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Carcass Traits, Cuts Yield, Raw Meat Quality and Burger Quality Characteristics of Different Marketing Ages and Sex Broiler Chickens

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THIS STUDY aimed to study the effects of marketing age and sex of broiler on the carcass traits and meat quality and chicken burger quality characteristics. The results revealed that the increasing of marketing age result in increasing of live bird weight with increasing rate ranged between 14 to 25 % every 5 days, also with increasing marketing age the dressed ratio increased since it was 70.72% at 30 days marketing age, while it reached 77.50% at 50 days marketing. In regard to giblets ratio, it was decreased with increasing the marketing age, since it decreased from 4.44% at 30 days marketing age to 3.10% at 50 days marketing age. Breast weight percent was increased with increasing marketing age, since it increased from 17.81% at 30 days marketing age to 20.86% at 50 days marketing age. The results showed that chicken burger processed from female chicken breast meat had superior physiochemical properties than that processed from male chicken breast meat. The same trend was obtained for cooking measurements which were higher for female chicken breast meat burger than that of male chicken breast meat burger. Sensorial results showed that burger processed from female chicken breast meat had higher acceptability for all sensory properties than burger which processed from male chicken breast meat. The results showed that 45 days marketing age was the super marketing age from both quality of breast chicken meat and quality of chicken breast meat burger.

Keywords: Broiler, Marketing age, Slaughter age, Chicken meat quality, Chicken burger

Introduction

The quality of meat in general and hence poultry meat is an extremely complex concept that can be assessed from different points of view. From the standpoint of consumer interests and the slaughter industry, broilers should have not only high slaughter yields and desirable carcass conformation scores but also good aesthetic, sensory and nutritional characteristics. Nutritionally speaking, poultry meat is a valuable source of proteins, vitamins and minerals, and has a relatively low fat content. In that respect, the chemical composition of muscle tissue of major primal cuts is an important element of broiler meat quality (Bogosavljeviæ-Boškoviæ *et al.,* 2003).

The main goal of broiler rearing is production of high quality broiler carcasses that will be acceptable from the consumers. Acceptability depends on the quality and quantity of edible parts of carcasses, and the amount of muscle mass in carcass (Nikolova and Bogosavljević-Bošković, 2011).

Carcass characteristics with emphasis on noble meat yield, such as breast meat, quality attributes, such as taste and color, fat deposition and muscle fiber composition are considered by breeding programs (Yang and Jiang, 2005). Another important aspect is the adjustment to the consumer market in order to meet the demand for processed and easy preparing products.

Bilgili *et al.* (1992) reported that chicken performance and carcass characteristics are mainly influenced by sex and slaughter age. Slaughter age affects the quality of poultry meat, it mainly determines the organoleptic attributes of meat, but also has an effect on its technological properties. In the modern intensive poultry production, age at slaughter depends on whether birds attain the desired body weight, since chickens should be

slaughtered immediately after the birds reach the maximum rate of weight gain (Poltowicz and Doktor, 2010).

Furthermore, the quality of poultry meat gathers quantifiable properties of meat such as water holding capacity, shear force, drip loss, cooking loss, pH, shelf life, collagen content, protein solubility, cohesiveness, and fat binding capacity, which are indispensable for processors involved in the manufacture of value-added meat products (Allen *et al.,* 1998).

This study aimed to compare the weight gain of chicken birds; males and females, to evaluate the yield of the carcass and cuts of commercial interest in different slaughter ages and evaluate the influence of birds, sex and age of slaughter on the quality characteristics of chicken meat and chicken breast meat burger.

Materials and Methods

Materials

Site area

The breeding experiment was carried out at the Poultry Research Station; belong to Animal Production Department, Faculty of Agriculture, Al-Azhar University, Cairo, Egypt.

Birds managements, diets and design

A total number of 480 broiler chicks Cobb500 one day old mixed sex birds were obtained from a commercial hatchery and brooded together in pen measured (4 x 5 m^2) at the first week of brooding practices. The chicks were kept under uniform environmental conditions to avoid any mortality occurred during the first week of age. On commencement, at 7^{th} day of age, chicks were distributed into a completely randomized design to five experimental groups with 3 replicates containing 30 birds each with equal sex ratio 15 males and 15 females to meet slaughter ages (30 , 35, 40, 45 and 50 days).

