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PRODUCTIVE PERFORMANCE, CARCASS CHARACTERISTICS AND MEAT QUALITY OF BROILER CHICKENS AT DIFFERENT MARKETING AGES

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ABSTRACT: Length of production cycle and broiler marketing decision is an important issue especially when productivity and product quality are considered. The objectives of this study were to determine the effects of the age at marketing on productive performance, carcass characteristics and meat quality traits of broiler chickens at five different ages. For this purpose, a total of 450 mixed-sex *Cobb*[500] broiler chicks were used. Chicks were randomly distributed into five equal groups with 3 replicates allocated in 15 pens. Broilers were reared until different marketing ages at 30, 35, 40, 45 and 50 days. Productive traits were recorded and performance indexes were calculated at different marketing ages. At each marketing day, a slaughter test was done using 12 birds subjected to a simplified carcass analysis. Breast muscles were used for evaluated meat quality and physicochemical properties. The results indicated that the age at marketing had significant effects ($p<0.05$) on all parameters investigated in point of productive traits, performance indexes, carcass traits, cut-up pieces and meat quality of broiler chickens. In conclusion, delaying marketing age positively increased live body weight and yield of live mass. But it negatively reduces feed efficiency, feed conversion ratio and livability % with increasing age which negatively affected the EPEF of broiler production. According to the EPEF, which expresses technical efficiency in one index, it can be stated that broiler production is only profitable with an EPEF at 30th and 35th days of age only. Thus, broiler farmers and producers have to differentiate or balance between ignoring some reduction in productive performance and compensating this with some added value from selling chicken in portions. But actually further research is required to find out an optimal marketing age in terms of economic considerations to calculate the costs and profits at different marketing ages.

Keywords: *broiler, marketing age, performance, carcass quality.*

INTRODUCTION

Commercial broiler breeds have a shorter production period compared to other animal production. The production period is completed in 5-7 weeks in broiler breeds. Breeding programs and genetic studies have provided significant improvements in the live body weight of broiler chicks and have allowed a reduction of age to market. The marketing age of broilers decreases about 0.75 days each year with the same productive performance (Gunasekar, 2006 and Szőllősi and Szűcs, 2014).

From the producers' perspective, Broiler production is raised primarily for human consumption within the shortest period of time in a profitable way. Modern commercial broilers lines are selected for efficient productive traits with good feed conversion potential, marked growth rate, higher yield of meat, cost-effectiveness and low levels of mortality. Modern commercial broilers are bred to attain maximum productive performance in only 35 to 42 days. Broilers should be sold at an optimal weight. More profit can be achieved if broilers can be sold at optimal market weight and meet consumer preferences and market needs (Wang et al., 2012).

On the other side, from the consumer perspective, consumer eating habits during the last decades have globally changed with a strong preference for meat cut-up (parts) and processed meat. Consequently, the market of chicken cuts has exceeded the whole-bird market. This has lead to later-finishing birds for the production of commercial cuts because larger birds present higher carcass yield and higher added value (Schmidt, 2008).

Marketing age is very important for growth performance, carcass traits, meat quality and economic efficiency. However, the problem is that the marketing day is different between different farmers and producers. Some producers believe in sell their bird sooner is better and represents a commercial advantage. But the younger birds maybe not have the best meat quality which also affected the price and consumers' attitude.

This is a conflict issue, for this purpose, in order to find the optimum marketing age for better growth performance and meat quality of broiler chicken which satisfies the goals of both producers and consumers. Thus the objectives of this study were to determine the effects of the age at marketing on productive performance, carcass characteristics and meat quality traits of broiler chickens at different ages.

MATERIALS AND METHODS

Experimental site area and the aim of the study:

The present experiment was carried out at the Experimental Poultry Farm of Agriculture Faculty of Al-Azhar University, Cairo, Egypt during summer season of 2017. Four hundred and fifty day-old broiler chicks ($Cobb^{500}$) were purchased from Dakahlia company hatchery, El-Obour city. The objectives of this study were to investigate the effect of different marketing age on productive performance, carcass characteristics and meat quality traits of broiler chickens at five different ages.

Experimental design, birds managements and diets:

A total number of 450 broiler chicks *Cobb*^{500} one-day-old chicks were used in this study. The initial weights were taken and recorded on arrival. Chicks were sexed by vent method, brooded in an open-sided pen, naturally ventilated and covered with wood shaving litter during the first week of age. The chicks were kept under uniform environmental conditions for acclimation. On commencement, at the 7th day of age, chicks were individually weighed to make uniform replicate groups (P>0.05) and randomly distributed into five equal experimental groups in a completely randomized design. The 5 groups were as follows:

T1: birds will be marketed at 30 days of age (MA_{30}).

T2: birds will be marketed at 35 days of age (MA_{35}).

T3: birds will be marketed at 40 days of age (MA_{40}).

T4: birds will be marketed at 45 days of age (MA_{45}).

T5: birds will be marketed at 50 days of age (MA_{50}).

Birds managements: Broiler chickens groups were housed in deep litter system using 15 pens (2 × 1.5 m dimensions/pen) with 3 replicates containing 30 birds (equal sex ratio) in each pen (10 chicks/m^2). All birds were reared under similar managerial and hygienic conditions during the entire rearing period conforming to the recommendation found in the strain manual guide. Temperature for all pens held constant at 33 ˚C for the first 7 days then gradually decreased 1˚C every two days to 25 ˚C from 7 to 21 days and then remained at 25 ˚C up to the end of the rearing period. The lighting schedule was 24L:0D from 1 d to 7 d and 23L:1D from 8 d to the end of the rearing period. Routine vaccination schedule was administered and necessary medication when needed based on diagnoses and symptoms shown by the birds.

