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# Influence of season and stocking density on productivity and profitability of some broiler breeds under Egyptian conditions

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**Abstract**

The present study aimed to identify the variables that are most influential in the profitability of intensive production of broiler chicken in order to achieve the level of economic efficiency and optimal profit resulting in increased broiler chickens production business.

Total 67 broiler cycles were selected from different poultry farms on EL- Qalyubia and El Menofia governorates in the period from 2016 to 2017 to evaluate the effects of different breeds, seasons and stocking densities on productive traits and economic efficiency measures. Data obtained revealed that, Season had significant effect on different productive traits as final body weight, BWG were higher in winter than summer for Ross, Hubbard and Indian River (2294.10±27.12, , 2125.00 ±14.43 and 2100.00±76.38 gm, respectively), for feed consumption was higher in summer season than winter season on Cobb, Hubbard and Indian River breeds (3737.50±49.16, 3975.00±25.00 and 3514.50±75.99 gm, respectively), these productive traits reflected on economic efficiency measures as feed cost increased in summer season than winter season, while TC and TVC was lower in summer than winter but total return (LE 53.24±0.98, 55.35±1.91, 48.24±0.28 and 58.22±3.46 for Ross, Cobb, Hubbard and Indian River, respectively) and net profit increased in all breeds in winter season than summer season (11.60±1.00, 14.38±1.77, 10.27±0.38 and 18.17±2.90 for Ross, Cobb, Hubbard and Indian River, respectively) due to improved BW and BWG in winter than summer. On the other hand, we found stocking density had a significant effect among different breeds, for Ross and Cobb breed had a higher BW, BWG and feed consumption in density level 10-12 bird/ $m^2$ than 8-10 bird/ $m^2$ on the contrary to that, Indian River had lower BW, BWG and feed consumption on density10-12 bird/$m^2$. These productive measures reflected on economic measures as feed cost was higher in Cobb and Ross in density level 10-12 bird/ $m^2$. While increasing stocking density resulted in lowering TC for Cobb and Indian River. For profitability measures as total return, net profit and BCR were the highest in Indian River at level 8-10 bird/ $m^2$ but for Cobb and Ross were higher in high density level 10-12 bird/ $m^2$. We found that breed effect on BW and BWG were higher in Ross and Cobb than Indian River and the lowest found in Hubbard breed, for profitability measures as return from bird, total return and net profit and BCR, the highest value recorded in Cobb breed followed by Ross breed then Indian River and the lowest value in Hubbard breed. It could be concluded that season, stocking density and breeds considered important factors affecting production and profitability of broiler chicken under Egyptian condition.

***Keywords:*** *Season, stocking density, broiler breeds, productivity, profitability.*

## Introduction

Broiler industry is considered to be one of the most profitable agro-industries, which can effectively solve the problems of unemployment and underemployment in the rural areas, particularly of small and marginal farmers **(Balamurugan and Manoharan, 2013)**. The sector of broiler production considered the main sources of animal protein in Egypt often connected to other industries such as animal feed, medicine and veterinary inputs This sector worth about 18 billion Egyptian pounds, works out to about 2.5 million workers between permanent and temporary workers about an important contribution in the value of livestock production in Egypt, as **(El Nagar and Ibrahim, 2007).**

Broiler industry under a wide range of climatic conditions can be adopted, Environmental factors especially season (temperatures and humidity) influence the rearing of poultry strains (**Zaghri *et al.* 2011**) as markedly affect production performances like growth, feed utilization, meat yield and survivability of broilers chicken due to adverse ambient temperatures **(Zahraa, 2008)**. Moreover, season also may had obvious effect on total medicament and ration consumed of the broiler production **(Attallah *et al.,* 1997)** and other variables affecting economic and productive efficiency in broiler farms under Egyptian conditions **(Omar, 2003).** So, controlling the broiler production environment plays a fundamental role in achieving high productivity, in a relatively small space and time **(Dawkins *et al.,* 2004)**.

furthermore, other factors like stocking density which has a major impact on animal production, as it affects productivity, animal welfare, farm profitability and ensure proper return on investment that meet production targets **(Richard, 2005)**. The higher densities is a management practice used to maximize profits through the fixed costs, housing, labor, fuel and equipment, over a large number of production units **(El Deek and Al Harthi, 2004).** On the other hand, high stocking density will impair the house environment, exert stress on the birds, and will have a negative influence on their health, productivity and welfare. So, most of the countries in the world, in order to protect and preserve the welfare of poultry, limit the maximum number of broilers' meat production by regulations and standards **Mitrovi *et al.,* (2010).**

Fast and rapid production with the lowest possible costs is the top priority of modern poultry industry. The choice of broiler chickens is built to achieve a higher live body weight over a shorter period, with low feed costs, mortality and good slaughter characteristics **(Stringhini *et al.,* 2003)**. Modern poultry meat production requires ongoing efforts to improve economic efficiency in conjunction with meeting business needs for a new product type that meets customer needs **(Pavlovski *et al.,* 2009).** So the aim of our research is to determine effect of different environmental factors like season, Genetic factors like, breeds and manage mental factors like density on production performance traits (body weight, body weight gain, feed intake, feed conversion rate, mortality % and broiler index) and economic efficiency measures (different costs, different returns and benefit cost ratio) of Egyptian broiler breeds.

## Materials and Methods

This study was done on 67 broiler cycles on different broiler breeds include Ross, Cobb, Hubbard and Indian River on EL Qalyubia and El Menofia governorates during period from 2016 to 2017.

The data were collected from records which available in poultry farms of the study areas and also, by using the structured questionnaires methods according to (**Koknaroglu and Atilgan, 2007 and Ali *et al.,* 2015).**

### A. Types of collected data:

**Productive and managemental data** :that included breed, average initial body weight, final body weight, body weight gain (BWG), feed intake (gm) during the cycle(FI), feed conversion rate (FCR) number of bird at beginning and at end of the cycle, floor space, Cycle Period, locality and season.

**Production costs:** It included total fixed costs depreciation of the equipment's and the building. The variable costs which include the cost of total veterinary management (prices of drugs, vaccines, disinfectants, and veterinary supervision), feed cost, chick price, labor, litter cost, fuel, water cost and electricity cost **(Attallah, 2000).**

**Production returns:** It included the returns from the birds and return from litter at end of production cycle per /bird.

**Classification of data:**

**Data classified according to season (Ali *et al.*, 2015)**

Class 1 summer season (from 21 March to 20 September).

Class 2 winter season (from 21 September 20 March).

