investigate the effects of body weight at 20 weeks of age on subsequent laying performance in Bovans brown and Hy-sex brown strains.

MATERIALS AND METHODS

A trial was carried out at the Poultry Research Farm, Faculty of Agriculture, South Valley University, Qena, Egypt, from February 2004 to January 2005. Two hundred and fifty two from Bovans brown (BV) and Hy-sex brown (HS) pullets at 20 weeks of age as a commercial egg strains were used in this experiment. Each strain included one hundred and twenty six of hens were classified according to body weight (X); into three category groups (42 hens of each) being heavy body weight (1400-1570 and 1700-1820 g), medium body weight (standard body weight) (1300-1360 and 1600-1680 g) and light body weight (1200-1280 and 1500-1580 g) in Bovans brown and Hy-sex brown pullets, respectively (Table 1). The hens of each group divided into six replicates (7 birds each). Each replicate was kept in wire cage of 61 × 55 × 45 cm (7 hens per cage) for 68 weeks of age in a closed system house using controlled system. Standard commercial management of layer birds was used throughout the experiment. Both hens were kept at 65% relative humidity and 22 °C temperature. The photoperiod was 16 hours per day and light intensity ranged from 20 to 25 Luxes. Feed and water were available *ad libitum*. All hens were kept under similar adequate managerial and hygienic conditions until 68 weeks of age. The composition and calculated analysis of the experimental diets are shown in Table (2).

Egg number, egg weight and egg mass were recorded daily and calculated periodically every 16 weeks. Egg production was recorded daily and calculated as hen-day and hen-housed egg production (HDP&HHP), periodically every 16 weeks. Feed consumption was recorded weekly and calculated periodically every 16 weeks. Feed conversion ratio as g feed/ g egg mass and g feed/ 12 eggs was calculated, periodically every 16 weeks. Dead birds were recorded daily throughout the experimental period and expressed as percentages.

Feed cost per bird (during 20-36 and 37-68 weeks of age) was calculated by multiplying mean FC per bird by the cost of 1 kg of diet. Depreciation costs were calculated by multiplying bird price at 68 weeks of age (14 LE. per bird) by mortality rate. Total mean of eggs per bird were calculated by multiplying mean egg number by price of one egg. Net revenue was calculated by subtracting total feed and depreciation costs from total income of eggs. Economic efficiency (EE) was estimated by dividing net revenue by total feed and depreciation costs.

Statistical analysis: Data collected were subjected to ANOVA by applying the General Linear Models Procedure of SAS software (SAS institute, version 6.12, 1996). Duncan (1955) was used to detect differences among means of different groups for each strain.

RESULTS AND DISCUSSIONS

1- Egg production and Eggs number (EN):

The medium birds of Bovans brown strain (MBV) had significantly ($P \leq 0.05$) higher hen day egg production (HDP) than those of heavy and light birds (HBV and LBV, respectively) at all ages studied (Table 3). Also, the overall mean of HDP in MBV were increased ($P \leq 0.05$) by about 4.0 and 5.4% as compared with that of HBV and LBV, respectively, while no significant differences between HBV and LBV were observed.

The heavy birds of Hy-sex brown strain (HHS) had significantly ($P \leq 0.05$) higher HDP than those of medium and light birds (MHS and LHS, respectively), during 20-36 weeks of age (Table 3). During 37-52 and 53-68 weeks of age, the HHS and MHS had significantly ($P \leq 0.05$) higher HDP than those of LHS. Also, the overall mean HDP in HHS and MHS were increased ($P \leq 0.05$) by about 5.0 and 5.2%, respectively as compared with that of LHS , while no significant differences between HHS and MHS were observed.

The hen housed egg production (HHP) had almost the same trend of HDP of three category body weight of both BV and HS strains at all ages studied (Table 4). The overall mean HHP in MBV were increased ($P \leq 0.05$) by about 4.0 and 12.3% as compared with that of HBV and LBV, respectively, while the overall mean HBV were increased ($P \leq 0.05$) by about 8.3% than those of LBV. The overall mean HHP in HHS and MHS were increased ($P \leq 0.05$) by about 8.6 and 8.8%, respectively as compared with that of LHS , while no significant differences between HHS and MHS were observed.