Diets and feeding: The birds had free access to feed and water for *ad-libtum* consumption. All experimental diets were isocaloric, isonitrogenous and were formulated to meet the requirements of the strain *Cobb*^{500} broiler performance and nutrition supplement manual (Cobb-Vantress, 2018a). Birds were fed on a corn-soybean meal based starter ration (2950 Kcal.ME/Kg, 22 % C.P. from 0 - 15 days) followed by grower ration (3000 Kcal.ME/Kg, 20 % C.P. from 15 - 28 days) and after that fed finisher ration (3150 Kcal.ME/Kg, 19 % C.P.) up to the end of rearing period.

Data collection: During the experimental period all birds were subjected to the same method of data collection. Chicks in each replicate were individually weighed at 0, 7, 14, 21, 28 days and at the end of the rearing period (different MAs) with electric balance. Also, weekly feed consumption (FC), total feed intake (TFI) and dead birds (if any) were recorded.

Performance indicators such as; total body weight gain (TBWG), feed consumption (FC), feed efficiency (FE), feed conversion ratio (FCR), mortality and livability % were calculated according to the following formulas:

BWG (g) = Final BW (g) at the end period – Initial BW (g) at start.

FC (g/bird) = (Feed offered – Feed residue)/No. of bird.

FE (g/g) = BWG ÷ FC.

FCR (g feed/g gain) = Total Feed consumed ÷ Live Body Weight

Mortality (%) = (No. of dead birds/Total number) * 100

Livability (%) = 100 – Mortality %

Performance indexes: After calculation of livability % and FCR performance indexes such as; European Production Efficiency Factors (EPEF), Yield per Unit

Area (YUA), and Russian Production Index (RPI) were used to evaluate the growing performance index of broilers as suggested by Aviagen, (2018). EPEF, YUA and RPI were calculated according to the following formula:

European Production Efficiency Factors (EPEF): $\text{PEF} = \frac{\text{Livability \%} * \text{BW (kg)}}{\text{Age (d)} * \text{FCR}} * 100$

Yield per Unit Area (YUA): $\text{YUA} = \text{LBW} * \text{Density} * \text{Livability \%}$

Russian Production Index (RPI): $\text{RPI} = \frac{\text{meat per m}^2 \text{ per cycle (kg)} * \text{Livability \%}}{\text{FCR} * 10}$

Slaughtering test and carcass traits:

At the end of each marketing age (30, 35, 40, 45 and 50 days) in order to determine the carcass characteristics and carcass cut-up, 12 birds (6 males and 6 females) from each group were randomly selected, weighed, fasted for 6 hrs, slaughtered with a knife (Halal Method), allowed to bleed for 150 sec, scalded at 60˚C for 80 sec, de-feathered and manually eviscerated. Following evisceration, all carcasses were chilled in cold water for 15 minutes. Hot carcass, economical cuts, edible parts and organs were weighed and calculated as a percentage on the basis of LBW.

Meat quality and physico-chemical properties:

Chickens breast meat from each carcass were deboned, skinned and individually placed in a labeled plastic bag. All samples were sent in icebox to food and meat quality lab at Food Science and Technology Department, Agriculture Faculty, Al-Azher University, Cairo, Egypt where all meat quality measurements and physico-chemical properties of chicken meat were performed. Chicken breast meat samples were frozen and stored at -18 ˚C until subsequent analysis.

Chemical Analyses: Proximate composition of moisture, cured protein (factor of 6.25 was used for conversion of nitrogen to crude protein), fat and ash content were determined according to the Association of Official Analytical Chemists (AOAC, 2005).

Physical analyses: The analysis of physico-chemical properties of meat included pH values, Water holding capacity (WHC) and drip loss % of breast muscles were done. The values of pH for chicken breast meat were determined by using a calibrated pH meter (Beckman model 3550, USA) according to the method described by Sebranek et al., (2001). Water holding capacity (WHC) was determined by a filter press method as described by Wang and Zayas (1992). Drip loss was determined by the difference between the weight of the complete frozen sample (chicken breast meat) and the weight of the same sample after thawing. The drip loss was calculated as the percentage of weight change according to El-Seesy (2000).

Statistical analysis: All data were expressed as mean±SE by one-way ANOVA with age at marketing as the main factor using statistical software of SPSS Ver. 24 (IBM SPSS, 2016). Comparisons of means when the factor had a significant effect were obtained using Duncan test (1955). A probability of $P<0.05$ was required for statements of significance.