**2- Data classified according to stocking density (Dabi, 2017)**

Class 1 from 8-10 bird/$m^2$

Class 2 from 10-12 bird/$m^2$

**C.- Economic and productive data calculation:**

**1. Productive data calculation:**

The feed intake (FI) was calculated by dividing the total amount of feed consumed in grams during the cycle by the number of chicks of this cycle**.** The gain in body weight (BWG) was calculated by subtracting the initial body weight from final body weight. Feed conversion ratio (FCR) was calculated by dividing the amount of feed consumed in grams (by a chick) during the cycle by the weight gain in grams during the same cycle **(Lambert *et al.*, 1936)**. Relative growth rate (RGR) (expressed in percentage) was calculated according to **Crampton and Lioyd (1959)** using the following formula:

$$RGR= \frac{w1-w2}{1/2(w2+w1)} \times 100 \quad \frac{w1-w2}{1/2(w2+w1)} \times 100$$

Where: W1 = Body weight at the beginning of week or period. W2 = Body weight at the end of week or period.

EBI (European Broiler Index) according to (**Marcu *et al.*, 2013)**

$$EBI= \frac{\text{Viability (\%)} \times \text{ADG} \left(\frac{\frac{g}{chick}}{day}\right)}{\text{FCR (kg feed/kg gain)} \times 10} \quad \frac{\text{Viability (\%)} \times \text{ADG} \left(\frac{\frac{g}{chick}}{day}\right)}{\text{FCR (kg feed/kg gain)} \times 10} \quad \frac{\text{Viability (\%)} \times \text{ADG} \left(\frac{\frac{g}{chick}}{day}\right)}{\text{FCR (kg feed/kg gain)} \times 10} \times 100$$

Where: ADG= Average daily gain

FCR= Feed conversion rate

Mortality rate was estimated according to **Vetter and Matthews (1999)**

**<u>2. Economic data calculation:</u>**

1. Average total costs per Egyptian pound = average total fixed costs + average total variable costs **(Atallah, 1994**).
2. Average total variable costs per Egyptian pound = feed cost + chick value + labor + water and electricity +fuel+ total veterinary management + litter cost. **(Eman and Liza, 2016**).
3. Average fixed costs per Egyptian pound = depreciation for equipment costs and depreciation of building by the straight line method according to **(Sankhayan, 1983)**.
4. Average total returns per Egyptian pound = return from birds (average final body weight (gm) *market price (gm) + return from litter **(Eman and Liza, 2016).**
5. Average net profit = average total returns – average total costs **(Atallah, 1994).**
6. Benefit cost ratio (BCR) = total return per each bird / total cost per each bird.

**D. Data analysis:-**

The data were collected, arranged, summarized and then analyzed statistically using the Spss software program **SPSS/PC$^+$ version 16**

**Statistical analyses methods:-**

The data were analyzed using relevant statistical methods of data analysis, namely:

1**. Univariant, General linear model (GLM) for analysis of variance (ANOVA):-**

This statistical model was constructed to determine the effect of the season and breed interaction and density and breed interaction on the productive and economic variables according to the following equation **(Steel and Torrie, 1981).** Significance was done using Duncan's multiple range test (DMRT) by MSTAT program.

**2. One way ANOVA**

One way ANOVA was used to determine means of variables among different breeds and significance was done using Duncan's multiple range test (DMRT)

## Results and Discussion

### Effect of different season among different breeds on productive traits.

Result Table (1) represent Initial Weight, Cycle Period, Final Weight, body weight gain (gm), Daily gain, Relative growth rate % (RGR), Feed consumption, Feed conversion rate (FCR), European broiler index (EBI) and Mortality% among different season of different breeds.

Highest averages of initial body weight were found in summer season of Ross, Cobb and Indian River breeds. Hubbard breed in summer season had longest Cycle Period (43.25±0.48). Final body weight was higher in winter season of Ross, Hubbard and Indian River breeds than in summer season. Highest values of final body weight were recorded in winter season of Ross breed (2294.10±27.12gm), while lowest value was recorded in summer season of Hubbard breed. BWG and daily gain was higher in winter season of Ross, Cobb and Hubbard breeds, the highest values were 2254.70±27.22 gm and 55.84±1.45, respectively in winter season of Cobb breed. These results come in accordance with **Osti *et al.* (2017)** who reported that final body weight and total weight gain was significantly affected by the seasons of the year, with final body weight higher in the winter than in the summer**.** Body weight decreased significantly during summer seasons as the feed consumption and feed efficiency was reduced **(Talaat, 2002)**. The high body weight during winter as compared to other seasons might be due to comfortable condition inside poultry house giving favorable microclimatic condition for broiler and higher feed intake resulted in higher body weight gain **(Ali *et al.*, 2015).** Also, **Koknaroglu and Atilgan (2007)** who said that live weight gain per carcass in summer were lower than in winter, this may due to lower energy ratio for protein energy output in summer than winter.

Feed consumption had a significant difference (P≤0.05) between summer and winter season in Cobb and Indian River breeds, while there was non-significant difference between seasons in Ross and Hubbard breeds. Feed consumption in winter was higher in Ross, Cobb and Indian River breeds than in summer season. The present results were similar with those reported by **Koknaroglu and Atilgan (2007)** who found the lowest feed consumption and live weight gain of broilers in summer. Low feed consumption during winter could be due to increased $CO^2$, ammonia, and other pollutants associated with decreased ventilation **(Atilgan, 2000)**.

FCR was better in winter of Ross, Hubbard and Indian River breed (1.69±0.03, 1.89±0.03 and 1.61±0.05, respectively) than in summer (1.75±0.02, 2.09±0.06 and 1.73±0.02, respectively). EBI showed a non-significant difference between seasons in Ross, Cobb and Indian River breeds. The highest value of EBI was recorded in winter season of Ross, Hubbard and Indian River breeds (296.12±4.96, 236.68±1.69 and 313.37±22.39 respectively). The results obtained were in consistence with the findings of **Osti *et al.*, (2017)** who found that FCR was better in winter (1.83) than in the summer (1.89). While, **Imaeda (2000)** indicated that feed conversion efficiency was nearly constant during summer and winter.

Mortality rate was higher in winter season than in summer season for all breeds. These results agree with **Osti *et al.*, (2017)** who found low mortality on summer than winter.

### Effect of different season among different breeds on Economic Efficiency parameters (LE per bird).

Results in table (2) represent total veterinary management ( TVM), feed cost, total fixed cost (TFC), total variable cost (TVC), total cost (TC), return from bird, return from litter, total return, net profit and benefit cost ratio showed significant difference (P<0.05) among different seasons of different breeds. Concerning, TVM the higher value found in Ross breed (LE 6.38±0.20 and 6.35±0.25 for summer and winter season), In contrast, Cobb, Hubbard and Indian River breed showed increased in TVM in winter season than summer which recorded the lowest value in Hubbard breed (LE 5.03±0.17), this result comes in agreement with **(Atallah *et al.,* 1997)** who found that total medication cost was higher in winter season compared to summer season.

