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ORIGINAL ARTICLE

Influence of Various Marketing Ages on the Growth, Carcass Characteristics, and Economic Indices of Broiler Chickens

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Abstract

INTRODUCTION: The global population continues to increase, which drives up demand for broiler meat. Furthermore, the production cycle's duration and the decisions made regarding broiler marketing are important factors, along with productivity and profitability.
OBJECTIVE: In this study, the effects of different marketing ages (MA) on carcass characteristics, economic indicators, and broiler chicken production were investigated.
METHOD: A total of 200 male, one-day-old Cobb-500 broiler chicks were used. The chicks were divided at random into four equal groups of five replicates. At 35, 42, 49, and 56 days old, distinct marketing ages for broilers were reached. At various marketing ages, performance indicators were calculated based on growth qualities, economic indices, and other data. For each marketing day, 10 birds were randomly chosen from each group and slaughtered for carcass analysis.
RESULT: The main findings indicated that MA 35 and MA 42 showed a high daily weight gain and feed conversion rate compared with MA 49 and MA 56. The mortality rate increased in MA 49 and MA 56. In addition, MA 56 for birds resulted in less economic return and profit.
CONCLUSION: In conclusion, extending the marketing age negatively impacts feed conversion ratio and livability percentage while directly increasing live body weight. Moreover, there is no significant difference in carcass traits like spleen%, gizzard%, heart%, and giblet%. The European Production Efficiency Factor and benefit cost ratio are profitable at MA35 and 42 days only.

Keywords: Broiler, Economic indices, Growth performance, Marketing age

1. Introduction

Due to the large global population, the poultry industry has grown enormously and the development of broiler bird sustainability has also increased [1]. Poultry meat is an excellent source of essential proteins, vitamins, and minerals with a relatively low saturated fat content, making it a highly nutritious and healthy food option [2]. In addition, chicken meat is considered a healthier option than red meat due to its lower cholesterol and fat levels [3]. Compared with other animal products, commercial broiler breeds have a shorter production cycle. In broiler breeds, the production stage is completed in 5−7 weeks. Advances in broiler chick live weight are a consequence of advancements in breeding programs and genetic manipulation. They have permitted a reduction of the marketable age [4]. The current broiler industry is described as mass broiler production with a high investment turnover but low profit per broiler. Business success is mainly determined by the skills of business persons to control the cost of production [1].

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The marketing age is related to various factors, such as the demand for poultry products in the market, mortality rates, the size of the flock, environmental conditions, and the hygiene standards of the farm where the poultry is raised [5]. In poultry production, in addition to improving live performance, genetic improvement has reduced the age to market. The length of the broiler production cycle significantly affects production and economic performance [6]. Growth performance is vital to determining the economically acceptable age for slaughter [7]. In determining the most profitable age and weight to market commercial broilers, producers should consider both production and market conditions. The livability and fat deposition are negatively affected (mortality and fat deposition increase) by the increase in broiler market age. High broiler weight at slaughter is the primary goal of the farmer. Due mostly to genetic advancement, better nutrition, and a controlled environment, broiler chicken development performance has increased significantly in the last 30 years, and it now takes just 33 days to achieve a finishing body weight of ~2 kg. The high cost of broiler production is influenced by feed costs, and feed costs changed unfavorably throughout the previous period. Increasing the slaughter age benefits producers by providing more meaty animals. However, despite the high mortality, the impacts on profit, meat product quality, environment, and animal welfare have been little investigated [8]. Increasing marketing age affects production efficiency, resulting in higher production costs. The higher marketing age leads to higher body weights obtained when trading meat cuts from the processors' perspective. However, over the past few decades, eating patterns around the world have developed, with a clear preference for processed meat and meat cuts. As a result, the industry for chicken chops has exceeded the market for whole birds [9].