RESULTS AND DISCUSSION

Growth performance and productive Traits:

The means related to final LBW, total BWG, total FC, FE, FCR and mortality % of broiler chickens as affected by different MA are presented in figures (1 and 2). Results showed that, high significant differences ($P<0.01$) were found in all evaluated parameters between all different groups. The effect of marketing age on final body weight and body weight gain were positive (R^2=0.997) and significantly ($P\leq0.01$) different between all groups. Final LBW of broilers raised to different MA (30, 35, 40, 45 and 50 days of age) reached a bodyweight of 1.51, 1.79, 2.09, 2.44 and 2.76 kg, respectively (fig. 1a). The highest BW was achieved by T5 group which raised up to 50 days of age. Moreover, prolonging the rearing period reflects an increase in final LBW and BWG ranged between 13 to 19 % every 5 days. Broiler LBW was increased by about 83 % for the late MA group (T5) group in compare with early MA one (T1). On the same trend, total BWG was increased by about 84.8 % for late MA group in compare with early MA one (fig. 1b).

As expected, final LBW and BWG at marketing increased progressively with age. But with advancing age, the growth rate decreases with lower daily weight gain where BWG reached a maximum change of 19.52 % between 35 and 40 days of age. Beyond this age, BWG declined and approached 13.04 % from 45 to 50 days of age. The turning point in the growth curve (the inflection point) corresponds to the time that the bird reaches its highest growth rate and thus the rate starts to lower down (Reddish and Lilburn, 2004). In this way, the growth curves of a certain strain may assist in the establishment of specific feeding and management programs to define the optimum marketing age.

Average Live body weight and average daily weight gain increased aggressively with age. These results confirm previous findings on the growth performance of birds at different slaughter ages (Goliomytis et al. 2003; Baeza et al., 2012; El-Waseif and Abougabal, 2017 and Rezaei et al., 2018). The results of Cicek and Tandogan(2016) found that, optimum slaughter age was 5.62 weeks (about 39.34 days). After that, broiler chicks should be sent to slaughter at 40th days according to the target performance values. Moreover, results in this study were similar with observations of Szőllősi and Szűcs, (2014) they found that LBW increased progressively with age by about 52.01 % from 1.98 kg at 35th d. to 2.99 kg at 49th days of age.

In contrary, these results are partially agreement with Cobb 500 manual (Cobb-Vantress, 2018a), where our growth rate and growth curve take the same trend but average LBW and BWG were lower than what was described in the Cobb 500 manual. Possibly because of the different conditions of our experiment, especially it was carried out in open side pens during the hot summer season in Egypt compared to the ideal conditions recommended in the Cobb broiler management guide (Cobb-Vantress, 2018b).

On the other side, delaying the marketing age from 30 to 50 days reflects a significant ($P<0.01$) effect on FC (R^2= 0.991), FCR (R^2=0.985) and mortality % (R^2=0.661) between different MA groups (Fig. 1 and 2). Increasing marketing age dramatically increased total FC from 2.25 kg for early MA group (30 d.) to 2.91, 3.61, 4.49 and 5.53 kg, for T2, T3, T4 and T5, respectively(fig. 1c). Feed consumption and cumulative FC increasing continuously with increasing age were mentioned by Goliomytis et al., (2003) and Wang et al., (2012).

Moreover, delaying MA was significantly affected feed utilization in terms of FE or FCR. The effect of MA on FE was negative (R^2=-0.994) and linear, with about - 24.6% between early MA group (0.65 g/g) in comparison with late MA group (0.49 g/g). On the same trend, early MA group (T1) recorded lowest and better value of FCR with 1.54 g feed/g gain and increased gradually in T2 (1.66), T3 (1.76), T4 (1.87) and T5 (2.05) group which recorded higher and worst FCR at 50 days of age(fig. 1e). From the producers' perspective, the difference in FCR values was 32.5% between T1 and T5 (about 1.62% increases in FCR per day from 30 to 50 days of age). These reductions in FCR values considered a negative effect where higher FCR causes a direct increase in production costs. It is a well-known fact that FCR increases as the bird gets older (Lesson, 2000). Schmidt (2008) determined a 2.1% increase in FCR per day of market age increase. Feed conversion ratio increased with increasing age of birds because more energy is used to produce body fat, body maintenance and activity but the contribution to body weight is low. So, FCR was affected by the age of the bird. Results in this study were fully agreement with Szőllősi and Szűcs, (2014) who found that FCR increased progressively with age from 1.71 at 35^{th} d. to 2.05 at 49^{th} days of age.

In the same context, lengthening the rearing period by delaying MA reflect a significant increase in mortality % between different groups. Mortality % changed from 0.0 % for early MA group to 3.33 % for T5 which sold at 50 days of age (fig. 1f). Reduction in Livability % as a function of delay MA was significant, reaching 3.3% difference between early MA group (30 d.) and late MA one (50 d.) which agrees with the finding of Goliomytis et al. (2003) and Baeza et al. (2012) whom reported that mortality % increased from 42 days of age, reaching 5 to 7 fold greater values for broilers reared until 63 days than for broilers reared until 35 or 42 days. Increased age-related mortality may be due to the incidence of metabolic disorders of rapid growth or leg weakness due to rapid weight gain and excessive body weight which affect leg health in the older broiler (Rezaei et al., 2018). Results of Schmidt (2008) highlighted an approximately 1% increase in mortality between 43 and 46 days of age. Our results in full agreement with Szőllősi and Szűcs, (2014) found that mortality % increased by about 2.69% with age from 35^{th} to 49^{th} days of age.