Birds were randomly allocated into 15 floor pens with dimensions 2 meter x 2.25 meter in an open sided house covered with wood shaving (30 birds per pen with equal sex ratio 15 males and 15 females). A pen was considered as an experimental unit for all performance measurements. Birds had a free access to feed and water for ad-libtum consumption with constant photoperiod 23 L: 1D per day during the growing period. All experimental diets were iso-caloric, iso-nitrogenous and were formulated to meet the requirements of the strain. Birds were fed a corn-soybean meal based starter diet (3000 Kcal.ME/Kg, 23 % C.P. from 0 – 21 days), and after that fed finisher diet (3200 Kcal.ME/Kg, 19 % C.P.) to the marketing age. All birds were reared under similar managerial and hygienic conditions.

Slaughtering test and procedure

At the end of each marketing age (30, 35, 40, 45 and 50 days), in order to determine the carcass traits and economical cuts yield, 12 birds (6 males and 6 females) were chosen randomly from each group. Birds were identified, weighted and fasted for 6 hrs. After the recommended fasting period, birds were weighted and then slaughtered manually with a knife (Halal method) and were allowed to bleed for 3 minutes. After a complete bleeding, birds were scalded at 65 ^{o}C for 45 sec., feather removed and manually eviscerated. Following evisceration, all carcasses were chilled in cold water for 15 minutes. Hot carcass, economical cuts, edible parts and organs were weighted and calculated as a percentage on basis of live body weight, then chicken breast meat groups (male and female chicken meat) were deboned, skinned and individually placed in a labeled plastic bags, since it were transported in icebox to Food Science and Technology Department, Faculty of Agriculture Al-Azhar University, Cairo, Egypt to evaluate the influence of bird's sex and marketing age on the quality characteristics of chicken breast meat, then chicken breast meat of different slaughter ages were processed into chicken breast meat burger to evaluate the effect of chicken sex and marketing age on the quality characteristics of chicken breast meat burger.

Other ingredients used in burger formula

Spices, Fresh eggs, onion and salt (sodium chloride) were obtained from local market. Soy flour was obtained from the Food Technology Institute Agriculture Research Center- Giza, Egypt. Sodium tripolyphosphate and sodium ascorbate were obtained from El-Gomhoria for Chemicals Co., Cairo- Egypt.

Methods

Chicken burger preparation

Chicken breast meat burger was prepared as described by Oroszvari et al. (2005) according to formula showed in Table 1 as follows: frozen chicken breast meat was cut into approximately 5 cm cubes and minced twice with the ice flakes

by using meat mincer. The other ingredients were added and mixed together by using a kitchen aid mixer using the paddle attachment (model Braun KM 32, Germany). After mixing, chicken burger mixture was shaped manually using a patty maker (stainless steel model "Form", Italy) to obtain round discs of 10 cm diameter and 0.50 cm thickness, weighing 50 g. Burger patties were aerobically packaged in a foam plate, wrapped with polyethylene film and kept in a freezer at –18±2°C till analysis.

Cooking of chicken burger patties

Chicken breast meat burgers were cooked according to the method of Ou and Mittal (2006), since burger patties were cooked directly from the frozen state by contact grilling on a preheated electrical grill for 20 min. until the brown color of cooked appearance was reached (6 min. for each side) at grilling temperature 150 °C, internal temperature 75°C for15 sec.

Chemical analyses

Proximate composition moisture, crude protein (factor of 6.25 was used for conversion of nitrogen to crude protein), fat and ash content were determined according to AOAC (2005). Total carbohydrates were calculated by difference as follows:

Total carbohydrate = 100 - (% moisture + % protein + %fat + % ash).

Caloric value determination

Total caloric values (Kcal) were calculated using method of AGAL (1998).

Physical analyses

PH value

pH value for chicken breast meat and chicken breast meat burgers was 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) and plasticity

Water holding capacity (WHC) (as % retained water) and plasticity (cm^2) were determined by filter press method as described by Wang and Zayas (1992).

Drip Loss

Drip loss was measured by the difference between weight of complete frozen sample (chicken breast meat and chicken breast meat burger) and weight of the same sample after thawing. The drip loss was calculated as the percentage of weight change according to El-Seesy (2000) using the following equation:

$$\% \text{ Drip loss} = \frac{\text{Frozen sample weight} - \text{Thawed sample weight}}{\text{Frozen sample weight}} \times 100$$

Cooking characteristics

Cooking shrinkage

Burgers after cooking were cooled to 21°C for 1 hr and blotted to determine cooking shrinkage according to the method of Berry (1992), since burger patties diameter were measured before cooking (A_1) and after cooking (A_2) and cooking shrinkage ratio was calculated according to the following equation:

$$\% \text{ Cooking Shrinkage} = \frac{A1 - A2}{A1} \times 100$$

TABLE 1. chicken burger formula.