Regarding growth efficiency, carcass characteristics, and profitability, marketing age is essential. The issue is that various producers and farmers have different marketing days. Some producers think that selling their chickens sooner is preferable and offers a market advantage. However, the price and profit are influenced by younger birds [10]. For this purpose, to achieve the objectives of both producers and consumers, it is essential to identify the ideal marketing age for broiler chicken to improve growth performance and economic efficiency. The goal of this study was to find out how varying marketing ages affected the productivity, carcass qualities, and economic parameters of broiler birds.

2. Materials and methods

2.1. Ethical approval and the experimental site

The experiment was conducted from September 9 to November 4 2020 at the Center of Experimental Animal Research, Faculty of Veterinary Medicine, Benha University, Egypt. All procedures and the research protocol were carried out following the guidelines of the Local Committee for Experimental Animal Care and were confirmed by the ethics of the Institutional Animals Care and Use Committee Research Ethics Board, Faculty of Veterinary Medicine, Benha University under ethical number BUFVTM 07-06-21.

2.2. Experimental design

A total of 200 male, 1-day-old Cobb-500 broiler chicks were obtained from a local hatchery. All chicks were subjected to the same managerial and hygienic housing conditions. The chicks were received, weighted, wing banded, and distributed randomly into four experimental groups (five replicates each and 10 birds/replicate). The chicks were kept in well-ventilated litter floor rooms and stocked at a density of 10 birds/m^2. The four groups were as follows:

(1) T1: At 35 days, poultry will be marketed (MA35).
(2) T2: At 42 days, poultry will be marketed (MA42).
(3) T3: At 49 days, poultry will be marketed (MA49).
(4) T4: At 56 days, poultry will be marketed (MA56).

2.3. Diets and feeding

The birds were provided ad libitum access to basic meals made of corn and soybean meal. The diets formulated were created following the Cobb-500 Broiler Management Guide, which is available at https://www.cobb-vantress.com/assets/5a88f2e793/Broiler-Performance-Nutrition-Supplement.pdf. The feeding program was separated into three parts. Part one extended from day 1 to day 14 and received a starter ration. The second part was lengthy from day 15 to day 28 and received a grower ration. The third part extended from day 29 to the day of marketing and received a finisher ration.

Table 1 lists the ingredients and calculated chemical composition of each basal diet. The chicks were divided into four groups at random, each having five replicate pens with 10 birds in them.

Table 1. Ingredients and calculated chemical composition of the basal diets used during different growth phases of broiler chicks.

Items	Starter diet	Grower diet	Finisher diet
Yellow corn	54.67	58.28	62.62
Soybean meal, 46%	36	33.8	28.9
Vegetable oil	2.5	3.5	4.5
Corn gluten meal, 60%	2	0	0
Dicalcium phosphate	1.7	1.45	1.33
Limestone	1.45	1.35	1.2
L-lysine	0.33	0.29	0.23
Sodium chloride	0.32	0.3	0.3
Vit & min premix[a]	0.3	0.3	0.3
DL-methionine	0.28	0.27	0.23
Sodium bicarbonate	0.19	0.17	0.17
Anticoccidian	0.05	0.05	0.05
Anti-mycotoxin	0.05	0.05	0.05
Anti-clostridium	0.03	0.03	0.03
L-threonine	0.03	0.04	0
Energy enzyme	0.02	0.04	0.01
Lysomax	0.01	0.01	0.01
Phytase enzyme	0.01	0.01	0.01
Protease B	0.01	0.01	0.01
Choline chloride	0.05	0.05	0.05
Calculated composition			
Crude protein%	23.02	21.03	19.03
MEn kcal/kg	3053.85	3152.05	3224.10
Crude fiber%	2.27	2.25	3.13
Lysine%	1.35	1.25	1.09
Methionine%	0.63	0.59	0.54
Methionine +cysteine%	1.02	0.95	0.86
Threonine%	0.94	0.88	0.77
Calcium%	1.05	0.95	0.85
Available phosphorus%	0.50	0.45	0.42