Performance indexes:

The means related to EPEF, YUA and RPI as affected by different MA are presented in Figures (2 and 3). The most important measure of all growth traits, as a term of EPEF, was significantly higher (P<0.01) in early MA chicks in comparison with other late MA groups. The best EPEF was achieved by chickens raised to 30 days only (326 pts) followed by T2, T3 T4 and T5 which achieved 306, 291, 282 and 261 pts, respectively (fig. 3a). The index of EPEF which expresses the overall production profile gives a reasonable idea about the overall technical and productive efficiency of the broiler management. The highest EPEF value gives the optimum return. According to Schmidt (2008), the maximum performance between 35 and 42 days of age, and then decreased. Our result highlights the limitations of increasing broiler age beyond 35 days, this mainly because of increased mortality % and decreased FCR which both affected the EPEF of broiler production with all respect to the increase in LBW. Similarly to our results, EPEF decreased progressively with age was mentioned by Szőllősi and Szűcs, (2014) who indicated that EPEF decreased from 317.7 at 35th d. to 286.8 at 49th days of age.

On the contrary, delaying marketing age from 30 to 50 days reflect a significant ($P<0.01$) positive effect on YUA ($R^2 = 0.991$) and RPI ($R^2 = 0.958$) between different MA groups. Marketing age changed YUA by about 76.58% and increased it gradually from 15.7 kg/m^2 for early MA group (30 d.) to 17.74, 20.49, 23.86 and 26.61 kg for T2, T3, T4 and T5, respectively (fig. 3b). These results are consistent with those reported by Szőllősi and Szűcs, (2014) who found that meat yield (kg/m^2) progressively increased with increasing slaughter age from 35 to 49 days of age. In the same trend, MA changed RPI by about 33.44% between early and late one, where early MA group (T1) recorded lowest value of RPI with 97.67 and increased gradually in T2 (107.33 pts), T3 (116.67 pts), T4 (127.0 pts) and T5 group which recorded higher level of RPI with (130.33) at late MA 50 days of age (fig. 3c).

Slaughter test and carcass traits:

Data presented in Fig. (4) reveals a significant effect of chickens' age on their dressing % and carcass cuts %. Delay marketing age of broiler causing a significant and positive increase on LBW of birds which reflect an increase in the whole carcass (dressing %) and carcass cuts %. In regard to dressing % data in Fig. (4a) shows that, as marketing age goes on the weight of hot carcass increased ($p<0.01$). Delaying marketing age increased dressing % by about (14.91%) while it was 69.01% at 30 days of age (T1), it reached 79.30% at 50 days of age for T5. On the same way, the front half % was increased with increasing marketing age, it was increased from 34.99% for T1 to 39.66% for T5 which slaughtered at 50 days of age (fig. 4b). Moreover, the same trend was observed for the hind half % (fig. 4c). In addition to this, breast fillets are the most economically important part of the carcass. As expected, in the present study, slaughter age had a significant effect on the front quarter and whole breast % (fig. 4d). Age at marketing significantly and positively increased breast % by about 13.3%. Breast % increased from 17.50% in the early MA group to 19.83% for late MA one.

Slaughter age has an effect on the broiler performance, carcass traits and carcass cut up (Karaoğlu et al., 2014 and Cobb-Vantress, 2018a). Bigger breast proportions with increasing the age of chicken were noticed by many authors (Baeza et al., 2012; Poltowicz and Doktor 2012 and El-Waseif and Abougabal 2017). These results are compatible with the results drawn from the study of Nikolova and Pavlovski (2009) and Nikolova and Bošković (2011) defined that age impact was significant where chickens at age of 49th and 56th day had a high dressing %, lot bigger mass, larger breasts and breast meat, thighs and drumsticks when compared to chicken slaughtered at age of 42nd and 35th day.

As expected, meat yield and total edible parts increased regularly with age at slaughter. The results of this study also show that edible parts % takes the same trend, it increased with increasing marketing age of the birds from 73.47 at 30 d. to 82.78% at 50 days of age. These results are in accordance with Baeza et al., (2012); Karaoğlu *et al.*(2014) and Cobb-Vantress, (2018a). Similarly, these results are consistent with those reported by El-Waseif and Abougabal (2017) found that when delaying marketing age hot carcass and dressing % increased since it was 70.72% at 30 days, it reached 77.50% at 50 days of age. In contrast with the above mentioned trend, the giblets and wing % were decreased with delaying the marketing age, since it was 8.58% at 30 days of age it decreased to 6.73% at 50 days of MA for T5. The percentages for wings are in general agreement with those reported by Coban et al., (2014). Also, a marked tendency towards a decrease in the proportion of giblets in the carcasses of older chickens was found by Poltowicz and Doktor (2012). They added, the age of birds significantly reduced the proportions of liver and gizzard, but had no significant effect on heart percentage.

Chicken breast meat quality:

In this study, meat quality was assessed through the measurement of several muscle characteristics, including pH, chemical composition and several classical meat quality traits such as water-holding capacity and drip loss %. Results presented in Fig. 5 and 6 showed that broiler age at marketing had a significant effect ($p<0.05$) on all chemical and physico-chemical properties of meat quality. Data in Fig. (5a) shows, the moisture % in chicken meat was decreased from 75.89% to 73.06% when the slaughter age increased up to 50 days of age. Muscle moisture directly affects the meat eating quality as the tenderness and succulence. The aged chicken had lower muscle moisture as found by Baeza et al., (2012) and Yi-ping et al., (2016).