Ingredients	٪
Chicken breast meat	62.00
Soybean	12.00
Fresh Ground onion	7.00
Whole Egg (blended)	7.00
Water (as ice flakes)	10.00
Sodium chloride	1.37
spices mixture	0.5
Sodium tri polyphosphate	0.1
Sodium ascorbate	0.03

Cooking yield (%) and cooking loss (%)

Samples were weighted before and after cooking to determine cook yield and cook loss according to the method of Akwetey and Knipe (2012) according to the following equations:

$$\% \text{ Cooking yield} = \frac{\text{Cooked weight}}{\text{Raw weight}} \times 100$$

$$\% \text{ Cooking loss} = \frac{\text{Raw weight - Cooked weight}}{\text{Raw weight}} \times 100$$

Moisture and fat retention (%)

The amount of retained moisture and fat in chicken burger samples were estimated according to the method described by Aleson *et al*. (2005) using the following equations:

$$\% \text{ Moisture retention} = \frac{[\text{cooked weight (g)} \times \% \text{ moisture in cooked samples}]}{[\text{raw weight(g)} \times \% \text{ moisture in raw samples}]} \times 100$$

$$\% \text{ Fat retention} = \frac{[\text{cooked weight (g)} \times \% \text{ fat in cooked samples}]}{[\text{raw weight(g)} \times \% \text{ fat in raw samples}]} \times 100$$

Statistical analysis

The data obtained from three replicates were analyzed by (ANOVA) using the SPSS statistical package program and differences among the means were compared using the Duncan's Multiple Range test at significant level of 0.05 (SPSS, 1998).

Results and Discussion

Evaluation of broiler performance

Table 2 shows the relative weights for male and female carcasses marketed at different ages the data show that the increase of marketing age result in significant increment of live bird weight with increment rate ranged between 14 to 25 % every 5 days, for male birds and 7 to 14 % every 5 days for female birds. At the end of the breeding period (50 days age) the male bird's weight was increased with almost 100 % of the first marketing age 30 days since the weight of birds was doubled, while this increment of weight was almost 55 % of the initial marketing for female birds. The weight increment of female birds as a function of marketing age is significantly lower than that of male birds, since at the initial marketing age 30 days the bird's weight is very nearly (1496 g for male birds and 1510 g for female birds), which is significantly different at the last marketing age 50 days (2977 g for male birds and 2345 g for female birds), which reflect the high turnover of feed in male birds as compared to female birds, so the long breeding period for male birds is more economical than that of female birds.

In regard to dressing percentage data in Table 2 show that with increasing marketing age the dressing percentage significantly increased since it was 70.72% at 30 days marketing age, while it reached 77.50% at 50 days marketing age for male birds, while it was 67.85% at 30 days marketing age and reached to 78.38 and 77.34% at 45 and 50 days marketing age respectively for female birds.

In contrast with the above mentioned trend the giblets ratio was significantly decreased with increasing marketing age, since it decreased from 4.44% at 30 days marketing age to 3.10% at 50 days marketing age for male birds, while it decreased from 4.47% at 30 days marketing age to 3.86% at 50 days marketing age for female birds, which indicate that female birds had higher giblets ratio than that of male birds this may be due to the lower weight of female birds.

Breast weight percent was significantly increased with increasing marketing age, since it increased from 17.81% at 30 days marketing age to 20.86% at 50 days marketing age for male birds, while it increased from 17.64% at 30 days marketing age to 20.65% at 50 days marketing age for female birds which have slightly lower breast weight percent than male birds.

The same trend was observed for thigh weight percent for both male and female birds except for the thigh weight at 45 days marketing age which was the highest weight percent (10.68) for male birds, while it was (10.42) for female birds.

The results also show that edible parts percent have the same trend, so it significantly increased with increased marketing age of the bird but there is no significant difference between the ratios of edible parts at 45 and 50 days marketing age for male birds (80.79 and 80.60 % respectively) but edible parts at 45 days marketing age for female birds was the highest one (81.85%).

The data in Table 2 show that non edible parts weight ratios were significantly decreased with increasing marketing age since it decreased from 24.84% at 30 days marketing age to 19.2% at 45 days marketing age for male birds, and it decreased from 27.67% at 30 days marketing age to 18.15% at 45 days marketing age for female birds.

The abdominal fat weight ratio also was increased with increasing marketing age, since it increased from 0.46% at 30 days marketing age to 1.35% at 50 days marketing age for male birds, while it increased from 0.89 % at 30 days marketing age to 1.64 % at 50 days marketing age for female birds.

These results are in agreement with the findings of Bogosavljevic-Boskovic *et al.* (2010) who reported that males had significantly bigger carcasses than females at all ages and slaughter yields were higher in the males.

Similarly Nikolova and Pavloski (2009) defined that influence of age was significant since the chicken at age of 49th day had a lot bigger mass and proportion of breasts, thighs and drumsticks than chicken at age of 42nd and 35th day.