[a] Each 3 kg contained: Vit. A 12,000,000 IU, Vit. D3 2,000,000 IU, Vit. E 10,000 mg, Vit. K3 2000 mg, Vit. B 11,000 mg, Vit. B2 5000 mg, Vit. B6 1500 mg, Vit. B12 10 mg, Biotin 50 mg, Pantothenic acid 10,000 mg, Nicotinic acid 30,000 mg, Folic acid 1000 mg, Manganese 60,000 mg, Zinc 50,000 mg, Iron 30,000 mg, Copper 10,000 mg, Iodine 1000 mg, Selenium 100 mg, Cobalt 100 mg, carrier (CaCo3) added to make the total 3 kg.

2.4. Evaluation of growth performance

Each chick in each replicate was weighed using an electric balance every week at days 0, 7, 14, 21, and 28 as well as at the end of the raising period (various marketing ages). By deducting the final body weight (FBW) from the initial body weight, the body weight gain (BWG) was computed according to Pouliot and Doyon [11].

The feed intake (FI) was calculated by deducting the amount of refused feed from the amount of the provided feed. The feed conversion ratio (FCR) was calculated by dividing the feed consumed (g/bird/week) by the BWG (g/bird/week) according to Shehata *et al.* [12].

Mortality percentage: The number of losses for each replicate was recorded every day until the rearing period was completed according to Hailegebreal *et al.* [13].

Mortality (%) = dead birds/total birds * 100.

Livability (%) = 100 − mortality % according to Abougabal and Taboosha [4].

The European Production Efficiency Factor (EPEF) was calculated using the equationEPEF = (average grams gained/day × survival rate)/(FCR × 10) as described by Mohammed *et al.* [14].

2.5. Carcass traits

On the day of marketing, ten birds were selected at random from each group, and they were fasted for 12 h. Each bird was then weighed, slaughtered, dressed, and eviscerated. The dressing percentage was determined as a percentage of live weight. Relative internal organ weights, such as those of the heart, gizzard, liver, spleen, and intestinal weights, were recorded individually, and their percentages to live body weight were calculated according to Olawumi *et al.* [15]. The giblet represents the sum of the liver, opened gizzard, spleen, and heart as described by Coban *et al.* [16].

2.6. Evaluation of economic efficiency

The economic efficiency of production was measured by calculating the cost of production and returns. The total costs (TC) comprised the total fixed costs, which included depreciation on buildings and equipment, and the total variable costs (TVC), which included feed consumption, veterinary care, labor, chick price, water, electricity, and litter [17,18]. The average value of each of these was calculated as LE for each bird in each group throughout the experiment. According to estimates, this reflects the average value for each bird in each group in LE (1 USD = 15.67 LE). The total feed cost = total feed intake/bird × price/kg of diet, according to Mohammed *et al.* [19]. The return criteria included total return (TR) as the sum of the average litter selling return per bird on the marketing day and the average bird selling return per gram and net profit (NP = TR−TC) were determined as return parameters according to Kato *et al.* [20].

Using the mentioned previous return and cost parameters, economic efficiency indices were determined as follows: benefit−cost Ratio (BCR) = TR (L.E/chick/group)/TC (L.E/chick/group), TR (L.E/chick/group/TVC (L.E/chick/group), net profit (NP)/TC, NP)/TVC, BW/kg (final BW/1000), and WG/kg (final BWG/1000).

2.7. Statistical analysis

The results were statistically analyzed using the IBM SPSS 'version 22' (SPSS, 2013) [21]. To identify distinctions among the different groups, one-way analysis of variance (ANOVA) was carried out to determine the means among different treatment groups. Tukey's test was used to calculate significance. Results are shown as mean and standard error (SE) of the mean. To examine the percent mortality among the different treatment groups, a cross-tabulation analysis was carried out.