In contrast with moisture, crude protein content of chicken meat was increased as the age of slaughter increased. Crude protein % tended to be significantly higher in older chickens than in younger birds. The highest protein % was obtained by chickens aged 50 days (21.81) followed by T4, T3, T2 and T1 (early MA_{30}) which recorded the lowest % of protein content in their muscles 19.32% (fig. 5b). A similar trend of results was observed also for fat and ash contents of chicken meat. These results are in line Kumar and Rani (2014) who report that the protein content of breast meat ranges from 21.9 to 23.5%. Moreover, Baeza et al., 2012; Yi-ping et al., 2016 and El-Waseif and Abougabal (2017) they found that, while moisture content decreased, crude protein and lipid content increased regularly for broiler breast, thigh and drumstick increases with their age.

In regard to physico-chemical properties of chicken meat, the result in Fig 6 shows that the marketing age significantly increased WHC and pH of chicken breast meat. From data in Fig.(6a) it could be observed that early MA group (T1) recorded the lowest value of WHC with 43.82 and it increased gradually in T2 (45.73), T3 (49.51), T4 (53.75) and T5 group which recorded a higher level of WHC with (57.23) at late MA 50 days of age.

WHC is a meat property describing the ability to retain water through self-structuring. WHC also influences the sensory quality of meat because water loss during cooking can affect the juiciness and tenderness of meat (Aleson-Carbonell et al. 2005). Therefore, meat with a low WHC that loses large amounts of fluid during cooking may taste dry (Sarica et al., 2019). In this study, the WHC of breast meat was significantly affected by the marketing age. Similar observations were also found by Kokoszynski et al. (2011); El-Waseif and Abougabal (2017) and Sarica et al., (2019) they found breast and thigh meat WHC values were significantly affected by both slaughter age and sex.

Another important factor that affects meat quality is pH. A high pH value shortens meat shelf life, since it creates a more favorable environment for bacteria (Chen et al., 2015). A similar trend of results was observed for pH values of chicken meat where pH tended to be significantly higher in older chickens than in younger ones (fig. 6b). Increasing age at slaughter affected muscle pH after death. It was increased, and the final pH value of meat was higher at older ages. Changes in pH mainly occurred between 30 and 50 d of age and were concomitant with changes in lactate and in glycolytic potential, both of which reached their greatest values in older chickens as reported by Radikara et al., (2016). In the present study, pH values ranged between 6.00 and 6.32 for breast meat. Breast meat pH values increased significantly with slaughter age (P<0.01). In general, the pH values and trends obtained in the current study were fully agreement with Kokoszynski et al., (2011); Kumar and Rani (2014) and Sarica et al., (2019).

On the opposite of the previous trend, the drip loss % of chicken breast meat was decreased with increasing marketing age. Drip loss % was decreased from 2.86% for the early MA group (T1 at 30 d.) to 1.63% for T5 which slaughtered at 50 days of age (fig. 6c). In general, both meat WHC and drip loss are affected by meat pH, higher pH values as in the present study, being associated with a relatively dry meat surface and high WHC (Sarica et al., 2019). Also, Poltowicz and Doktor (2012) reported that broilers showed increases in pH and decreases in drip loss in line with slaughter age. Similarly, the present study found drip loss was significantly lower among older broiler chickens. Overall, the drip-loss values in the present study (2.86% - 1.63%) are in line with those found for guinea fowl that were reported by El-Waseif and Abougabal (2017) and Sarica et al., (2019).

CONCLUSIONS

Based on the results obtained through this study, we have demonstrated that, although prolonging the rearing by delaying marketing age beyond 40th days producing heavy broilers weight at slaughter which are efficient in producing high carcass weight, carcass parts and meat yields appropriate for consumer eating habits and further processing.

However, from the producers' perspective, postpone marketing age positively increased live body weight and yield of live mass. But it negatively reduces feed efficiency, feed conversion ratio and livability with increasing age which negatively affected the EPEF of broiler production. According to the EPEF, which expresses technical efficiency in one index, it can be stated that broiler production is only profitable with an EPEF at 30th and 35th days of age only.

Thus, broiler farmers and producers have to differentiate or balance between ignoring some reduction in productive performance and compensating this with some added value from selling chicken in portions. Also, further research is required to find out an optimal marketing age in terms of economic considerations to calculate the costs and profits at different marketing ages.