Regarding feed cost the higher value found in summer season of Hubbard breed (LE 24.84±1.09) and in winter season of Ross breed (LE 24.80±0.42) and the lowest value found in Indian River breed during winter season (LE 20.79±0.18) this fluctuations among different seasons attributed to unstable broiler market **(Tohura, 2004)**. Regarding total variable cost (TVC) and total cost (TC) increased in winter season than summer season of different breeds as the highest value found in winter season of Ross breed (LE 41.04±0.96) and the highest value of TC found on winter season of Ross breed (LE 41.63±0.91) while the lowest value recorded in Hubbard breed during summer season (LE37.93 ±1.30) this due to total cost increased as environmental temperature decreased, as during winter season requiring more energy for brooding **(Koknaroglu and Atilgan, 2007).**

Winter season achieved higher return from bird sale ,total return ,net profit and benefit cost ratio among different breed, additionally the highest value recorded in Indian River breed during winter season (57.50±3.42, 58.22±3.46, 18.17±2.90 and 1.45±0.07 for return from bird, total return ,net profit and BCR, respectively) and the lowest value recorded in summer season of Hubbard breed (LE 42.40±1.56, 42.79±1.57, 4.85 and 1.13±0.05 for return from bird, total return, net profit and BCR respectively), this result in agreement with **(Rahman *et al.,* 2003 and Ali *et al.,* 2015)** they found that profitability measures as total return and net profit were increased in winter season than summer season due to improved performance and also due to market price was found to be the highest in winter season compared to summer season resulted in higher sale value **(Ramdur *et al.,* 2010 and Ali *et al.,* 2015)**.

**Effect of different stocking density among different breeds on productive traits.**
Result in table (3) showed Initial Weight, Cycle Period, Final Weight, Body weight gain (gm), Daily gain, Relative growth rate % (RGR), Feed consumption, Feed conversion rate (FCR), European broiler index (EBI) and Mortality% among different stocking density of different breeds.

Stocking density is a very important welfare factor which directly and indirectly affects growth performance of chicken **(Skrbic *et al.,* 2009)**. Regarding, final body weight showed a significant difference among different level of stocking density of Cobb and Indian River breed. Density level had a significant effect on BWG of Cobb and Indian River breeds. Highest values of BWG were recorded for higher stocking density (10-12 bird/ $m^2$) of Ross and Cobb breeds (2237.80±39.57 and 2223.90±35.69, respectively). Regarding, daily gain, it was significantly affected, higher value recorded in broiler of lower density level (8-10 bird/$m^2$) of Ross, Cobb and Indian River breeds (54.02±0.50, 54.65±1.18 and 56.26±0.51, respectively) than in those of higher density level. This results in agreement with **Nahashon *et al.,* (2009)** who indicated higher body weight gain in broiler of 12 bird /$m^2$. On the contrary to the present findings, **Ravindran *et al.,* (2006)** who observed a non significant difference in the final weight of broiler chickens raised on different stocking density levels.

Concerning, relative growth rate showed a non -significant difference between different levels of stocking density of Ross and Cobb, while in Indian River breed there was significant difference which come in the accordance with **Silas *et al.,* (2014)** who reported that stocking density had no significant effect on the growth performance. Stocking density level had a non significant effect on feed consumption of Ross and Cobb breeds. Higher EBI was 315.11±9.43 which recorded in higher density level of Cobb breed. These results confirm those reported by **Adeyemo *et al.,* (2016)** who found that stocking density had no significant effect on total feed intake. While, **Iyasere *et al.,* (2012)** found that increased stocking density reduced feed intake.

In respect to FCR, there was no significant difference of FCR among different stocking density levels of Ross, Cobb and Indian River breeds. These results were similarly to **Sekeroglu *et al.*, (2011)** who recorded that there was no effect of stocking density on FCR. However, **Ravindran *et al.*, (2006)** reported that increasing stocking density of broiler adversely affected FCR. There was a negative consequence of high stocking on FCR **(Estevez, 2007)**. Contrary to this result **Sekeroglu *et al.*, (2011)** reported that there was no effect of stocking density on FCR. Stocking density had no significant effect total feed intake and feed conversion rate **(Adeyemo *et al.*, 2016).**

In our study, stocking density had a significant effect on mortality % of Cobb and Indian River breeds, the higher mortality % was reported in lower density level of these breeds. The observed lower mortality at the higher stocking densities may be a consequence of good husbandry and health management in the broiler farm **(Adeyemo *et al.*, 2016)**. On other hand, **Feddes *et al.*, (2002) and Adeyemo *et al.*, (2016)** reported that stocking density had no effect on mortality rates.

**Effect of different stocking density among different breeds on Economic Efficiency parameters (LE per bird).**
Result in table (4) showed total veterinary management (TVM), feed cost, total fixed cost (TFC), total variable cost (TVC), total cost (TC), return from bird, return from litter, total return, net profit and benefit cost ratio among different stocking density of different breeds.

Regarding, TVM was significantly differed among different density levels, for Ross and Cobb breed we noticed that TVM increased with increasing density level and the highest value found in higher density level of Ross breed (LE 6.94±0.24). Concerning, Feed cost increased in Ross and Indian River breed with increasing density level above 10 birds /m$^2$ and the highest value found in Ross breed (LE 25.64±0.33) in higher density level above10 birds/m$^2$. This result in agreement with **Sirri *et al.*, (2007)** as they have reported increased feed intake with increasing stocking density which resulted in increased feed costs.

Concerning, TVC and TC showed a significant difference on Ross breed with different level of density and attain higher value on Ross breed with higher density level 10-12 bird/m$^2$ (LE 43.21±0.65and 43.54±0.65 for TVC and TC, respectively). While, in Cobb breed and Indian River breed showed decreasing TVC and TC with increasing density. For results of Cobb and Indian River breed in agreement with **(El Deek and Al Harthi, 2004)** who found reducing total variable costs associated with reducing labor, fuel, and equipment's costs with higher density.