3. Results

3.1. Growth performance

Table 2 shows the impacts of various MA on broiler chicken performance. All the supplemented groups significantly improved ($P < 0.05$) in live weight, weight gain, FI, and FCR when compared with the control group on days 28 and 35.

Various marketing ages of broiler chickens were found to have a significant impact on their livability, mortality rate, feed intake, feed conversion ratio, body weight, BWG, and feed input. MA 56 and MA 49 had higher FBW, final body weight gain (FBWG), and total feed intake (TFI) than MA 35 and MA 42. However, MA 35 and MA 42 had the highest average weight gains (DWG) ($P < 0.05$).

Furthermore, there was a notable divergence in FCR between different marketing ages of broilers. Among the different groups, MA35 exhibited the lowest (best FCR), followed by MA 42, MA 49, and MA 56. As the MA was extended, FCR worsened and BWG decreased. In addition, by lengthening the rearing period, the mortality percentage increases.

3.2. Economic efficiency

Table 3 shows the effects of different marketing ages (MA) on the economic parameters of broiler chickens during the experimental period. There was no significant difference among different marketing age groups in broiler birds in the 1st and 2 nd weeks and grower (3rd and 4th weeks) diets for the costs of different marketing ages in broiler birds. However, the cost of the finisher diet showed a significant ($P < 0.05$) difference among different MA groups. The MA 56 group showed higher feed costs, followed by the MA 49 and MA42 groups.

Table 4 demonstrates the effects of different marketing ages on economic efficiency measures. It revealed that TR/TVC, NR/TC, NR/TVC, BCR, and EPEE were highest in the MA35 group, followed by the MA 42, MA 49, and MA 56 groups. In terms of BW/kg and BWG/kg, there was a considerable increase in the MA56 group, followed by the MA 49, MA 42, and MA 35 groups.

3.3. Carcass traits

The impacts of various marketing ages on broiler chicken carcass traits are shown in Table 5. At the end of the experimental period, the percentages of dressed weight and spleen showed significant ($P > 0.05$) differences among different marketing ages. However, the gizzard and giblet percentages showed nonsignificant differences at the end of the experimental period. It was observed that prolonging the broiler's marketing age resulted in a considerable and favorable increase in the bird's live body weight (LBW), which reflects an improvement in the dressed weight of the whole carcass. However, there are no significant differences in gizzard, liver, or giblet (%).

4. Discussion

The poultry industry is considered the fastest growing and the most flexible sector in the regional livestock market. Egypt's poultry industry has quickly established itself as one of the most successful of all livestock activities [22]. Raising and selling chicken is characterized by quick financial turnover, a short capital cycle, and a higher return

Table 2. Growth performances of broilers at different marketing ages.

Items	IBW Mean ± SE	FBW Mean ± SE	FBWG Mean ± SE	DWG Mean ± SE	TFI Mean ± SE	FCR Mean ± SE	Livability% Mean ± SE	Mortality% Mean ± SE
MA35	$49.28^a \pm 0.47$	$1842.50^c \pm 49.05$	$1793.22^c \pm 49.10$	$51.23^a \pm 1.40$	$2534.00^d \pm 36.18$	$1.42^d \pm 0.05$	97.5^a	2.5
MA42	$49.29^a \pm 0.65$	$2225.00^b \pm 43.30$	$2175.71^b \pm 43.51$	$51.80^a \pm 1.04$	$3421.75^c \pm 42.78$	$1.57^c \pm 0.03$	95^b	5
MA49	$49.45^a \pm 0.49$	$2482.50^a \pm 65.62$	$2433.05^a \pm 65.57$	$49.65^a \pm 1.34$	$4395.00^b \pm 72.65$	$1.81^b \pm 0.03$	95^b	5
MA56	$49.75^a \pm 0.85$	$2695.00^a \pm 41.13$	$2645.25^a \pm 41.27$	$47.24^a \pm 0.74$	$5508.25^a \pm 86.36$	$2.08^a \pm 0.02$	90^c	10

[a]Means within a column with different superscripts (a,b,c) differ significantly at P less than 0.05 among different marketing ages in broiler chickens. MA, marketing age; IBW, initial body weight; FBW, final body weight; FBWG, final body weight gain; TFI, total feed intake; FCR: feed conversion rate; DWG: daily weight gain; SE: standard error of the mean; MA35, marketing age at 35 days; MA42, marketing age at 42 days; MA49, marketing age at 49 days; MA56, marketing age at 56 days.