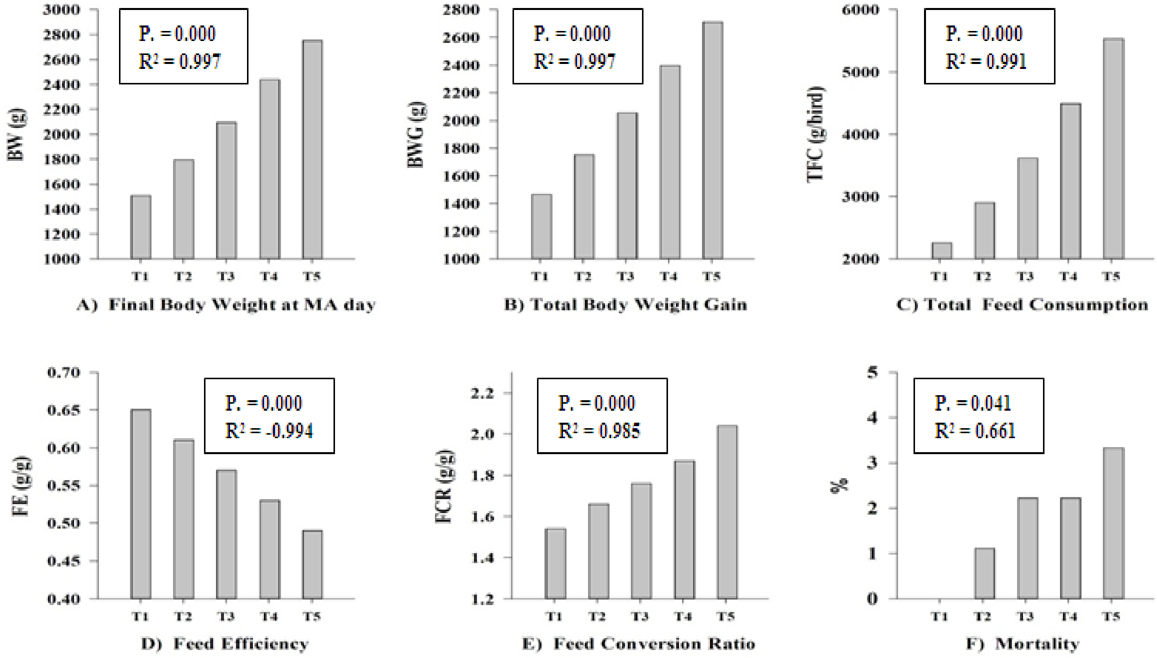

Figure 1. Showing productive traits of broiler chickens; (A) Final LBW at MA day, (B) Total BWG, (C) Total FC, (D) Feed efficiency, (E) FCR and (F) Mortality % as affected by marketing age.

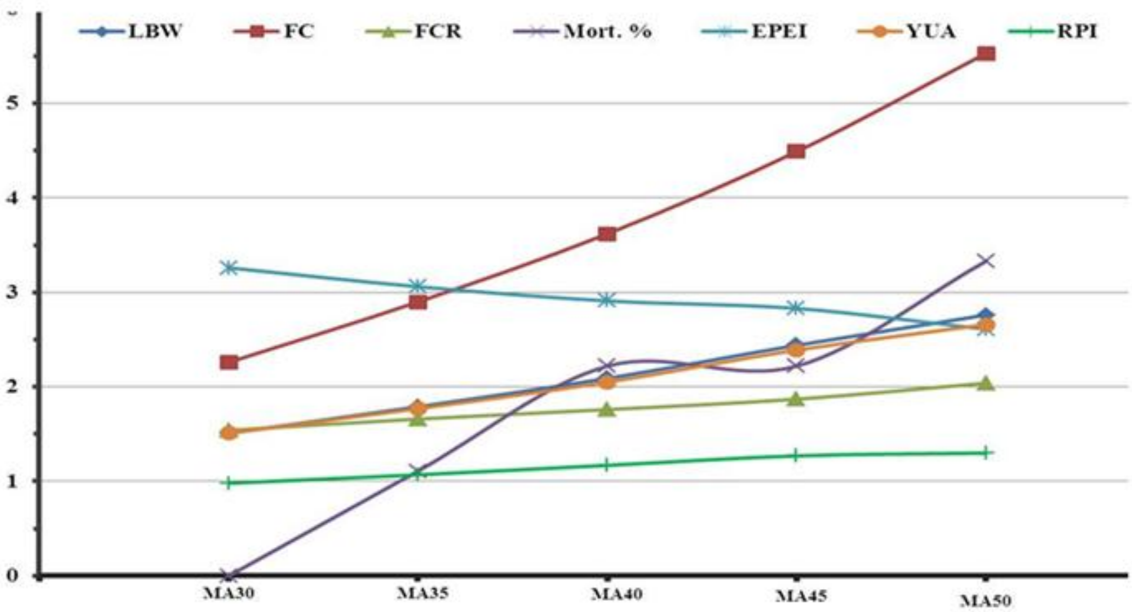

Figure 2. Showing all productive traits and performance indexes of broiler chickens as affected by different marketing age. (EPEF = *100, YUA = *10 and RPI = *100).

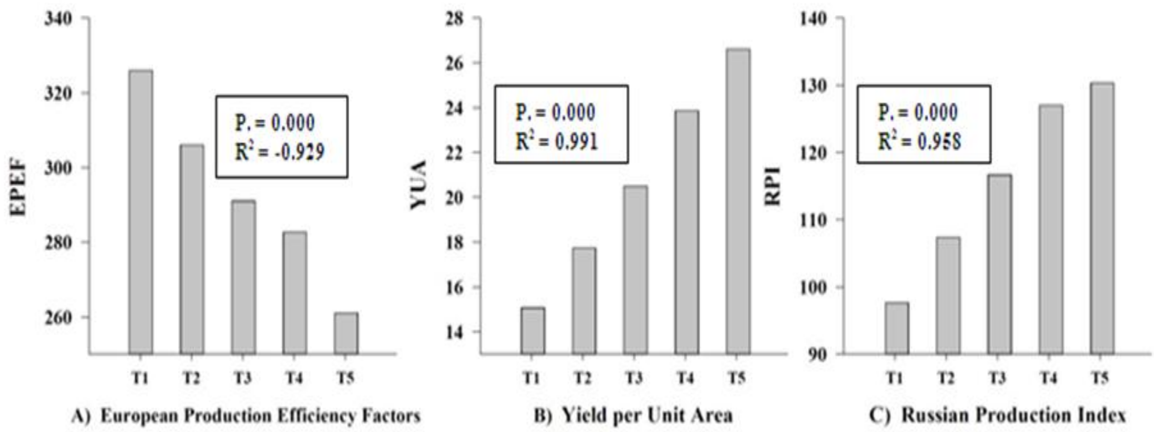

Figure 3. Showing performance indexes of broiler chickens; (A) European Production Efficiency Factor, (B) Yield Unit Area and (C) Russian Production Index as affected by marketing age.