Also, Karaoğlu et al. (2014) reported that slaughter age significantly affected the carcass weight. As slaughter age goes on the weight of cold carcass increased. They also showed that age impact was statistically significant, so the chicken at age of 49th day had a lot bigger mass and proportion of breasts than chicken at age of 42nd and 35th day, as the chicken at age of 42nd days had significantly larger mass and major carcass parts proportion than chicken at age of 35th day.

Chemical composition of chicken breast meat quality

Breast fillets are very important for human nutrition because providing high quality protein, low collagen and low fat contents Karaoğlu *et al.* (2014). Table 3 shows that the amount of moisture in chicken meat was decreased when the slaughter age increased in male and female. It could be noticed from data in table 3 that chicken male's meat was slightly higher in moisture content than that of chicken female's meat at any slaughter age.

In contrast with the situation with moisture, protein content of chicken meat was increased as the age of slaughter increased which agree with the findings of Suchy *et al.* (2002) who reported that protein content of breast, thigh and drumstick increased as the age increased.

The protein content of chicken female's meat was slightly higher than that of chicken male's meat at all slaughter ages. Similar results were obtained by Žlender *et al.* (1995), Bogosavljević-Bošković *et al.* (1999), Suchy *et al.* (2002) and Kumar and Rani (2014).

TABLE 2. Carcass traits (as % of live body weight) as affected by different marketing ages.

Parameter	Bird's sex	Age (days)				
		30	35	40	45	50
LBW*(g)	Male	1496^{e}	1877^{d}	2154^{c}	2521^{b}	2977^{a}
	Female	1510^{e}	1685^{d}	1918^{c}	2186^{b}	2345^{a}
Carcass %	Male	70.72^{c}	74.18^{b}	73.66^{b}	77.27^{a}	77.50^{a}
	Female	67.85^{d}	73.13^{c}	76.80^{b}	78.38^{a}	77.34^{a}
Giblets %	Male	4.44^{a}	3.88^{b}	3.67^{c}	3.51^{d}	3.10^{e}
	Female	4.47^{a}	4.25^{b}	3.59^{d}	3.47^{e}	3.86^{c}
Breast %	Male	17.81^{c}	16.49^{d}	16.25^{e}	18.85^{b}	20.86^{a}
	Female	17.64^{b}	16.68^{c}	17.03^{c}	20.58^{a}	20.65^{a}
Thigh %	Male	9.53^{c}	9.37^{c}	10.21^{b}	10.68^{a}	10.15^{b}
	Female	8.66^{d}	8.86^{d}	9.52^{c}	10.42^{a}	9.90^{b}
Edible parts %	Male	75.16^{d}	78.06^{b}	77.34^{c}	80.79^{a}	80.60^{a}
	Female	72.33^{c}	77.38^{b}	80.38^{a}	81.85^{a}	81.20^{a}
Inedible parts %	Male	24.84^{a}	21.94^{c}	22.66^{b}	19.21^{d}	19.40^{d}
	Female	27.67^{a}	22.62^{b}	19.62^{c}	18.15^{e}	18.80^{d}
A. fat %	Male	0.46^{c}	1.04^{b}	0.98^{b}	1.02^{b}	1.35^{a}
	Female	0.89^{b}	1.06^{b}	1.57^{a}	1.49^{a}	1.64^{a}

* LBW = live body weight.

** In the same raw values with different superscripts are significantly different (P≤ 0.05).

The same trend was observed for fat and ash contents of chicken meat, which can be attributed to as the moisture content of chicken meat decreased with increasing slaughter age the other component of chicken meat are increased with observation that fat content of chicken female's meat was slightly higher than that of chicken male's meat. In general breast meat had low fat content which is in agree with Diaz et al., (2010) who relates that to the high white fibers content of breast muscle.

In contrast carbohydrate content is decreased as slaughter age increased, which can be explained by increasing the other components as the slaughter age increased.

The differences observed were due to the different metabolism in male and female broilers as reported by Bogosavljević-Bošković *et al.* (2010).

In regard to caloric value of chicken meat, the caloric value was increased as the marketing age increased which can be attributed to the increase of meat components and the decrease of moisture content beside the accumulation of fat with increasing marketing age which reflected in increment of caloric value of chicken meat. The results revealed that the caloric value of male chicken meat was higher than that of female chicken meat which due to the higher contents of protein, fat and carbohydrates of male meat as compared to female meat at any marketing age.