Regarding, return from bird, return from litter, total return (TR), net profit and benefit cost ratio (BCR) were significantly differed (P≤0.05) among different breeds and the highest value found in Indian River breed of low density level 8-10 bird/m$^2$ (LE 57.04±1.05, 57.70±1.06, 16.78±1.18 and 1.41±0.02 for return from bird, TR, Net profit and BCR, respectively) this results in agreement with **Bandyopadhyay *et al.*, (2006),** as they observed a decrease in body weight with increased stocking density above 10/m$^2$ which resulted in decrease total return. These results disagree with **Gupta *et al.*, (2015)** who found that body weight was higher in group contains (12 birds/m$^2$) than 8 birds/m$^2$.

Effect of different stocking density among different breeds onproductive traits (kg per unit m$^2$) and Economic Efficiency parameters (LE per unit m$^2$).

Results in table (5) represent productive traits (feed amount, body weight gain, and yield) per unit m$^2$ and economic efficiency parameters (total return, total cost and net profit) per unit m$^2$.

Regarding, Feed amount per kg/m$^2$, body weight gain kg/m$^2$ and yield kg/m$^2$ were significantly differ (P≤0.05) among different stocking density levels of Ross and Cobb breeds. Higher values observed in higher density level (41.55±1.36, 23.85±0.67 and 24.27±0.68, respectively for Ross breed &37.87±0.45, 22.66±0.46 and 23.11±0.46, respectively for Cobb). Similarly, **Feddes *et al.,* (2002)** also reported that yield kg/$m^2$ was affected by stocking density and also increased with higher stocking densities.

Concerning, total return and total cost (per unit $m^2$) changed significantly ($P \leq 0.05$) with change stocking density as increased with increasing stocking density in most breeds and the highest values recorded in Ross breed in range (10-12bird/$m^2$) were LE 573.12±14.46 and 463.49±10.20 for TR/$m^2$ and TC/$m^2$, respectively, and the lowest value found in range 8- 10 bird / $m^2$ in Hubbard breed (374.98±11.32 and 312.45±4.07 for TR and TC, respectively). Net profit was increased with increasing stocking density in Cobb and Ross breed but in Indian River decreased with increasing density which mainly due to fluctuation in market price **(Tohura, 2004)** also in agreement with **El Deek and Al Harthi (2004)** and **Estevez (2007)** who indicated that total return increased as the number of bird per unit space increases. And **Ghosh *et al.,* (2012)** who found increasing total return and net profit with increasing stocking density.

**Effect of different breeds on different productive variables (per bird).**

Result in table (6) showed Initial Weight, Cycle Period, Final Weight, Body weight gain (gm), Daily gain, Relative growth rate % (RGR), Feed consumption, Feed conversion rate (FCR), European broiler index (EBI) and Mortality% among different breeds.

Breed had significant effect on Cycle Period, longest cycle (41.88±0.69) was found in Hubbard breed. There was significant difference of initial weight between different breeds, the heaviest initial weight was found in Indian River breed (46±1.89) and lightest initial weight recorded in Hubbard breed (39.50±0.19). Regarding, Feed consumption significantly differ with different breeds, the highest value was 3962.50±18.30 for Hubbard and lowest value was 3468.60±64.14 for Indian River breed. Regarding, Ross breed had higher values of final weight, BWG and RGR (2252.40±23.90, 2212.80±23.99 and 193.07±0.09, respectively), while Hubbard breed had the lowest values (2037.50±40.92, 1998.00±40.94 and 191.30±0.46, respectively).

Moreover Breed had a significant effect on final body weight, but there was a non significant difference of final weight between Ross and Cobb. Similarly, **Fernandes *et al.,* (2013)** observed a significant difference of final live weight among Ross, Cobb, Hubbard and Arbor Acres breeds. These results were opposite to those found by **Hristakieva *et al.,* (2014)** who reported a significant difference of final weight between Cobb and Ross, and Cobb breed attained higher average live weight than that of Ross.

Hubbard breed showed lowest daily gain (47.88±1.58) and highest FCR (1.99±0.05). Cobb breed provided better FCR (1.69±0.02) than other breed. Also, **Hossain *et al.,* (2011)** also reported that Cobb- 500 strain provide better FCR than other strain in Bangladesh. Cobb-500 provided significantly better FCR (1.39) followed by Hubbard Classic (1.44), Lohman Meat (1.51) and Ross Broiler (1.64) **(Husna *et al.,* 2017)**. In support of the present study, **Amao *et al.,* (2011)** reported a significant genetic difference in body weight, average daily gain, feed intake, and feed conversion ratio among Ross, Anak, and Marshall Strains of broiler chickens. On the contrary, **Udeh *et al.,* (2015)** reported that genotypes did not differ significantly in body weight, body weight gain, feed intake, and mortality rate.

Breed had significant effect on mortality% as the highest percent was reported in Hubbard breed (12.52±0.52). Moreover, Hubbard breed had the lowest EBI (212.04±10.62) than other breed. On contrary, **Hossain *et al.,* (2011)** and **Husna *et al.,* (2017)** stated that there were no significant differences ($P>0.05$) on mortality % in different strains of broiler.

**Effect of different breeds on different economic variables (LE/bird).**

Results in table (7) showed that TVM had a significant difference ($P \leq 0.05$) among different breeds and the highest value recorded on Ross breed (LE 6.36±0.17) and the lowest value found on Hubbard breed (LE 5.19±0.14). Regarding, Feed cost showed non-significant difference among Ross, Cobb, Hubbard breed and was higher in them than Indian River which achieved the lowest value (LE 21.97±0.40) this due to Indian River consumed the lowest amount of feed as the cost of feed correlated with feed consumption, so production inputs that need to be reduced is the feed **(Sunarno *et al.,* 2017).** Furthermore, breeds had significant effect on total feed consumption and total veterinary management cost and was lower in Hubbard breed compared to Cobb breed this results in accordance with **(Omar, 2003).** Concerning TVC and TC showed a significant difference among different breeds and the highest value found in Ross breed (40.75±0.65and 41.32±0.61 for TVC and TC, respectively) and the lowest value found in Hubbard breed (37.64±0.60 and 37.95±0.60 for TVC and TC, respectively). These changes in cost parameters which affect profitability attributed to fluctuation of market price of broilers **(Raha, 2007).**

Regarding, different return parameters as return from bird, total return an net profit and BCR ,the highest value recorded in Cobb breed followed by Ross breed then Indian River and the lowest value in Hubbard breed (return from bird LE 53.19±1.43,51.86±0.81, 49.98±2.08 and 45.10±1.26 for Cobb, Ross, IR and Hubbard breed, respectively), total return (LE 53.96±1.43, 52.60±0.82, 50.64±2.09 and 45.51±1.27 for Cobb, Ross, IR and Hubbard breed, respectively), net profit (LE 13.51±1.22,11.28±0.80, 11.33±1.76 and 7.56±1.29 for Cobb, Ross, IR and Hubbard breed, respectively) and BCR (LE 1.33± 0.03,1.28±0.02, 1.28±0.04 and 1.20±0.03 for Cobb, Ross, IR and Hubbard breed, respectively). The differences of the live weight which affect the total return and net profit among different broiler breeds due to different factors, as genotype, feed, sex, strains, change in environmental conditions **(Korver *et al.,* 2004)**. These results confirm those reported by **Eman and Liza (2016)** they found that total cost, total return, net profit and BCR were higher in Cobb breed than Ross breed**.** Also these results come in accordance with **Asmaul *et al.,* (2017)** who reported that Cobb strain seemed to be the most economical breed to rear among the four broiler strains they reared.