The MBV produced significantly ($P \leq 0.05$) higher egg number (EN) than those of HBV and LBV at all ages studied except that insignificant ones during 36-52 weeks of age (Table 5). Also, the overall mean of MBV showed a significantly ($P \leq 0.05$) higher EN by about 13.4 and 18.4 eggs than those of HBV and LBV, respectively, while no significant differences between HBV and LBV were observed.

The HHS and MHS had significantly ($P \leq 0.05$) higher egg number (EN) than those of LHS at all ages studied (Table 5). Also, the overall mean of HHS and MHS showed significantly ($P \leq 0.05$) higher EN by about 16.9 and 17.6 eggs than those of LHS, respectively, while no significant differences between HHS and MHS were observed.

Many researchers have shown that smaller birds produce significantly fewer eggs than do heavier birds (Bell *et al.,* 1981; Harms *et al.,* 1982; Summers and Leeson, 1983), and the results presented here are in agreement with those researchers. Reddy and Siegel (1976) reported that heavy weight birds had a significantly greater HDP% and total eggs than those of lower weight birds. Also, Robinson and Robinson, (1991) reported that low body weight birds produced fewer eggs than medium- or high-weight birds due to delayed onset of production. Singh and Nordskog (1982) calculated that a 100-g increase in body size of the pullet at first egg results in a 1% increase in rate of lay.

Gous and Cherry (2004) reported longer laying period of the heaviest birds of Ross broiler breeders, which started laying 20 days before the lightest birds and the number produced per 100 eggs laid increasing by 0.12 for each 100-g increment in body weight at 20 weeks. Also, the same authors suggested the decrease of egg production in the light birds was related to all birds were fed the same maximum amount of food throughout the laying period, the smallest birds at 20 weeks would have used less of the feed for maintenance than the larger birds, and would therefore be expected to gain more weight during the laying period than the other birds. In addition, the smaller birds reached sexual maturity after the larger birds, and this delay in maturity meant that the food consumed during that period was used for growth instead of being used for egg production. Singh and Nordskog (1982) reasoned poorer rate of lay of the light birds due to smaller birds laid smaller eggs at a faster rate. Reddy and Siegel (1976) found that ovarian weights and number of developing and ruptured follicles were significantly greater in heavy weight birds than lower weight pullets over all ages pooled. This is consistent with the reports of Japp and Mohammadian, (1969) and Udale, (1972) who found that the fast growing chickens had significantly greater number of developing and ruptured follicles than the slow growing individuals. Similar findings were reported for turkey by Nestor *et al.,* (1970). However, Nordskog and Briggs (1968) found that a 100-g increase in housing body weight decrease hen day egg production by 5.82 eggs and decrease hen housed egg production by 6.19 eggs. Nofal and Hassan (2004) using Mamourah and Gimmizah chickens reported that heavy birds showed significantly ($P \leq 0.05$) lower production than that of the medium and light birds. Also, the same authors reported that size of birds affect significantly ($P \leq 0.01$) eggs number, where heavy birds significantly ($P \leq 0.01$) gave lower egg number than the medium and light ones. In contrast, Ruiz *et al.,* (1983) and Spies *et al.,* (2000) showed that body weight of broiler breeder hens alone did not affect egg production. Similar results reported by Madrid *et al.,* (1981) that egg production not significantly different for the categories body weight.

2- Mortality rate:

No deaths occurred of high and medium birds of both BV and HS strains at all ages, while the mortality rate was 8.0 and 4.8% for LBV and LHS, respectively (Table 11). Dickerson and Hughes (1964) reported the lighter birds reached sexual maturity more slowly and had higher adult mortality. Harms *et al.,* (1982) found that livability was similar between the four body weight groups. However, Bish *et al.,* (1985) showed that the percent livability of white leghorn for the heavy birds was significantly less than for both the medium and the light birds. At 64 weeks of age, the livability of the heavy birds was 13.4 and 12.3% significantly less than for the medium and the small birds, respectively.

3- Egg weight (EW) and Egg mass (EM):

The HBV had significantly ($P \leq 0.05$) higher egg weight (EW) than those of MBV and LBV at all ages studied (Table 6). Also, the overall mean of HBV showed significantly ($P \leq 0.05$) higher EW by about 1.8 and 2.4% than those of MBV and LBV, respectively, while the birds of MBV showed significantly ($P \leq 0.05$) higher by about 2.1% than those of LBV.