Physical properties of chicken breast meat

Water holding capacity (WHC) is a meat property describing the ability to retain water. It is a technological parameter used by the meat industry because it is related to post-slaughter weight loss, along with the quality and yield of meat and meat products. WHC also influences the sensory quality of meat because water loss during cooking can affect the juiciness and tenderness of meat (Aleson-Carbonell e*t al.* 2005). Table 4 shows that water holding capacity of chicken breast meat was significantly increased as the marketing age increased for both male and female chicken meat. Also, it could be noticed that the WHC of male birds Is significantly higher that of female birds at any marketing age.

From data in Table 4 it could be observed that meat of male chicken was had higher pH values when compared to meat of female chicken at any marketing age, which result in high moisture content of male chicken meat, since meat with higher pH value has higher water holding capacity as reported by Warriss (2000). These results are comparable to that obtained by Kumar and Rani (2014) who reported pH values ranged between 5.59 and 6.09 for chicken meat in Saudi Arabia market.

The drip loss percent of chicken breast meat are decreased with increasing marketing age but chicken female meat have the lower drip loss ratios because it have higher protein content which associated with greater protein hydration, which increased the water holding capacity of chicken muscles as reported by Kokoszyński1 *et al.* (2011).

Chemical composition of chicken breast meat burger

Table 5 shows the chemical composition of chicken breast meat burger processed from male and female chicken breast meat at different

TABLE 3. Chemical composition (%) and Caloric value (Kcal) of chicken breast meats with different sex and marketing ages.

parameter	Male Age / Days					Female Age / Days				
	30	35	40	45	50	30	35	40	45	50
Moisture	76.50^{a}	75.90^{a}	74.46^{b}	74.22^{b}	73.10^{c}	75.27^{ab}	75.13^{ab}	74.63^{b}	73.22^{cb}	73.01^{c}
Protein	19.20^{c}	19.56^{c}	20.23^{b}	20.89^{b}	21.76^{a}	19.43^{c}	19.74^{c}	20.23^{b}	21.45^{a}	21.86^{a}
Fat	0.94^{d}	1.32^{c}	1.46^{b}	1.53^{b}	1.70^{a}	1.02^{d}	1.38^{c}	1.51^{b}	1.73^{a}	1.84^{a}
Ash	1.03^{ef}	1.51^{c}	1.72^{b}	1.88^{b}	2.04^{a}	0.89^{f}	1.15^{e}	1.36^{d}	1.67^{c}	1.85^{b}
Carbohydrates	2.33^{b}	1.71^{c}	2.13^{c}	1.48^{d}	1.40^{d}	3.39^{a}	2.60^{b}	2.27^{bc}	1.93^{c}	1.44^{d}
Caloric value	95.4^{c}	97.0^{c}	103.9^{b}	103.2^{b}	107.9^{a}	100.5^{b}	101.8^{b}	103.6^{b}	109.1^{a}	109.8^{a}

* In the same raw values with different superscripts are significantly different (P≤ 0.05).

slaughter age. The moisture content of chicken breast meat burger of male chicken meat was slightly higher than that of female chicken breast meat burger at any slaughter age without any significant differences, the moisture content of chicken burger is decreased with increasing slaughter age for both male and female chicken meats which may be explained by increasing contents of other components as protein, fat and ash, which exhibit a contrary trend for the moisture content since they increased with increasing the slaughter age, protein and ash also were higher in male chicken breast meat burger than that of female chicken breast meat burger at any slaughter age, but the fat content of male chicken breast meat was lower than that of female chicken breast meat at any slaughter age. The carbohydrates content take the trend of moisture content since it decreased as the slaughter age increased but the carbohydrates content of female chicken breast meat burger was higher than that of male chicken breast meat burger at any age with a contrary trend for the other components of chicken breast meat.

The chemical composition results of chicken breast meat burgers processed from male or female chicken meat were comparable for that of Babji *et al.* (2000) who reported similar chemical composition for franchise chicken breast meat burgers (moisture 67.42 %, protein 20.47%, fat 6.75%, carbohydrate 3.86% and ash 1.51%).

The caloric value of chicken breast meat burger was increased as slaughter age increased which related to the decreasing of moisture content of chicken meat and increasing of other components contents with increasing the slaughter age. Also the data in Table 5 indicated that burger processed from female chicken breast meat was had significantly higher caloric value than that of burger processed from male chicken breast meat at 50 days marketing age.