**Conclusion**

We concluded that season, stocking density and breeds considered important factors affecting production and profitability of broiler chicken under Egyptian condition. Final body weight and BWG of Ross, Hubbard and Indian River breeds were higher in winter season than in summer. Profitability measures (as total return and net profit) were increased in winter season than summer in all breeds. Final body weight and BWG were higher at stocking density level of (10-12 bird/$m^2$) in Cobb and Ross breed. But Indian river breed had highest final body weight and BWG at stocking density level of (8-10 bird/$m^2$) and succeed to obtained highest profitability measures in terms of total return and net profit.

**Table (1).** Effect of different season on productive traits (per bird) among different breeds.

| Variables | Ross | | Cobb | | Hubbard | | Indian River | |
|---|---|---|---|---|---|---|---|---|
| | Summer | Winter | Summer | Winter | Summer | Winter | summer | winter |
| | Mean ±SE | Mean ±SE | Mean ±SE | Mean ±SE | Mean ±SE | Mean ±SE | Mean ±SE | Mean ±SE |
| **Initial weight** | $39.83^{c}\pm$ 0.32 | $39.41^{c}\pm$ 0.29 | $43.96^{ab}\pm$ 1.22 | $40.50^{bc}\pm$ 0.65 | $39.50^{c}\pm$ 0.29 | $39.50^{c}\pm$ 0.29 | $47.27^{a}\pm$ 2.22 | $41.33^{bc}\pm$ 1.86 |
| **Cycle Period** | $42.42^{ab}\pm$ 0.82 | $41.41^{ab}\pm$ 0.51 | $41.08^{ab}\pm$ 0.50 | $38.00^{d}\pm$ 0.00 | $43.25^{a}\pm$ 0.48 | $40.50^{bc}\pm$ 0.87 | $36.82^{d}\pm$ 0.63 | $38.67^{cd}\pm$ 0.33 |
| **Final Weight** | $2193.20^{ab}\pm$ 38.18 | $2294.10^{a}\pm$ 27.12 | $2265.00^{a}\pm$ 39.14 | $2162.50^{ab}\pm$ 55.43 | $1950.00^{c}\pm$ 50.00 | $2125.00^{b}\pm$ 14.43 | $2081.40^{b}\pm$ 45.91 | $2100.00^{b}\pm$ 76.38 |
| **BWG** | $2153.40^{abc}\pm$ 38.28 | $2254.70^{a}\pm$ 27.22 | $2221.00^{ab}\pm$ 38.68 | $2122.00^{abc}\pm$ 55.25 | $1910.50^{d}\pm$ 50.17 | $2085.50^{bc}\pm$ 14.15 | $2034.10^{cd}\pm$ 47.25 | $2058.70^{c}\pm$ 74.97 |
| **Daily gain** | $50.92^{c}\pm$ 1.08 | $54.51^{ab}\pm$ 0.66 | $54.10^{abc}\pm$ 0.88 | $55.84^{a}\pm$ 1.45 | $44.21^{d}\pm$ 1.47 | $51.54^{bc}\pm$ 0.75 | $55.24^{a}\pm$ 0.86 | $53.22^{abc}\pm$ 1.50 |
| **RGR** | $192.84^{ab}\pm$ 0.15 | $193.23^{a}\pm$ 0.11 | $192.38^{ab}\pm$ 0.20 | $192.63^{ab}\pm$ 0.19 | $192.04^{b}\pm$ 0.25 | $192.70^{ab}\pm$ 0.00 | $191.03^{c}\pm$ 0.56 | $192.28^{ab}\pm$ 0.21 |
| **Feed consumption** | $3766.70^{abc}\pm$ 78.66 | $3814.70^{ab}\pm$ 48.65 | $3737.50^{bc}\pm$ 49.16 | $3575.00^{cd}\pm$ 47.87 | $3975.00^{a}\pm$ 25.00 | $3950.00^{ab}\pm$ 28.87 | $3514.50^{d}\pm$ 75.99 | $3300.00^{e}\pm$ 28.87 |
| **FCR** | $1.75^{c}\pm$ 0.02 | $1.69^{cd}\pm$ 0.02 | $1.69^{cd}\pm$ 0.03 | $1.69^{cd}\pm$ 0.05 | $2.09^{a}\pm$ 0.06 | $1.89^{b}\pm$ 0.03 | $1.73^{c}\pm$ 0.02 | $1.61^{d}\pm$ 0.05 |
| **EPI** | $271.64^{b}\pm$ 7.79 | $296.12^{ab}\pm$ 4.96 | $311.32^{a}\pm$ 9.38 | $307.70^{a}\pm$ 20.30 | $187.41^{d}\pm$ 10.91 | $236.68^{c}\pm$ 1.69 | $306.16^{a}\pm$ 8.14 | $313.37^{a}\pm$ 22.39 |
| **Mortality %** | $6.90^{bc}\pm$ 0.60 | $8.16^{b}\pm$ 0.75 | $3.43^{d}\pm$ 0.30 | $7.55^{b}\pm$ 1.80 | $12.03^{a}\pm$ 0.88 | $13.00^{a}\pm$ 0.58 | $4.36^{cd}\pm$ 0.87 | $5.89^{bcd}\pm$ 1.57 |

BWG (body weight gain), RGR (Relative growth rate), FCR (feed conversion rate), EBI (European broiler index )

$^{(a-b-c-d)}$ Means within the same row carrying different superscript significantly differed at ($P\leq0.05$) among different seasons.