The HHS and MHS had significantly ($P \leq 0.05$) higher egg weight (EW) than those of LHS at all ages studied (Table 6), while no significant differences between HHS and MHS were observed at all ages studied except that significant one during 20-36 weeks of age. The overall mean of HHS and MHS showed significantly ($P \leq 0.05$) higher EW by about 1.8 and 1.5% than those of LHS, respectively, while no significant differences between HHS and MHS were observed.

The heavy and medium birds of both Bovans brown (BV) and Hy-sex brown (HS) strains had significantly ($P \leq 0.05$) higher egg mass (EM) than those of light birds , at all ages studied except that insignificant ones during 37-52 weeks of age of BV (Table 7). Also, the overall mean of heavy and medium birds of both two strains showed a significantly ($P \leq 0.05$) higher EM than those of light birds by about 0.90 and 1.38 kg/hen of BV and 1.26 and 1.16 Kg/hen of HS, respectively, while no significant differences between heavy and medium birds of each strain were observed.

These results are in agreement with pervious findings of Akanbi and Goodman (1982), Ruiz *et al.,* (1983), Goodling *et al.,* (1984) Leeson and Summers (1987) and Nofal and Hassan (1999) who reported that larger hens produced larger eggs than smaller hens. A significant ($P \leq 0.01$) linear positive increase in egg weight was observed with increasing body weight

(Wilson and Harms, 1986; Nofal *et al.,* 2004; Nofal and Hassan, 2004). Abdel-Ghani (1996) showed that light body weight produced significantly (P≤0.05) less egg mass than those of the other body weight categories. Madrid *et al.,* (1981) and Leeson *et al.,* (1991) showed that the reduced body weight was the association with reduced egg size and overall decline in egg mass production. Leeson *et al.,* (1997) reported that the smaller birds consistently ate less feed throughout lay, regardless of strain and this resulted in loss of egg size. Harms *et al.,* (1982) calculated that a 100-g increase in body size of the pullet at 28 weeks of age results in a 4.5% increase in feed intake and that this is associated with a 1.3-g increase in egg size and about a 1-g increase in daily egg mass. Singh and Nordskog (1982) calculated that a 100-g increase in body size of the pullet at first egg results in a 0.62 to 0.86 g in increase egg weight and a 0.9 to 1.2g in increase egg mass output. But, Nofal *et al.,* (2004) indicated no differences due to size in Gimmizah laying hens on egg mass / hen /day.

Singh and Nordskog (1982) reasoned lower egg mass of the lighter birds, because this class would include more unhealthy birds than the heavier classes. Bish *et al.,* (1985) reported that the light birds of white leghorn produced significantly less total egg mass than did both the medium and the heavy birds. The light birds produced significantly more small and medium eggs than both the medium and large birds, while the medium and large birds produced significantly more large, extra-large and jumbo eggs than did the light birds. Leeson and Summers (1989) also indicated that a 100-g increase in mature body weight size resulted in a 3.5-g increase in daily feed intake and a 1.2-g increase in egg size. Gous and Cherry (2004) reported that heavier body weights at 20 weeks resulted in an increased production of double-yolked eggs.

4- Feed consumption (FC):

The HBV consumed significantly (P≤0.05) more feed than those of MBV and LBV at all ages studied, while the MBV consumed significantly (P≤0.05) more feed than those of LBV during 37-52 and 53-68 weeks of age (Table 8). The overall mean of FC in HBV consumed significantly (P≤0.05) more feed by about 2.5 and 4.4%, respectively as compared with that of MBV and LMV, while the MBV consumed significantly (P≤0.05) more feed by about 2.0% than those of LBV.

The HHS and MHS consumed significantly (P≤0.05) more feed than of LHS at all ages studied except that insignificant ones during 20-36 weeks of age (Table 8). The overall mean of FC in HHS and MHS increased significantly (P≤0.05) by about 2.1 and 1.1%, respectively as compared with that of LHS, while no significant differences between HHS and MHS were observed.