Physiochemical properties of chicken breast meat burger

Table 6 shows the physiochemical characteristics of chicken breast meat burger processed from male and female chicken meat at different slaughter ages. The water holding capacity (WHC) value (as % retained water) of chicken breast meat burger was slightly increased with increasing the marketing age of both male

TABLE 4. Physical and Chemical quality characteristics of chicken meats with different sex and marketing age.

parameter	Male Age / Day					Female Age / Day				
	30	35	40	45	50	30	35	40	45	50
WHC	45.17^{g}	47.14^{f}	51.21^{d}	56.11^{b}	59.19^{a}	42.47^{i}	44.31^{h}	47.80^{e}	51.38^{d}	55.27^{c}
pH	6.11^{cd}	6.13^{cd}	6.21^{ab}	6.23^{ab}	6.34^{a}	5.88^{e}	6.00^{d}	6.14^{c}	6.19^{bc}	6.30^{a}
Drip loss	3.18^{a}	3.16^{a}	3.15^{a}	2.29^{c}	2.14^{c}	2.53^{b}	2.26^{c}	1.80^{d}	1.74^{d}	1.12^{e}

* In the same raw values with different superscripts are significantly different (P≤ 0.05).

TABLE 5. Chemical composition (%) and Caloric value (Kcal) of chicken burger processed from chicken meats with different sex and marketing age.

parameter	Male Age / Day					Female Age / Day				
	30	35	40	45	50	30	35	40	45	50
Moisture	68.71^{a}	68.65^{a}	68.40^{ab}	68.12^{abcd}	67.84^{bcd}	68.34^{abc}	68.27^{abc}	67.83^{bcd}	67.74^{cd}	67.66^{d}
Protein	18.67^{bc}	18.72^{bc}	18.89^{bc}	19.41^{a}	19.63^{a}	18.50^{c}	18.61^{c}	18.85^{bc}	19.12^{ab}	19.50^{a}
Fat	5.65^{c}	5.83^{bc}	6.08^{abc}	6.17^{ab}	6.29^{a}	5.72^{bc}	5.91^{abc}	6.11^{abc}	6.25^{a}	6.38^{a}
Ash	2.24^{b}	2.35^{ab}	2.42^{ab}	2.56^{ab}	2.68^{a}	2.20^{b}	2.28^{b}	2.36^{ab}	2.48^{ab}	2.61^{a}
Carbohydrates	4.73^{b}	4.45^{bc}	4.20^{cd}	3.74^{d}	3.56^{d}	5.24^{a}	4.86^{a}	4.85^{a}	4.40^{bc}	3.85^{d}
Caloric value	144^{d}	145^{cd}	147^{bcd}	148^{bcd}	149^{bc}	146^{bcd}	147^{bcd}	149^{bc}	150^{b}	156^{a}

* In the same raw values with different superscripts are significantly different (P≤ 0.05).

and female chickens, but the water holding capacity value of chicken burger processed from male chicken meat was slightly higher than that of burger processed from female chicken meat at any slaughter age. The plasticity (cm^2) of chicken meat burger was slightly increased with increasing slaughter age but burger processed from male chicken meat was had slightly higher plasticity value than that of burger processed from female chicken meat at any marketing age.

The same trend was observed for pH values of chicken breast meat burger, since it increased as the marketing age increased of both male and female chickens, but pH values of burger processed from male chicken meat was had slightly higher pH value than that of burger processed from female chicken m eat at slaughter age.

Cooking measurements of chicken breast meat burger

Table 7 shows that the cooking yield of chicken breast meat burger is increased as the marketing age increased but the burger processed from female chicken meat was had higher cooking yield at any marketing age when compared to male chicken burger, an opposite situation was observed with cooking loss since the younger marketing age birds were have higher cooking losses than that of older marketing age birds, the results are showed also that burger processed from female chicken meat was have lower cooking losses than that of male chicken burger at any marketing age. These results are due to the higher protein content of female chicken meat which bind excess water amount which lowering cooking losses of chicken burger. These results are in agreement with that of Alakali et al. (2010) who reported that cooking losses of chicken burger range from about 5-25%, which due to moisture evaporation and drip of melted fat.

In regard to shrinkage of chicken meat burger the data in Table 7 showed that as the marketing age of chicken birds increased the shrinkage ratio decreased but burger processed from female chicken meat were had lower shrinkage ratio when compared to that processed from male chicken meat at any marketing age. Which in the line with Ramadhan et al. (2011) who reported that chicken burger shrinkages were 10% because of meat protein denaturation and fluid (moisture and fat) loss.

In regard to moisture retention, the percent of retained moisture was significantly increased with increasing marketing age for both chicken burger processed from meat of male birds and that processed from meat of female birds, but chicken burger processed from meat of female birds was had superior moisture retention than that processed from meat of male in birds which explained by high protein content of female chicken meat and in comparable with the results of cooking yield and cooking shrinkage results, since the highest moisture retention percent was observed for beef burger processed from female chicken meat at 50 days marketing age (76.70 %), while the lowest moisture retention percent was recorded for beef burger processed from male chicken meat at 30 days marketing age (66.27%). These results were higher than that obtained by Nisar et al. (2010) for Buffalo Meat Patties cooked by different methods.