**Table (2).** Effect of different season on Economic Efficiency parameters (LE per bird) among different breeds.

| Variables | Ross | | Cobb | | Hubbard | | Indian River | |
|---|---|---|---|---|---|---|---|---|
| | Summer | Winter | Summer | Winter | Summer | Winter | Summer | Winter |
| | Mean ±SE | Mean ±SE | Mean ±SE | Mean ±SE | Mean±SE | Mean±SE | Mean ±SE | Mean ±SE |
| **TVM** | $6.38^{a}\pm$ 0.20 | $6.35^{a}\pm$ 0.25 | $5.57^{bc}\pm$ 0.08 | $6.36^{a}\pm$ 0.37 | $5.03^{c}\pm$ 0.17 | $5.35^{bc}\pm$ 0.20 | $5.43^{bc}\pm$ 0.07 | $5.97^{ab}\pm$ 0.52 |
| **Feed Cost** | $24.35^{ab}\pm$ 0.51 | $24.80^{a}\pm$ 0.42 | $23.80^{abc}\pm$ 0.46 | $22.71^{bc}\pm$ 0.29 | $24.84^{a}\pm$ 1.09 | $24.49^{a}\pm$ 0.18 | $22.29^{cd}\pm$ 0.47 | $20.79^{d}\pm$ 0.18 |
| **TVC** | $40.33^{ab}\pm$ 0.82 | $41.04^{a}\pm$ 0.96 | $39.29^{ab}\pm$ 0.56 | $40.02^{ab}\pm$ 1.08 | $37.64^{b}\pm$ 1.28 | $37.64^{b}\pm$ 0.09 | $38.08^{ab}\pm$ 0.52 | $39.12^{ab}\pm$ 0.50 |
| **TFC** | $0.55^{b}\pm$ 0.07 | $0.59^{b}\pm$ 0.07 | $0.98^{a}\pm$ 0.05 | $0.95^{a}\pm$ 0.02 | $0.29^{c}\pm$ 0.02 | $0.33^{c}\pm$ 0.00 | $1.03^{a}\pm$ 0.04 | $0.93^{a}\pm$ 0.07 |
| **TC** | $40.88^{ab}\pm$ 0.76 | $41.63^{a}\pm$ 0.91 | $40.27^{ab}\pm$ 0.54 | $40.97^{a}\pm$ 1.11 | $37.93^{b}\pm$ 1.30 | $37.97^{b}\pm$ 0.09 | $39.11^{ab}\pm$ 0.52 | $40.05^{ab}\pm$ 0.56 |
| **Return from bird** | $51.04^{bc}\pm$ 1.42 | $52.44^{abc}\pm$ 0.97 | $52.71^{abc}\pm$ 1.82 | $54.64^{ab}\pm$ 1.89 | $42.40^{d}\pm$ 1.56 | $47.80^{c}\pm$ 0.29 | $47.93^{c}\pm$ 2.13 | $57.50^{a}\pm$ 3.42 |
| **Return from litter** | $0.66^{ab}\pm$ 0.02 | $0.80^{a}\pm$ 0.04 | $0.78^{ab}\pm$ 0.07 | $0.71^{ab}\pm$ 0.02 | $0.39^{c}\pm$ 0.03 | $0.44^{c}\pm$ 0.01 | $0.64^{b}\pm$ 0.03 | $0.72^{ab}\pm$ 0.04 |
| **TR** | $51.70^{bc}\pm$ 1.41 | $53.24^{abc}\pm0.$ 98 | $53.49^{abc}\pm$ 1.82 | $55.35^{ab}\pm$ 1.91 | $42.79^{d}\pm$ 1.57 | $48.24^{c}\pm$ 0.28 | $48.57^{c}\pm$ 2.14 | $58.22^{a}\pm$ 3.46 |
| **Net Profit** | $10.82^{b}\pm$ 1.34 | $11.60^{b}\pm$ 1.00 | $13.22^{b}\pm$ 1.54 | $14.38^{ab}\pm$ 1.77 | $4.85^{c}\pm$ 1.66 | $10.27^{b}\pm$ 0.38 | $9.46^{bc}\pm$ 1.75 | $18.17^{a}\pm$ 2.90 |
| **BCR** | $1.27^{b}\pm$ 0.03 | $1.28^{b}\pm$ 0.03 | $1.33^{ab}\pm$ 0.04 | $1.35^{ab}\pm$ 0.05 | $1.13^{c}\pm$ 0.05 | $1.27^{b}\pm$ 0.01 | $1.24^{bc}\pm$ 0.04 | $1.45^{a}\pm$ 0.07 |

TVM (total veterinary management), TVC (total variable cost), TFC (total fixed cost), TC (total cost), TR (total return), BCR (benefit cost ratio)

$^{(a-b-c-d)}$ Means within the same row carrying different superscript significantly differed at ($P\leq0.05$) among different seasons.

**Table (3).** Effect of different stocking density on productive traits among different breeds

| Variables | Ross | | Cobb | | Hubbard | Indian river | |
|---|---|---|---|---|---|---|---|
| | 8-10 | 10-12 | 8-10 | 10-12 | 8-10 | 8-10 | 10-12 |
| | Mean ±SE | Mean ±SE | Mean ±SE | Mean ±SE | Mean ±SE | Mean ±SE | Mean ±SE |
| **Initial Weight** | 40.00$^{bc}$± 0.29 | 39.08$^{c}$± 0.26 | 40.00$^{bc}$± 0.58 | 43.81$^{ab}$± 1.13 | 39.50$^{bc}$± 0.19 | 42.67$^{bc}$± 1.45 | 46.91$^{a}$± 2.32 |
| **Cycle Period** | 40.63$^{bc}$± 0.63 | 43.31$^{a}$±0 .36 | 38.00$^{dc}$± 0.00 | 40.85$^{bc}$± 0.52 | 41.88$^{ab}$± 0.69 | 39.00$^{cd}$± 0.00 | 36.73$^{e}$± 0.60 |
| **Final Weight** | 2232.40$^{ab}$± 29.31 | 2276.90$^{a}$± 39.52 | 2116.70$^{bc}$± 44.10 | 2267.70$^{a}$± 36.11 | 2037.50$^{c}$± 40.92 | 2236.70$^{ab}$± 18.56 | 2044.10$^{c}$± 40.24 |
| **BWG** | 2192.40$^{ab}$± 29.45 | 2237.80$^{a}$± 39.57 | 2076.70$^{bc}$± 44.66 | 2223.90$^{a}$± 35.69 | 1998.00$^{c}$± 40.94 | 2194.00$^{ab}$± 19.86 | 1997.20$^{c}$± 41.23 |
| **Daily Gain** | 54.02$^{ab}$± 0.50 | 51.80$^{b}$± 1.32 | 54.65$^{ab}$± 1.18 | 54.51$^{ab}$± 0.90 | 47.88$^{c}$± 1.58 | 56.26$^{a}$± 0.51 | 54.41$^{ab}$± 0.92 |
| **RGR** | 192.94$^{a}$± 0.13 | 193.23$^{a}$± 0.13 | 192.57$^{a}$± 0.25 | 192.41$^{a}$± 0.18 | 192.37$^{a}$± 0.17 | 192.51$^{a}$± 0.31 | 190.96$^{b}$± 0.54 |
| **Feed con-sumption** | 3718.80$^{bc}$± 62.56 | 3888.50$^{ab}$± 46.05 | 3600.00$^{c}$± 57.74 | 3719.20$^{bc}$± 48.77 | 3962.50$^{a}$± 18.30 | 3736.70$^{bc}$± 18.56 | 3395.50$^{d}$± 65.52 |
| **FCR** | 1.70$^{b}$± 0.02 | 1.74$^{b}$± 0.02 | 1.73$^{b}$± 0.01 | 1.68$^{b}$± 0.03 | 1.99$^{a}$± 0.05 | 1.70$^{b}$± 0.01 | 1.70$^{b}$± 0.03 |
| **EBI** | 292.13$^{ab}$± 4.98 | 278.43$^{b}$± 8.62 | 290.07$^{ab}$± 14.24 | 315.11$^{a}$± 9.43 | 212.04$^{c}$± 10.62 | 301.82$^{ab}$± 5.22 | 309.31$^{ab}$± 9.59 |
| **Mortality** | 8.45$^{b}$± 0.65 | 6.64$^{b}$± 0.74 | 8.08$^{b}$± 2.43 | 3.62$^{c}$± 0.34 | 12.52$^{a}$± 0.52 | 8.64$^{b}$± 0.53 | 3.61$^{c}$± 0.62 |