Madrid *et al.,* (1981), Goodling *et al.,* (1984) and Nofal *et al.,* (2004) showed that the heavy birds consumed significantly (P<0.01) more feed than of medium and light ones. Leeson *et al.,* (1997) reported that the smaller birds consistently ate less feed throughout lay. Bish *et al.,* (1985) reported that the heavy birds of white Leghorn consumed significantly more (3.66%) feed/g egg than did the light birds. Singh and Nordskog (1982) reported that a 100-g increase in body size of the pullet at first egg results in a 4 g increase in daily feed consumption. Harms *et al.,* (1982) calculated that a 100-g increase in body size of the pullet at 28 weeks of age results in a 4.5% increase in feed intake. Leeson and Summers (1987, 1989) also indicated that a 100-g increase in mature body weight size resulted in a 3.5-g increase in daily feed intake. Gous and Cherry (2004) showed that each 100 g increment in body weight of Ross broiler breeders at 20 weeks was associated with a significant increase of 0.55 Kg in cumulative feed intake.

5- Feed conversion (FCR):

No significant were found in feed conversion either g feed/ g egg mass (FCRM) or g feed/ 12 eggs (FCRN) among three body weight categories of both BV and HS strains at all ages studied except that significant of FCRN of BV during 53-68 weeks of age (Tables 9 and 10). It was observed that, there were no significant differences in cumulative FCRM and FCRN among three body weight categories of both BV and HS strains. However, the medium birds had insignificantly better cumulative FCRM by about 13.7 and 11.3% of BV and by about 1.7 and 16.8% of HS than those of heavy and light birds, respectively. Also, the medium birds had insignificantly better cumulative FCRN by about 236 and 119 g of BV and by about 29 and 199 g of HS than those of heavy and light birds, respectively.

Nofal and Hassan (2004) showed that feed conversion (g feed / g egg mass) was significantly (P≤0.01) affected by initial body weight category, where heavy birds consumed more feed and gave lower egg mass than medium /or light birds similarly to those obtained by Abdel-Ghani (1996). Harms *et al.,* (1982) and Goodling *et al.,* (1984) showed that the heavier hens were less efficient at converting feed into eggs than the hens of the lower body weight. Similar results reported by Madrid *et al.,* (1981) who reported that feed conversion (g feed/dozen eggs) of heavier body birds was lower than that of the lower body birds. Singh and Nordskog (1982) calculated that a 100-g increase in body size of the pullet at first egg results in 0.03 to 0.04 units increase in feed conversion. The same authors found that feed conversion in the heavy class was significantly the lowest which reflects the higher body maintenance requirement. The medium weight class was the highest in rate of lay.

6- Economical efficiency (EE):

The birds of heavy groups of both BV and HS consumed more feed, thus it had the highest feed cost. The birds of light groups of both BV and HS strains showed highest depreciation costs due to the higher mortality rate, but heavy and medium birds of both BV and HS strains had no mortalities. The MBV and MHS and HHS had higher egg number and net revenue per bird than those of other body weight categories. Also, EE of MBV exceeded by 17.5 and 16.2% compared to HBV and LBV, respectively, while the EE of MHS and HHS exceeded by 18.3 and 14.9%, respectively compared to LHS. The MBV (standard body weight) and MHS and HHS recorded the best EE value as compared with the other body weight categories.

CONCLUSION

From obtained results in this experiment, the medium birds of Bovans brown strain had greater egg production, eggs number, egg mass and exceeded economical efficiency as compared with those of heavy and light birds while, the heavy birds showed a significantly ($P \leq 0.05$) higher egg weight and feed consumption as compared with that of MBV and LBV. But, the heavy and medium birds of Hy-sex brown strain had greater egg production, eggs number, egg weight, egg mass, and increased feed consumption and exceeded economical efficiency as compared with that of light birds. It could be concluded that, the medium birds (standard body weight) of BV and medium and heavy birds of HS recorded the best EE value as compared with the other body weight categories.

Table 1: Average initial body weight (g) at 22 weeks of age of the Bovans brown and Hy-sex brown laying hens strains.

Treatment	Bovans Brown (BB)	Hy-sex Brown (HS)
Heavy	1471 ± 9^{b}	1740 ± 9^{a}
Medium	1323 ± 4^{b}	1647 ± 5^{a}
Light	1236 ± 6^{b}	1547 ± 9^{a}

a-----c Means ± standard error in the same row with different superscripts are significantly different ($P \leq 0.05$).

Table 2: Composition and calculated analysis of the experimental diets.