Also, data in Table 7 revealed that fat retention was significantly increased with increasing marketing age and the meat of female birds had higher fat retention percent than meat of male birds, since the highest fat retention percent was noticed for chicken burger processed from female birds at marketing age 50 days (56.63 %) while the lowest fat retention percent was recorded for chicken burger processed from meat of male birds at marketing age (43.82%).

TABLE 6. Physiochemical characteristics of chicken burger processed from chicken meats with different sex and marketing age.

parameter	Male Age / Day					Female Age / Day				
	30	35	40	45	50	30	35	40	45	50
WHC	56.14^{cd}	56.21^{cd}	56.80^{abc}	57.04^{ab}	57.56^{a}	55.82^{d}	56.10^{cd}	56.31^{bcd}	56.52^{bcd}	57.25^{ab}
Plasticity	2.29^{a}	2.32^{a}	2.35^{a}	2.40^{a}	2.43^{a}	2.25^{a}	2.28^{a}	2.33^{a}	2.37^{a}	2.41^{a}
pH	6.20^{a}	6.21^{a}	6.21^{a}	6.22^{a}	6.25^{a}	6.10^{a}	6.13^{a}	6.15^{a}	6.17^{a}	6.18^{a}

* In the same raw values with different superscripts are significantly different ($P \leq 0.05$).

In general, consumers judge meat quality from its appearance, texture, juiciness, water holding capacity, firmness, tenderness, odor and flavor (Tougan *et al.,* 2013). Table 8 shows the sensory evaluation values of chicken burger processed from male or female chicken meat at different marketing ages. Regarding the color the data show that the sensory value of color was increased with increasing the marketing, since it increased gradually but chicken burger processed by using female chicken meat was have higher color sensorial value at any marketing age than that processed from male chicken meat. The highest color value was observed for chicken burger processed from female chicken meat at 50 days marketing age, while the lowest value was recorded for the comparable male chicken burger.

Data in Table 8 show the effect of marketing age on flavor of chicken burger processed from male or female chicken meats. The results showed that the flavor of chicken burger was increased with increasing marketing age, since the highest flavor value was observed for burgers processed from chicken meat at 45 and 50 days among tested marketing ages for both male and female chickens but female chicken meat burgers were had higher flavor values than the comparable male ones.

Regarding tenderness the data show that the tenderness of chicken burger processed from male chicken meat was increased with increasing marketing age. The chicken burger processed from male meat at 45th day was had the highest tenderness value in both male chicken burger and female chicken burger after which the tenderness was decreased, the data also revealed that male chicken burger was tenderer than the comparable female chicken burger at any marketing age, the data indicated that the highest tenderness value of female chicken burger was recorded for the 40th marketing day after which the tenderness value was decreased. In general the data showed that the chicken meat with higher marketing ages (more than 45 days for male birds and more than 40 days for female birds) was tougher than the previous age which records the highest tenderness value. The same trend was observed for the juiciness since the tenderness and juiciness are tightly correlated and each one affect the other one. These results are in agree with the foundation of Touraille et al. (1991) who observed that tenderness was decreased with increasing age.

The data also show that the appearance and overall acceptability of chicken burger processed from either male or female chicken meat was positively affected by increasing marketing age, since the highest values of appearance and overall acceptability were recorded for chicken burger processed at 45 days marketing age.

Conclusion

In conclusion, older chicken birds had significantly higher mean body weight and carcass weight. With advancing age, the relative weights of breast muscles and thigh muscles were increased and the proportion of giblets decreased (significantly in males). Compared to females, males were characterized by higher body weight and carcass weight than females. Female chicken breast meat burger had superior physiochemical properties, cooking measurements and sensory properties than male chicken breast meat burger. The results showed that 45 days marketing age was the super marketing age from both quality of breast chicken meat and quality of chicken breast meat burger.