Table 3. Economic parameters of broilers at different marketing ages.

Items	MA35	MA42	MA49	MA56
	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE
Chick price	6	6	6	6
Price kg meat	25	25	25	25
Starter cost	3.63^{a}±0.05	3.53^{a}±0.10	3.62^{a}±0.06	3.61^{a}±0.11
Grower cost	8.11^{a}±0.43	8.36^{a}±0.08	8.37^{a}±0.11	8.53^{a}±0.10
Finisher cost	4.70^{d} ± 0.17	10.10^{c}±0.15	16.09^{b} ± 0.33	22.91^{a}±0.53
Total feed	16.44^{d} ± 0.24	21.99^{c}±0.28	28.08^{b} ± 0.46	35.05^{a}±0.54
Drug cost	1.40^{d} ± 0.00	1.50^{c}±0.00	1.60^{b} ± 0.00	1.70^{a}±0.00
Vaccine cost	0.30	0.30	0.30	0.30
Disinfectant	0.30	0.30	0.30	0.30
TVM	2.00	2.10	2.20	2.30
Litter cost	1.20^{d}	1.40^{c}	1.50^{b}	1.60^{a}
Labor	1.75	2.00	2.50	2.75
Water and Electricity	0.15^{d}	0.20^{c}	0.25^{b}	0.30^{a}
TVC	27.54^{d} ± 0.24	33.69^{c}±0.28	40.53^{b} ± 0.46	48.00^{a}±0.54
Building	2.00	2.25	2.50	2.75
Equipment	0.20	0.20	0.20	0.20
TFC	2.20^{d}	2.45^{c}	2.70^{b}	2.95^{a}
TC	29.74^{d} ± 0.24	36.14^{c}±0.28	43.23^{b} ± 0.46	50.95^{a}±0.54
Litter sale	0.50	0.50	0.50	0.50
Broiler sale	46.06^{d} ± 1.23	55.63^{c}±1.08	61.56^{b} ± 1.72	67.38^{a}±1.03
Total return	46.56^{d} ± 1.23	56.13^{c}±1.08	62.06^{b} ± 1.72	67.88^{a}±1.03
Net Profit (NP)	16.82^{a}±1.28	19.98^{a}±1.06	18.83^{a}±1.33	16.93^{a}±0.74

[a]Means within a row with different superscripts (a,b,c) differ significantly at *P* less than 0.05 among different marketing ages in broiler chickens. MA, marketing age; SE: standard error of the mean; TVM, total veterinary management; TFC, total fixed cost; TVC, total variable cost; TC, total costs; TR, total return; NP, net profit; kg: kilogram; SE: standard error of the mean; MA35, marketing age at 35 days; MA42, marketing age at 42 days; MA49, marketing age at 49 days; MA56, marketing age at 56 days.

on investment. Unfortunately, the production cost of broiler meat increases and remains high due to continuous increases in feed costs, which are responsible for up to 75–80% of livestock production costs, especially in poultry production [5]. In the present investigation, we studied the impacts of different MAs to determine which had the least negative influence on birds' health, livability, daily

Table 4. Economic efficiency measures of broiler chicken at different marketing ages.