Ingredients, %	19-36 weeks of age	37-70 weeks of age
Yellow corn	60.40	60.90
Soybean meal (44% CP)	20.0	21.60
Corn gluten meal (60% CP)	8.90	6.00
Vit & Min. Premix*	0.30	0.30
Wheat bran	0.00	0.45
Dicalcium phosphate	1.76	1.36
Calcium carbonate	8.20	8.95
Salt	0.40	0.40
DL-methionine	0.00	0.04
L- lysine	0.04	0.00
Total	**100**	**100**
Calculated analysis:		
ME, Kcal/Kg	2814.00	2766.00
Crude Protein, (%)	19.37	18.45
Crude fiber, (%)	2.59	2.68
Crude fat, (%)	2.80	2.78
Ca, (%)	3.66	3.87
P (Available, %)	0.45	0.38
Lysine, (%)	0.83	0.85
Methionine, (%)	0.44	0.40
Price of ton diet (LE), 2005	**1467**	**1396**

*Vitamins and minerals premix provided per kilogram of the diet: Vit A, 10000 IU; D_3, 2000 ICU; Vit E, 10 mg; Vit K, 1 mg; B1, 10 mg; B_2, 5 mg; *B6, 15000 mg; B12, 10 mg; Pantothenic acid, 10 mg; Nicotinic acid, 30 mg; Folic acid, 1 mg; Biotin, 50 mcg;* Chlorine chloride, 500 mg; copper, 10 mg; iron, 50 mg; *I, 10 mg;* Manganese, 60 mg; Zinc, 50 mg, and selenium, 0.1 mg.

Table 3: The effect of body weight on Hen day egg production (%) of Bovans brown and Hy-sex brown laying hens.

Age (weeks)	Bovans Brown (BV)			Hy-sex Brown (HS)		
	Heavy	Medium	Light	Heavy	Medium	Light
20-36	85.5 [b] ±0.9	90.4 [a] ±0.7	80.2 [c] ±0.9	84.3 [a] ±0.5	82.7 [b] ±0.5	76.9 [c] ±0.7
37-52	84.7 [b] ±0.5	86.4 [a] ±0.5	84.7 [b] ±0.5	85.1 [a] ±1.2	86.2 [a] ±1.5	81.2 [b] ±1.1
53-68	80.3 [b] ±1.1	85.7 [a] ±1.3	81.4 [b] ±1.7	79.5 [a] ±1.0	80.5 [a] ±1.7	75.6 [b] ±0.9
Overall mean	**83.5 [b] ±1.1**	**87.5 [a] ±0.9**	**82.1 [b] ±1.1**	**82.9 [a] ±1.0**	**83.1 [a] ±1.0**	**77.9 [b] ±1.1**

a-------c Means ± standard error within each row within each strain with no common superscripts are significantly different ($P \leq 0.05$).

Table 4: The effect of body weight on Hen housed egg production (%) of Bovans brown and Hy-sex brown laying hens.

	Bovans Brown (BV)			Hy-sex Brown (HS)		
Age (weeks)	Heavy	Medium	Light	Heavy	Medium	Light
20-36	85.5 [b] ±0.9	90.4 [a] ±0.7	80.2 [c] ±0.9	84.3 [a] ±0.5	82.7 [b] ±0.5	76.9 [c] ±0.7
37-52	84.7 [b] ±0.5	86.4 [a] ±0.5	75.5 [c] ±0.6	85.1[a] ±1.2	86.2 [a] ±1.5	81.2 [b] ±1.1
53-68	80.3 [b] ±1.1	85.7 [a] ±1.3	69.8 [c] ±1.4	79.5 [a] ±1.0	80.5 [a] ±1.7	64.8 [b] ±0.9
Overall mean	**83.5 [b] ±1.1**	**87.5 [a] ±0.9**	**75.2 [c] ±1.0**	**82.9 [a] ±1.0**	**83.1 [a] ±1.0**	**74.3 [b] ±1.1**

a-------c Means ± standard error within each row within each strain with no common superscripts are significantly different (P≤ 0.05).

Table 5: The effect of body weight on eggs number/hen of Bovans brown and Hy-sex brown laying hens.