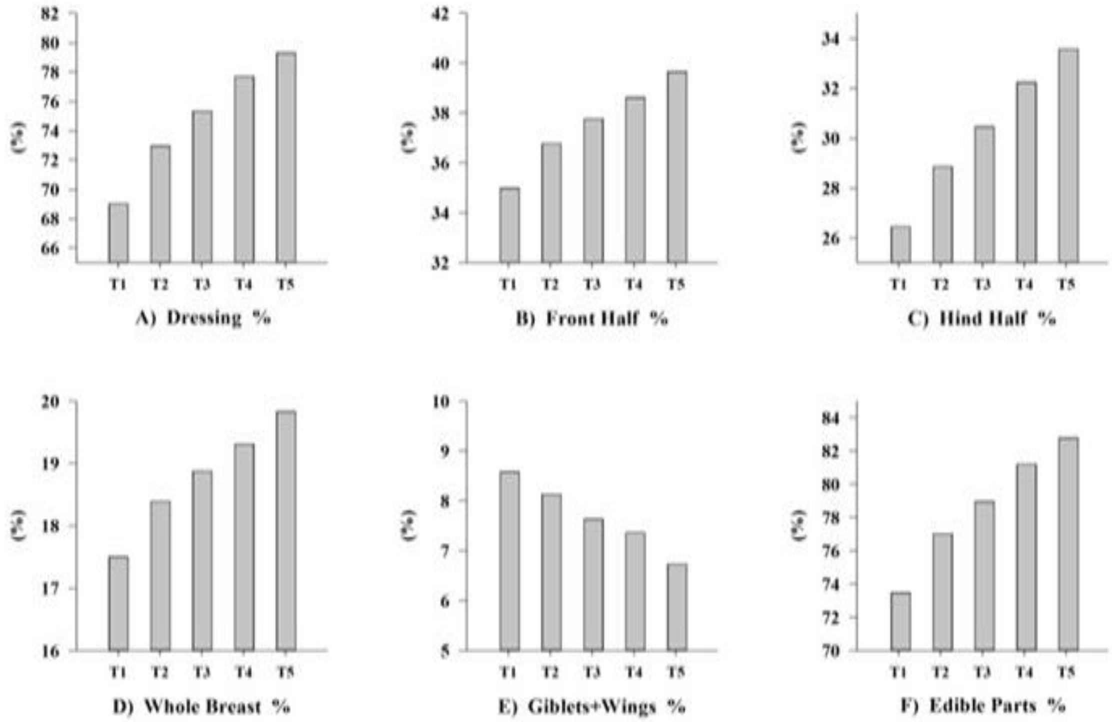

Figure 4. Showing carcass traits and carcass cuts of broiler chickens; (A) Dressing %, (B) Front Half %, (C) Hind Half %, (D) Breast %, (E) Giblets+Wings % and (F) Edible Parts % as affected by marketing age.

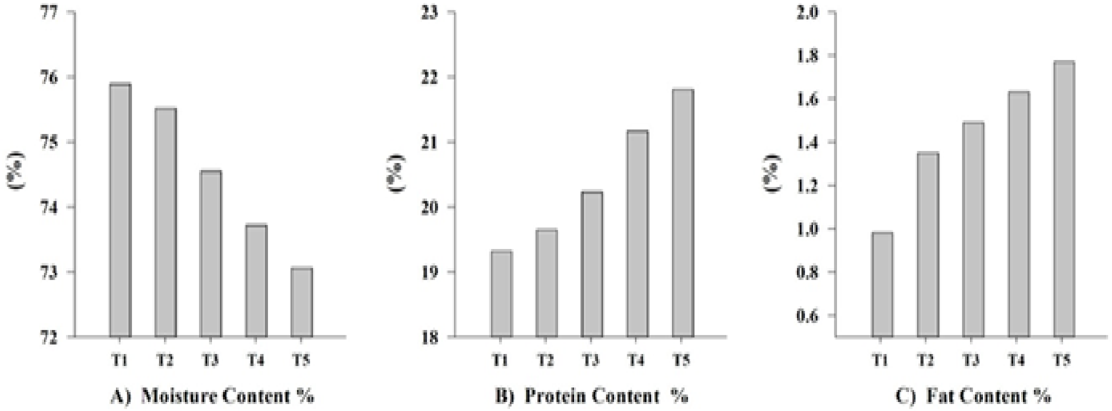

Figure 5. Showing breast chemical composition of broiler chickens; (A) Moisture content %, (B) Protein content % and (C) Fat content % as affected by marketing age.