Economic efficiency measures				
	MA35 Mean ± SE	MA42 Mean ± SE	MA49 Mean ± SE	MA56 Mean ± SE
TR/TVC	1.69^{a}±0.05	1.67^{ab} ± 0.03	1.53^{b} ± 0.03	1.41^{c}±0.01
NR/TC	0.57^{a}±0.04	0.55^{ab} ± 0.03	0.43^{b} ± 0.03	0.33^{c}±0.01
NR/TVC	0.61^{a}±0.05	0.59^{ab} ± 0.03	0.46^{b} ± 0.03	0.35^{c}±0.01
BW/kg	1.84^{d} ± 0.05	2.23^{c}±0.04	2.46^{b} ± 0.07	2.70^{a}±0.04
BWG/kg	1.79^{d} ± 0.05	2.18^{c}±0.04	2.43^{b} ± 0.07	2.65^{a}±0.04
BCR	1.57^{a}±0.04	1.55^{ab} ± 0.03	1.43^{b} ± 0.03	1.33^{c}±0.01
EPEF	354.65^{a}±20.60	313.33^{b} ± 11.99	254.51^{c}±10.75	204.25^{c}±4.65

[a]Means within a row with different superscripts (a,b,c) differ significantly at *P* less than 0.05 among different marketing ages. TVC, total variable cost; TC, total costs; TR, total return; NP, net profit; BW, body weight; FBW, final body weight; BWG, kg: kilogram; BCR, benefit–cost ratio; EPEF, European production efficiency factor; SE: standard error of the mean; MA35, marketing age at 35 days; MA42, marketing age at 42 days; MA49, marketing age at 49 days; MA56, marketing age at 56 days.

Table 5. Effect of different marketing ages (MA) on carcass traits of broiler birds during the experimental period.

Items	Live body weight Mean ± SE	Dressed weight% Mean ± SE	Gizzard% Mean ± SE	Liver % Mean ± SE	Spleen % Mean ± SE	Giblet % Mean ± SE
MA35	1866.67^{b} ± 44.10	71.61^{b} ± 1.00	2.74^{a}±0.17	1.95^{a}±0.11	0.17^{a}±0.01	2.83^{a}±0.15
MA42	2220.00^{ab} ± 69.28	77.72^{a}±1.35	2.31^{a}±0.11	1.92^{a}±0.08	0.15^{a}±0.01	2.49^{a}±0.09
MA49	2420.00^{ab} ± 47.35	75.55^{ab} ± 0.84	2.64^{a}±0.07	1.77^{a}±0.05	0.12^{a}±0.01	2.73^{a}±0.07
MA56	2710.00^{a}±65.83	77.66^{a}±0.93	2.37^{a}±0.10	1.81^{a}±0.05	0.11^{a}±0.01	2.42^{a}±0.12

[a]Means within a row with different superscripts (a,b,c) differ significantly at *P* less than 0.05 among different marketing ages in broiler chickens. LBW, live body weight; SE: standard error of the mean; MA35, marketing age at 35 days; MA42, marketing age at 42 days; MA49, marketing age at 49 days; MA56, marketing age at 56 days.

weight gain, and profit. Economic analysis guided the selection of the current study, which aims to provide producers with applicable and cost-effective recommendations for rearing their birds.

The present study indicated that MA56 and MA49 in broiler chickens had a significant increase in FBW, FBWG, and TFI. This follows the theory of increasing BW and BWG, a prolonged marketing age results in weekly increases in final body weight and weight gain. As expected, FBW and FBWG in marketing increased with age [23]. However, as age progresses, the growth rate decreases and DWG diminishes, with BWG reaching its peak between 35 and 42 days of age. Beyond this age, BWG dropped from 49 to 56 days old. When the bird reaches its peak growth rate, which marks the inflection point in the growth curve, the rate begins to slow. Age was associated with a significant rise in live body weight and daily weight gain [7,24]. Furthermore, the findings of this study were consistent with previous studies, which revealed that live body weight increased progressively with age [6,14,25].