	Bovans Brown (BV)			Hy-sex Brown (HS)		
Age (weeks)	Heavy	Medium	Light	Heavy	Medium	Light
20-36	95.8 [b] ±1.2	101.3 [a] ±1.9	89.8 [b] ±2.5	94.4 [a] ±2.2	92.6 [a] ±1.2	86.1 [b] ±1.4
37-52	94.9 ±2.6	96.7 ±1.9	94.8 ±2.1	95.3 [a] ±1.2	96.5 [a] ±1.6	90.9 [b] ±1.6
53-68	90.0 [b] ±1.2	96.1 [a] ±1.5	91.1 [b] ±1.8	88.9[a] ±1.5	90.2 [a] ±1.9	84.7 [b] ±1.0
Overall mean	**280.7 [b] ±3.6**	**294.1 [a] ±3.1**	**275.7 [b] ±3.7**	**278.6 [a] ±3.4**	**279.3 [a] ±3.4**	**261.7 [b] ±3.7**

a-------c Means ± standard error within each row within each strain
with no common superscripts are significantly different (P≤ 0.05).

Table 6: The effect of body weight on egg weight (g) of Bovans brown and Hy-sex brown laying hens.

	Bovans Brown (BV)			Hy-sex Brown (HS)		
Age (weeks)	Heavy	Medium	Light	Heavy	Medium	Light
20-36	59.5 [a] ±0.2	58.9 [b] ±0.1	56.2 [c] ±0.1	56.5 [a] ±0.2	55.8 [b] ±0.1	55.1 [c] ±0.1
37-52	63.5 [a] ±0.3	61.8 [b] ±0.4	60.7 [c] ±0.3	61.3 [a] ±0.1	61.1 [a] ±0.4	59.6 [b] 0.5±
53-68	65.2 [a] ±0.3	64.1 [b] ±0.1	64.0 [b] ±0.1	62.5 [a] ±0.1	62.5 [a] ±0.1	61.9 [b] ±0.2
Overall mean	**62.7 [a] ±0.2**	**61.6 [b] ±0.2**	**60.3 [c] ±0.3**	**60.0 [a] ±0.2**	**59.8 [a] ±02**	**58.9 [b] ±0.3**

a-------c Means ± standard error within each row within each strain
with no common superscripts are significantly different (P≤ 0.05).

Table 7: The effect of body weight on egg mass (Kg/hen) of Bovans brown and Hy-sex brown laying hens.

	Bovans Brown (BV)			Hy-sex Brown (HS)		
Age (weeks)	**Heavy**	**Medium**	**Light**	**Heavy**	**Medium**	**Light**
20-36	5.73 ^{a} ±0.14	6.00 ^{a} ±0.13	5.14 ^{b} ±0.16	5.41 ^{a} ±0.15	5.20 ^{a} ±0.07	4.88 ^{b} ±0.08
37-52	6.08 ±0.18	6.00 ±0.13	5.79 ±0.14	5.83 ^{a} ±0.11	5.88 ^{a} ±0.09	5.42 ^{b} ±0.11
53-68	5.86 ^{b} ±0.08	6.15 ^{a} ±0.09	5.84 ^{b} ±0.12	5.56 ^{a} ±0.09	5.62 ^{a} ±0.11	5.24 ^{b} ±0.11
Overall mean	**17.67 ^{a} ±0.24**	**18.15 ^{a} ±0.20**	**16.77 ^{b} ±0.26**	**16.80 ^{a} ±0.20**	**16.70 ^{a} ±0.20**	**15.54 ^{b} ±0.24**

a-------c Means ± standard error within each row within each strain
with no common superscripts are significantly different ($P \leq 0.05$).

Table 8: The effect of body weight on feed consumption (g/hen/day) of Bovans brown and Hy-sex brown laying hens.