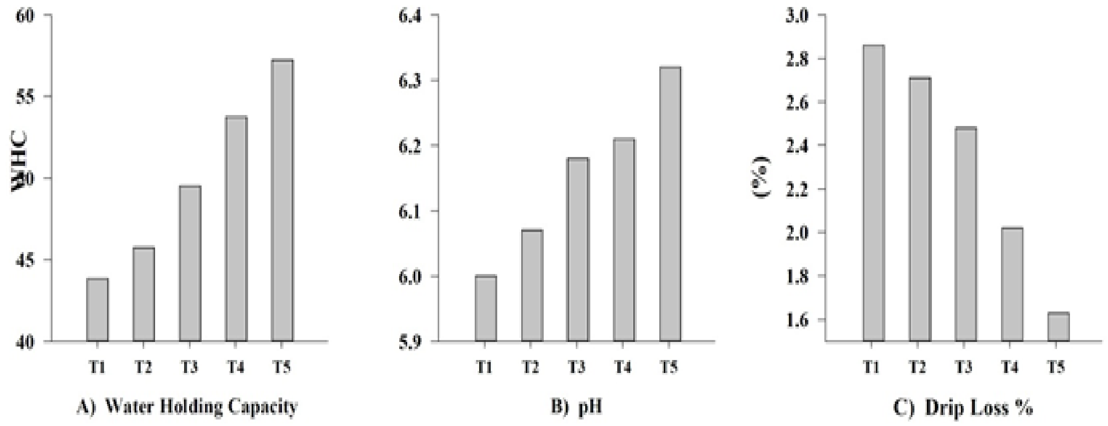

Figure 6. Showing physico-chemical properties of broiler chickens meat; (A) Water Holding Capacity %, (B) pH values and (C) Drip Loss % as affected by marketing age.

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الملخص العربى

الأداء الإنتاجي وخصائص الذبيحة وجودة اللحم لدجـــاج التسمـين عند أعمار تسويقـية مخـتلفة

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تعتبر مدة دورة الإنتاج وقرارالتسويق لدجاج التسمين أمرًا مهمًا خاصة عند الأخذ بعين الإعتبار للأداء الإنتاجى وصفات جودة المنتج لذلك كانت أهداف هذه الدراسة هى تحديد تأثير العمر عند التسويق على الأداء الإنتاجى وصفات الذبيحة وأجزائها ونوعية اللحوم فى دجاج التسمين عند خمسة أعمار تسويقية مختلفة. ولهذا الغرض استخدم فى هذه الدراسة ٤٥٠ كتكوت (***Cobb***^{500}) وتم توزيعها عشوائيا إلى خمســـة مجـموعات متساوية (٥ مجموعات * ٣ مكررات * ٣٠ طائر). وتم تربية الكتاكيت حتى الأعمار التسويقية المختلفة عند ٣٠ و ٣٥ و ٤٠ و ٤٥ و ٥٠ يوما وتم تسكين الكتاكيت في أعشاش منفصلة تحت نفس الظروف البيئية والرعائية والتغذوية. تم تسجيل وقياس الصفات الإنتاجية مثل وزن الجسم الحى والزيادة فى وزن الجسم والغذاء المأكول والكفاءة الغذائية ومعامل التحويل الغذائى وأيضا الوفيات أسبوعيا وعند أعمار التسويق المختلفة تم حساب دلائل الكفاءة الإنتاجية (معامل كفاءة الإنتاج الأوروبى EPEF ومحصول اللحم الناتج من وحدة المساحة YUA ودليل الإنتاج الروسى RPI) لكل عمر تسويقى، وتم اختيار ١٢ طائر (٦ ذكور و 6 إناث) لتجربة الذبح وقياس صفات الذبيحة من كل فئة عمرية وتم استخدام عضلات الصدر لتقييم جودة اللحوم والخصائص الفيزيائية والكيميائية للحم الناتج. وتم تحليل البيانات إحصائيا باستخدام تحليل التباين واختبار دنكن متعدد المدى. أشارت النتائج إلى أن العمر عند التسويق وكما هو متوقع كان له تأثيرات معنوية كبيرة جدًا على جميع الصفات المدروسة. (الصفات الإنتاجية والأداء الإنتاجى وصفات الذبيحة وأجزائها ونوعية اللحوم الناتجة وجودتها).

إجمالاً تشير النتائج إلى أن تأخير عمر التسويق يؤدى إلى زيادة وزن الجسم الحى وكميات اللحم الناتجة بشكل إيجابى ولكنه عكسيا يقلل من الكفاءة الغذائية ومعامل تحويل الغذاء ونسبة الحيوية مع زيادة العمر التسويقى وبالتالى أثرت سلبياً على معامل كفاءة الإنتاج الأوروبى EPEF لدجاج التسمين والذى يعبر عن جميع صفات الإنتاج فى مؤشر واحد وبالتالى يمكن القول أن إنتاج دجاج التسمين يكون أكفأ إنتاجيا فقط عند عمر ٣٠ و ٣٥ يوم بناءًا على دليل الإنتاجEPEF.

وختاما يجب على المربين والمنتجين لدجاج التسمين المفاضلة والمقارنة بين التغاضى عن بعض النقص فى الأداء الإنتاجى وتعويض ذلك ببعض القيمة المضافة من بيع الدجاج في صورة قطعيات وأجزاء. ولكن فى الواقع هناك حاجة ملحة إلى مزيد من البحوث للوقوف على العمر التسويقى الأمثل من الناحية الإقتصادية وحساب التكاليف والأرباح عند مختلف الأعمار التسويقية.