The MA35 exhibited the lowest FCR, followed by the MA42, MA49, and MA56. As MA increases, the FCR worsens and the BWG decreases. As marketing age increases, so does the mortality rate. This is due to feed consumption and total feed consumption increases with age, while DWG decreases after 42 days of age. These findings correspond with those of Abougabal and Taboosha [4]. The results of this study show a strong correlation between MA and mortality rate. By lengthening the rearing period, the mortality percentage increases as evidenced by a high mortality associated with MA 56 and MA 49. These findings are in agreement with Szőllősi and Szűcs [6], who found that the mortality % increased by about 2.69% with age from 35th to 49th days of age.

Economically, lengthening the slaughter age of broilers causes a significant decline in TR, NR, and other economic efficiency measures. As FI was high in the birds' MA 49 and MA 56, the main causes of these financial losses were the reasonable reductions in BWG and the cost of feeding the birds. This explains the elevated TVC values seen in flocks of birds stocked at high densities because, in chicken farms, feed costs account for approximately 70−80% of the TVC [26]. The MA 56 group had the highest feeding costs, followed by the MA 49 and MA42 groups. The broiler sales and total return were observed high in the MA56 group, followed by the MA49 group. However, decreased broiler sales were detected in MA35 and MA42 groups. There was no significant difference among different MA groups in broilers in net profit (NP). However, the highest NR was observed in MA 42 and MA 49 groups. However, the highest NR was observed in the MA 42 and MA 49 groups. This is due to increased feed consumption, which reflects the feed cost. Furthermore, feeding expenditures account for 70−80% of TVC, representing total costs [16,27]. MA56 and MA 49 outperformed MA42 and MA35 in terms of broiler sales, total return, and net profit. This is because older chickens have a higher body weight than younger chickens. There is a direct association between broiler sales and final body weight, indicating TR and NP [28,29]. The maximum income is obtained with 42- to 49-day-old chicken broilers, while profits decline with longer growing periods.

The economic analysis of the extended marketing age revealed that increasing TR, NR, TVC, and TC in prolonged MA led to decreased TR/TVC, NR/TC, NR/TVC, and BCR in MA56 and MA49 groups compared with MA42 and MA35 groups. This is due to more feed consumption during the long rearing period, which contributes 70−80% of total costs [14]. Furthermore, MA56 and MA49 exhibited higher BW (kg) and BWG (kg) with longer marketing ages. This is due to the law of diminishing return which states that after some maximum level of capacity is reached, adding a factor of production will result in smaller increases in output. This result agreed with successive increments of daily feed intake, resulting in progressively smaller increases in daily BW gain [30]. In addition, EPEF was significantly higher in early MA chicks than in other late MA groups. The best EPEF was detected by broilers raised to 35 days, followed by MA42, MA49, and MA56. This finding supports Kamruzzaman *et al*. [5].

In this study, it was observed that the delay in the marketing of broilers had a notable and positive increase in LBW of chickens, which reflects an increase in the percentage of a whole carcass dressed weight. It was noticed that MA56 and MA49 have a higher whole carcass and dressed weight% than MA42 and MA35. There are no substantial differences in gizzard, liver, or giblet percentages. Similarly, these findings are compatible with those of Abougabal and Taboosha [4], Smaldone *et al*. [31], and Tavaniello *et al*. [32], who found that extending marketing age in broilers did not affect gizzard% and giblet%. These findings were consistent with previous studies on the growth performance of birds at various slaughter ages.

5. Conclusion

Our results indicate that the marketing age of broilers could be prolonged up to 49 days. The average daily gain decreased beyond 42 days. Birds can achieve appropriate growth performance at MA 42 while showing no evidence of stress or economic loss. MA 42 had the highest NP, followed by 49 days (19.98, and 18.83 LE/bird, respectively), with MA56 having the lowest NP. BCR was better in MA 35 and 42. MA56 had high BW and BWG (2.70 and 2.65 kg, respectively). There were no significant differences among marketing ages according to carcass traits.

Conflicts of interest

There are no conflicts of interest.

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