	Bovans Brown (BV)			Hy-sex Brown (HS)		
Age (weeks)	**Heavy**	**Medium**	**Light**	**Heavy**	**Medium**	**Light**
20-36	112.0 ^{a} ±1.4	108.9 ^{b} ±0.9	106.8 ^{b} ±1.4	115.2 ±1.0	114.2 ±1.1	112.4 ±1.4
37-52	115.5 ^{a} ±0.1	112.6 ^{b} ±0.1	110.5 ^{c} ±0.1	116.6 ^{a} ±0.3	115.5 ^{a} ±0.4	113.9 ^{b} ±0.6
53-68	114.0 ^{a} ±0.1	111.4 ^{b} ±0.2	109.2 ^{c} ±0.1	113.5 ^{a} ±0.3	112.3 ^{a} ±0.4	111.8 ^{b} ±0.1
Overall mean	**113.8 ^{a} ±0.5**	**111.0 ^{b} ±0.5**	**108.8 ^{c} ±0.5**	**115.1 ^{a} ±0.4**	**114.0 ^{a} ±0.4**	**112.7 ^{b} ±0.5**

a-------c Means ± standard error within each row within each strain
with no common superscripts are significantly different ($P \leq 0.05$).

Table 9: The effect of body weight on feed conversion ratio (g feed/ g egg mass) of Bovans brown and Hy-sex brown laying hens.

	Bovans Brown (BV)			Hy-sex Brown (HS)		
Age (weeks)	**Heavy**	**Medium**	**Light**	**Heavy**	**Medium**	**Light**
20-36	2.41 ±0.28	2.13 ±0.14	2.69 ±0.35	2.67 ±0.31	2.64 ±0.04	3.52 ±0.81
37-52	2.62 ±0.48	2.18 ±0.12	2.25 ±0.15	2.29 ±0.09	2.21 ±0.04	2.40 ±0.09
53-68	2.19 ±0.04	2.04 ±0.05	2.13 ±0.07	2.30 ±0.05	2.29 ±0.09	2.41 ±0.06
Overall mean	2.41 ±0.19	2.12 ±0.06	2.36 ±0.13	2.42 ±0.11	2.38 ±0.08	2.78 ±0.28

Table 10: The effect of body weight on feed conversion ratio (g feed/ 12 eggs) of Bovans brown and Hy-sex brown laying hens.

Age (weeks)	Bovans Brown (BV)			Hy-sex Brown (HS)		
	Heavy	Medium	Light	Heavy	Medium	Light
20-36	1692 ±166	1487 ±73	1750 ±174	1758 ±153	1736 ±110	2169 ±392
37-52	1963 ±347	1599 ±69	1629 ±92	1673 ±63	1619 ±35	1708 ±55
53-68	1711 [a] ±35	1573 [b] ±40	1636 [ab] ±54	1726 ±37	1713 ±71	1791 ±43
Overall mean	1789 ±127	1553 ±36	1672 ±67	1719 ±56	1690 ±45	1889 ±133

a-------c Means ± standard error within each row within each strain with no common superscripts are significantly different (P≤ 0.05).

Table 11: Effect of body weight on mortality rat (%) and economical efficiency of Bovans brown and Hy-sex brown laying hens.

Item	Bovans Brown (BV)			Hy-sex Brown (HS)		
	Heavy	Medium	Light	Heavy	Medium	Light
Total feed consumption (20-36 weeks of age), (Kg)	12.544	12.197	11.962	12.902	12.79	12.589
Feed costs (20-36 weeks of age), (LE.)	18.57	18.05	17.70	19.10	18.93	18.63
Total feed consumption (37-68 weeks of age), (Kg)	25.704	25.088	24.606	25.771	25.514	25.278
Feed costs (37-68 weeks of age), (LE.)	35.99	35.12	34.45	36.08	35.72	35.39
Total Feed costs (LE.)	54.55	53.18	52.15	55.17	54.65	54.02
Mortality rate (%)	0.00	0.00	8.00	0.00	0.00	4.8
Depreciation costs (LE.)	0.00	0.00	1.12	0.00	0.00	0.67
Total feed and depreciation costs (LE.)	**54.55**	**53.18**	**53.27**	**55.17**	**54.65**	**54.69**
Total egg number per hen/336	280.7	294.1	275.7	278.6	279.3	261.7
Total eggs price (LE.)	**84.21**	**88.23**	**82.71**	**83.58**	**83.79**	**78.51**
Net revenue per hen	29.66	35.06	29.44	28.4	29.14	23.82
Economical efficiency	0.54	0.66	0.55	0.52	0.53	0.44
Relative economical efficiency (%)	**82.5**	**100**	**83.8**	**96.6**	**100**	**81.7**

Price of egg, 2004 = 0.30 LE. Price of 1 kg feed of 20-36 weeks of age, 2004 = 1.48 LE. Price of 1 Kg feed of 37-68 weeks of age, 2004 = 1.40 LE. LE = gyptian pound. Price of hen at 68 weeks of age = 14 LE.