BWG (body weight gain), RGR (Relative growth rate), FCR (feed conversion rate), EBI (European broiler index)
$^{(a-b-c-d)}$ Means within the same row carrying different superscript significantly differed at (P≤0.05) among different stocking density.

**Table (4).** Effect of different stocking density on Economic Efficiency parameters (LE per bird) among different breeds

| Variables | Ross | | Cobb | | Hubbard | Indian river | |
|---|---|---|---|---|---|---|---|
| | 8-10 | 10-12 | 8-10 | 10-12 | 8-10 | 8-10 | 10-12 |
| | Mean ±SE | Mean ±SE | Mean ±SE | Mean ±SE | Mean ±SE | Mean ±SE | Mean ±SE |
| **TVM** | 5.89$^{bc}$± 0.15 | 6.94$^{a}$± 0.24 | 6.48$^{ab}$± 0.49 | 5.60$^{c}$± 0.08 | 5.19$^{c}$± 0.14 | 5.35$^{c}$± 0.08 | 5.60$^{c}$± 0.15 |
| **Feed Cost** | 23.78$^{bc}$± 0.42 | 25.64$^{a}$± 0.33 | 22.81$^{cd}$± 0.39 | 23.70$^{bc}$± 0.44 | 24.67$^{ab}$± 0.52 | 23.41$^{bc}$± 0.44 | 21.57$^{d}$± 0.43 |
| **TFC** | 0.77$^{b}$± 0.05 | 0.33$^{c}$± 0.01 | 0.95$^{a}$± 0.04 | 0.98$^{a}$± 0.05 | 0.31$^{c}$± 0.01 | 0.94$^{a}$± 0.03 | 1.03$^{a}$± 0.04 |
| **TVC** | 38.75$^{b}$± 0.74 | 43.21$^{a}$± 0.65 | 39.96$^{b}$± 1.53 | 39.36$^{b}$± 0.52 | 37.64$^{b}$± 0.60 | 39.99$^{b}$± 0.52 | 37.84$^{b}$± 0.43 |
| **TC** | 39.52$^{bc}$± 0.72 | 43.54$^{a}$± 0.65 | 40.91$^{b}$± 1.56 | 40.34$^{bc}$± 0.50 | 37.95$^{c}$± 0.60 | 40.93$^{b}$± 0.53 | 38.87$^{bc}$± 0.45 |
| **Return from** bird | 50.91$^{abc}$± 1.10 | 53.04$^{ab}$± 1.16 | 52.92$^{ab}$± 1.10 | 53.26$^{ab}$± 1.76 | 45.10$^{c}$± 1.26 | 57.04$^{a}$± 1.05 | 48.06$^{bc}$± 2.31 |
| **Return from litter** | 0.67$^{ab}$± 0.01 | 0.82$^{a}$± 0.05 | 0.70$^{ab}$± 0.03 | 0.78$^{ab}$± 0.06 | 0.41$^{c}$± 0.02 | 0.66$^{b}$± 0.00 | 0.66$^{b}$± 0.03 |
| **TR** | 51.58$^{ab}$± 1.10 | 53.86$^{ab}$± 1.17 | 53.61$^{ab}$± 1.13 | 54.04$^{ab}$± 1.76 | 45.51$^{c}$± 1.27 | 57.70$^{a}$± 1.06 | 48.71$^{bc}$± 2.33 |
| **Net profit** | 12.06$^{abc}$± 1.20 | 10.32$^{bc}$± 0.98 | 12.70$^{abc}$± 0.82 | 13.70$^{ab}$± 1.50 | 7.56$^{c}$± 1.29 | 16.78$^{a}$± 1.18 | 9.84$^{bc}$± 2.01 |
| **BCR** | 1.31$^{ab}$± 0.04 | 1.24$^{b}$± 0.02 | 1.31$^{ab}$± 0.02 | 1.34$^{ab}$± 0.07 | 1.20$^{b}$± 0.05 | 1.41$^{a}$± 0.02 | 1.25$^{b}$± 0.05 |

TVM (total veterinary management), TVC (total variable cost), TFC (total fixed cost),TC (total cost ), TR (total return), BCR (benefit cost ratio )
$^{(a-b-c-d)}$ Means within the same row carrying different superscript significantly differed at (P≤0.05) among different stocking density.