TABLE 7. Cooking measurement of chicken burger processed from chicken breast meats from different sex and marketing ages broiler.

parameter	Male Age / Day					Female Age / Day				
	30	35	40	45	50	30	35	40	45	50
Cooking yield %	74.20^{c}	74.95^{c}	75.63^{bc}	79.12^{b}	79.17^{b}	78.14^{bc}	78.54^{bc}	79.21^{b}	84.59^{a}	84.44^{a}
Cooking loss %	25.80^{a}	25.05^{a}	24.37^{a}	20.88^{b}	20.83^{b}	21.86^{b}	21.46^{b}	20.79^{b}	15.41^{c}	15.56^{c}
Shrinkage %	14.14^{a}	13.00^{ab}	12.00^{ab}	11.57^{b}	10.53^{b}	12.27^{ab}	11.53^{b}	10.68^{b}	10.27^{b}	9.53^{b}
Moisture retention %	66.27^{e}	67.78^{de}	69.67^{bcde}	71.93^{bc}	72.67^{b}	68.07^{cde}	71.10^{bcd}	72.92^{ab}	75.18^{ab}	76.70^{a}
Fat retention %	43.82^{c}	44.67^{bc}	45.75^{bc}	46.61^{bc}	53.13^{a}	45.73^{bc}	47.41^{bc}	48.28^{b}	55.26^{a}	56.63^{a}

* In the same raw values with different superscripts are significantly different (P≤ 0.05).

TABLE 8. Sensory evaluation of chicken burger processed from chicken meats with different sex and marketing age.

parameter	Male Age / Day					Female Age / Day				
	30	35	40	45	50	30	35	40	45	50
Color	8.10^{fg}	8.20^{ef}	8.25^{de}	8.35^{d}	8.00^{g}	8.55^{c}	8.60^{bc}	8.65^{bc}	8.70^{b}	8.85^{a}
Flavor	8.00^{e}	8.07^{de}	8.15^{cd}	8.25^{bc}	8.25^{bc}	8.15^{cd}	8.28^{abc}	8.35^{ab}	8.40^{a}	8.40^{a}
Tenderness	7.10^{e}	7.30^{cd}	7.40^{c}	7.55^{b}	7.60^{b}	7.25^{d}	7.35^{cd}	7.55^{b}	7.65^{ab}	7.75^{a}
Juiciness	7.20^{f}	7.35^{de}	7. 55^{bc}	7.80^{a}	6.90^{g}	7.25^{ef}	7.40^{d}	7.80^{a}	7.60^{b}	7.45^{cd}
Appearance	7.00^{f}	7.70^{de}	7.90^{bc}	8.00^{b}	7.85^{bcd}	7.60^{e}	7.80^{cd}	7.90^{bc}	8.20^{a}	7.95^{bc}
Overall acceptability	7.60^{d}	7.70^{d}	8.00^{bc}	8.15^{ab}	8.00^{bc}	7.70^{d}	7.90^{c}	8.10^{ab}	8.20^{a}	8.05^{abc}

* In the same raw values with different superscripts are significantly different (P≤ 0.05).

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تأثير عمر التسويق وجنس الطائر علي صفات الذبيحة وناتج قطع اللحم وصفات الجودة للحم الخام ولبرجر الدجاج المصنع منه

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استهدف هذا البحث دراسة تأثير عمر التسويق وجنس الطائر عي صفات الذبيحة وجودة اللحم وجودة برجر الدجاج المصنع منه وقد أظهرت النتائج أن زيادة عمر التسويق يؤدي إلي زيادة وزن الطائر الحي بنسبة زيادة تتراوح بين ١٧ و ٢٥ ٪ كل خمسة أيام وكذلك أدت زيادة عمر التسويق إالي زيادة نسبة التصافي للذبيحة حيث كانت70,72 ٪ عند عمر تسويق 30 يوم بينما كانت ٧٧,٥٠ ٪ عند عمر تسويق ٥٠ يوم وبالنسبة لنسبة الأعضاء الداخلية فقد انخفضت بزيادة عمر التسويق حيث قلت من ٤,٤٤ ٪ عند عمر ٣٠ يوم إلي ٣,١٠ ٪ . وقد زادت نسبة لحم الصدر بزيادة عمر التسويق حيث زادت من ١٧,٨١ ٪ عند عمر ٣٠ يوم إلي ٢٠,٨٦ ٪ عند عمر ٥٠ يوم.

وقد أظهرت النتائج أن برجر الدجاج المصنع من لحم صدور إناث الدجاج كان له صفات فيزيوكيماوية أفضل من ذلك المصنع من لحم صدور ذكور الدجاج ونفس الاتجاه قد ظهر مع مقاييس الطهي والتي كانت أعلي لبرجر الدجاج المصنع من لحم صدور إناث الدجاج عن ذلك المصنع من لحم صدور ذكور الدجاج وقد أظهرت نتائج التقييم الحسي أن برجر الدجاج المصنع من لحم صدور إناث الدجاج كان له درجة قبول أعلي لكل الصفات الحسية عن برجر الدجاج المصنع من لحم صدور ذكور الدجاج وقد أظهرت النتائج أن عمر التسويق ٤٥ يوم كان عمر التسويق الأفضل من حيث جودة لحم صدر الدجاج وكذلك جودة برجر الدجاج المصنع منه.