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الملخص العربي

تأثير وزن الجسم عند عمر ٢٠ أسبوع على الاداء الانتاجى لسلالتى البوفينز البنى والهايسكس البنى لانتاج بيض المائده

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أجريت هذه الدراسة على مائتين واثنين وخمسون دجاجه احلال من سلالتىالبوفينز البنى والهايسكس البني لانتاج بيض المائده عند عمر ٢٠ اسابيع واشتملت كل سلاله على مائه وسته وعشرون دجاجه وقسمت دجاجات كل سلاله حسب وزن الجسم (المتوسط ± الانحراف القياسى) الى ثلاثه مجاميع (٤٢ دجاجه بكل مجموعه).

الاولى: وزن الجسم الثقيل (١٤٧١ ، ١٧٤٠ جرام)، والثانيه: وزن الجسم المتوسط (١٣٢٣، ١٦٤٧جرام)، والثالثه: وزن الجسم الخفيف (١٢٣٦، ١٥٤٧ جرام) فى سلالتى البوفينز البنى والهايسكس البنى على التوالى. وقسمت دجاجات كل مجموعه الى ٦ مكرارت (٧ طائر فى كل مكرره). وربيت الدجاجات فى بطاريات حتى عمر ٦٨ اسبوع.

يمكن تلخيص النتائج المتحصل عليها كالتالي:

اظهرت الطيور متوسطه الوزن لسلاله البوفينز البنى (الوزن القياسى للسلاله) اعلى معنويا ($P \leq 0.05$) فى انتاج بيض (HDP) بحوالى ٤ ، ٥,٤% ، وHHP بحوالى ٤، ١٢,٣%، وعدد بيض بحوالى ١٣,٤، ١٨,٤ بيضه، وكتله بيض بحوالى ٠,٩، ١,٣٨ كجم/دجاجه، وزياده الكفاءه الاقتصاديه بحوالى ١٧,٥، ١٦,٢% مقارنه بتلك الطيور ثقيله وخفيفه الوزن على التوالى. وكانت الطيور ثقيله الوزن الوزن لسلاله البوفينز البنى اعلى معنويا ($P \leq 0.05$) فى وزن البيضه

بحوالى ١,٨، ٢,٤%، والغذاء المستهلك بحوالى ٢,٥، ٤,٤%، مقارنه بتلك الطيور متوسطه وخفيفه الوزن على التوالى.

ولقد وجد أن الطيور ثقيله ومتوسطه الوزن لسلاله الهايسكس البنى اعلى معنويا ($P \leq 0.05$) فى انتاج بيض (HDP) بحوالى ٥,٠، ٥,٢%، و HHP بحوالى ٨,٦، ٨,٨%، وعدد بيض بحوالى ١٦,٩ ، ١٧,٦ بيضه، ووزن البيضه بحوالى ١,٨، ١,٥ %، وكتله البيض بحوالى ١,٢٦، ١,١٦ كجم/دجاجه، والغذاء المستهلك بحوالى ٢,١، ١,١%، وزياده الكفاءه الاقتصاديه بحوالى ١٤,٩، ١٨,٣% على التوالى مقارنه بتلك الطيور خفيفه الوزن.

ولم توجد اي اختلافات معنويه فى كفاءه التحويل الغذائي (جرام غذاء/ جرام كتله بيض، أو جرام غذاء / ١٢ بيضه) مابين مجاميع الاوزان المختلفه الثلاثه لكلا من سلالتى البوفينز البنى والهايسكس البنى. ولم يحدث نفوق للطيور الثقيله وخفيفه الوزن لكلا من سلالتى البوفينز البنى والهايسكس البني، بينما كانت نسبه النفوق ٨,٠، ٤,٨ % للوزن الخفيف لسلالتى البوفينز البنى والهايسكس البني على التوالى.

بصفه عامه نستخلص ان الطيور متوسطه الوزن لسلاله البوفينز البنى (الوزن القياسى للسلاله) والطيور متوسطه وثقيله الوزن لسلاله الهايسكس البنى سجلت احسن كفاءه اقتصاديه مقارنه مع الاوزان الاخري.