**Table (5).** Effect of different stocking density on productive traits (kg per unit m$^2$) and Economic Efficiency parameters (LE per unit m$^2$) among different breeds

| Variables | Ross | | Cobb | | Hubbard | Indian river | |
|---|---|---|---|---|---|---|---|
| | 8-10 | 10-12 | 8-10 | 10-12 | 8-10 | 8-10 | 10-12 |
| | Mean ±SE | Mean ±SE | Mean ±SE | Mean ±SE | Mean ±SE | Mean ±SE | Mean ±SE |
| Feed Amount/ Unit m$^2$ | 32.31$^{cd}$± 0.37 | 41.55$^{a}$± 1.36 | 29.96$^{d}$± 0.68 | 37.87$^{b}$± 0.45 | 32.65$^{cd}$± 0.41 | 32.34$^{cd}$± 0.13 | 34.32$^{c}$± 0.66 |
| Gain/ Unit m$^2$ | 19.07$^{b}$± 0.28 | 23.85$^{a}$± 0.67 | 17.28$^{c}$± 0.36 | 22.66$^{a}$± 0.46 | 16.46$^{c}$± 0.39 | 18.99$^{d}$± 0.14 | 20.21$^{b}$± 0.51 |
| Yield /Unit m$^2$ | 19.42$^{bc}$± 0.28 | 24.27$^{a}$± 0.68 | 17.61$^{cd}$± 0.37 | 23.11$^{a}$± 0.46 | 16.79$^{d}$± 0.39 | 19.36$^{bc}$± 0.13 | 20.68$^{b}$± 0.50 |
| TR /Unit m$^2$ | 449.86$^{c}$± 12.71 | 573.12$^{a}$± 14.46 | 446.14$^{c}$± 9.26 | 552.31$^{ab}$± 23.13 | 374.98$^{d}$± 11.32 | 499.38$^{bc}$± 8.93 | 493.93$^{bc}$± 27.21 |
| TC /Unit m$^2$ | 343.29$^{c}$± 4.17 | 463.49$^{a}$± 10.20 | 339.95$^{c}$± 1.25 | 411.41$^{b}$± 8.62 | 312.45$^{d}$± 4.07 | 354.23$^{c}$± 5.67 | 393.20$^{b}$± 6.73 |
| Net Profit / Unit m$^2$ | 106.58$^{ab}$± 11.33 | 109.63$^{ab}$± 9.87 | 106.19$^{ab}$± 10.20 | 140.89$^{a}$± 16.56 | 62.53$^{b}$± 10.86 | 145.16$^{a}$± 9.90 | 100.73$^{ab}$± 21.40 |

TC (total cost), TR (total return)
$^{(a-b-c-d)}$ Means within the same row carrying different superscript significantly differed at (P≤0.05) among different stocking density.

**Table (6).** Effect of different breeds on different productive variables (per bird).

| Variables | Ross | Cobb | Hubbard | Indian River |
|---|---|---|---|---|
| | Mean ±SE | Mean ±SE | Mean ±SE | Mean ±SE |
| Initial weight | 39.59$^{b}$± 0.21 | 43.09$^{a}$± 0.99 | 39.50$^{b}$± 0.19 | 46.00$^{a}$± 1.89 |
| Cycle Period | 41.83$^{a}$± 0.45 | 40.31$^{a}$± 0.51 | 41.88$^{a}$± 0.69 | 37.21$^{b}$± 0.54 |
| Feed Consumption | 3794.80$^{b}$± 42.65 | 3696.90$^{b}$± 42.12 | 3962.50$^{a}$± 18.30 | 3468.60$^{c}$± 64.14 |
| Final Weight | 2252.40$^{a}$± 23.90 | 2239.40$^{a}$± 33.58 | 2037.50$^{b}$± 40.92 | 2085.40$^{b}$± 38.35 |
| Body weight Gain | 2212.80$^{a}$± 23.99 | 2196.30$^{a}$± 33.14 | 1998.00$^{b}$± 40.94 | 2039.40$^{b}$± 39.27 |
| Daily Gain | 53.02$^{a}$± 0.67 | 54.53$^{a}$± 0.75 | 47.88$^{b}$± 1.58 | 54.81$^{a}$± 0.75 |
| FCR | 1.72$^{b}$± 0.02 | 1.69$^{b}$± 0.02 | 1.99$^{a}$± 0.05 | 1.70$^{b}$± 0.67 |
| RGR | 193.07$^{a}$± 0.09 | 192.44$^{a}$± 0.15 | 192.37$^{a}$± 0.17 | 191.30$^{b}$± 0.46 |
| EBI | 285.99$^{b}$± 4.83 | 310.41$^{a}$± 8.32 | 212.04$^{c}$± 10.62 | 307.70$^{ab}$± 7.57 |
| Mortality % | 7.64$^{b}$± 0.51 | 4.46$^{c}$± 0.65 | 12.52$^{a}$± 0.52 | 4.68$^{c}$± 0.75 |

BWG (body weight gain), RGR (Relative growth rate), FCR (feed conversion rate), EBI (European broiler index)
$^{(a-b-c)}$ Means within the same row carrying different superscript significantly differed at (P≤0.05) among different breeds.

**Table (7).** Effect of different breeds on different Economic variables (LE/bird).

| Variables | Ross | Cobb | Hubbard | Indian River |
|---|---|---|---|---|
| | Mean ±SE | Mean ±SE | Mean ±SE | Mean ±SE |
| **TVM** | $6.36^{a}$±0.17 | $5.77^{b}$±0.14 | $5.19^{c}$±0.14 | $5.54^{bc}$±0.12 |
| **Feed cost** | $24.61^{a}$±0.32 | $23.53^{a}$±0.37 | $24.67^{a}$±0.52 | $21.97^{b}$±0.40 |
| **TFC** | $0.57^{b}$±0.05 | $0.98^{a}$±0.04 | $0.31^{c}$±0.01 | $1.01^{a}$±0.04 |
| **TVC** | $40.75^{a}$±0.65 | $39.47^{ab}$±0.49 | $37.64^{b}$±0.60 | $38.30^{b}$±0.43 |
| **TC** | $41.32^{a}$±0.61 | $40.45^{a}$±0.48 | $37.95^{b}$±0.60 | $39.31^{ab}$±0.43 |
| **Return from litter** | $0.74^{a}$±0.03 | $0.77^{a}$±0.05 | $0.41^{b}$±0.02 | $0.66^{a}$±0.02 |
| **Return from bird** | $51.86^{a}$±0.81 | $53.19^{a}$±1.43 | $45.10^{b}$±1.26 | $49.98^{a}$±2.08 |
| **TR** | $52.60^{a}$±0.82 | $53.96^{a}$±1.43 | $45.51^{b}$±1.27 | $50.64^{a}$±2.09 |
| **Net Profit** | $11.28^{ab}$±0.80 | $13.51^{a}$±1.22 | $7.56^{b}$±1.29 | $11.33^{ab}$±1.76 |
| **BCR** | $1.28^{ab}$±0.02 | $1.33^{a}$±0.03 | $1.20^{b}$±0.03 | $1.28^{ab}$±0.04 |

TVM (total veterinary management), TVC (total variable cost), TFC (total fixed cost) ,TC (total cost ), TR (total return), BCR (benefit cost ratio )
$^{(a-b-c)}$ Means within the same row carrying different superscript significantly differed at (P≤0.05) among different breeds.

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