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Original Article

The meat quality of layer males from three exotic chickens

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ABSTRACT

In chick hatcheries, males of laying hybrids are considered to be "waste" and the majority of these males are killed just after hatching. On the other hand, the interest of consumers in products from alternative systems (organic) is increasing. The idea was to evaluate the meat quality of these males when they have access to commercial feed because there is not much such a study available. The aim of this study was to compare the meat quality characteristics and chemical (proximate) results of the three meats of layer males at the same age when all had access to commercial feeds and when they were fed up to 16 weeks of age. Novo Brown, Lohman Brown and Dominant Sussex breed layer males were kept in intensive management conditions to evaluate carcass and meat quality at 16 weeks of age. Novo brown cockerels show significantly higher live weight and lower carcass yield performance in comparison with other breeds (P<0.05). The proportions of moisture in the breast meat were significantly lower (P<0.05) in Lohman brown cockerels. The value of protein was significantly higher in Lohman brown cockerels (P<0.05). The laying males are acceptable for an intensive system of poultry meat production from the aspect of meat quality. The quality was comparable in comparison with fast-growing chickens.

Keywords: Breast Meat, Fat, Moisture, Protein.

INTRODUCTION

The interest of consumers in products from alternative systems (organic) is increasing mainly because these systems can be environmentally friendly, sustaining animals in good health with high welfare standards and resulting in higher quality products (Watanabe *et al*., 1996). The production of chicken meat is regulated in the EU (Directive EWG 1538/91) and organic livestock farming is defined by basic guidelines (EEC – the regulation for organic agriculture /EEC/ No. 1804/1999). Among others in organic production, the minimum age at slaughter shall be 81 days. Fast growing commercial hybrids are suitable for these production systems, because they are slaughtered between 5 and 7 weeks and at 81 (84) days of age they are too heavy. However, in the United States organic and other specialty poultry production mostly utilizes the same fast-growing broiler genotype as in conventional production systems (Fujimura *et al*., 1996 & Fanatico *et al*., 2005a). The antagonistic relationship between meat and egg production led to the separation of the meat and egg-type strains of birds. Consequently, the day-old male layer chickens have been used in the pet food industry as a high quality animal protein source for predators, reptiles, falcons, hawks and zoo animals. Moreover, in hatcheries the male chickens of layer breeds have to be killed due to their poor fattening performance and consequently high fattening costs. In addition, consumers do not normally accept this type of bird as meat chicken. The superiority and genetic improvement of meat-type chickens in terms of growth is well documented (Havestein *et al*., 2003a & Damme and Ristic, 2003 & Gerken *et al*., 2003 & Khawaja *et al*., 2012 & Northcutt *et al*., 1994); however, there are only a few studies concerning the carcass composition and meat quality of commercial layer male's comparison at the same age of (Gerken *et al*., 2003 & Lonergan *et al*., 2003) , and (Fanatico *et al*., 2005a) evaluated the effect of genotypes on the carcass quality, but they compared fast and slower growing broilers, but no layer males (Lonergan *et al*., 2003), compared the carcass quality of slower and faster growing birds at the same live weight (different age) and (Fanatico *et al*., 2005b & Kotula *et al*., 1960) compared the carcass quality of slower and faster growing birds at the same carcass weight (different age and different live weight) compared the retention of protein and fat in the meat of fast and slow-growing chickens, but they are broiler types. The aim of this study was to evaluate the meat quality of laying males when they have access to commercial feed and to compare the carcass and meat quality at the same age when they were fed 16 weeks of age. On the basis of the results the suitability of laying males for intensive system with regard to meat quality should be concluded

MATERIAL AND METHODS

Animals and diets

A total of 500 unsexed day-old chicks of the three breeds were brought from Debrezeit Research Center and housed at JUCAVM brooder house. One hundred fifty chicks of each of Dominant Sussex d104, Lohman Brown and Novo Brown breeds were randomly selected from the total of 500 in each case. The selected chicks of each breed were placed in separate pens and placed on standard commercial starters ration for 7 days. At the end of the 7 days, each group (breed) of 150 chicks was further sub-divided into three groups, each with 50 chicks of equal mean group weight (total of 9 groups each with 50 chicks). Each group was randomly assigned to one of the nine individual experimental pens, well prepared in advance. Each pen was equipped with all the required chick brooding facilities and had an area of $6m^2$ (3m x 2m) concrete floor adequately covered with litter materials. Finally, each group of 50 experimental chicks was randomly assigned to the experimental pens in completely randomized design with 3 replicates. The floor was covered with wood shavings. All birds were given an initial 23h photoperiod, and then a 16L: 8D lighting schedule from 8 days of age was provided. Temperature was maintained at 30°C at the beginning of the experimental period, and gradually decreased to 20°C by the fourth week of age. From 4 weeks of age, the birds were subjected to the ambient temperature. The birds had free access to feed and water at all times. All birds received the same diets *ad libitum* (1–60 days: starter; 60–120 growers). All birds were individually weighed at weekly intervals.

Carcass quality measurements

Two cockerels each were randomly selected from each replicate of each of the three breed at an age of 16 weeks. The selected cockerels were slaughtered after taking the live weight as per the procedure given by (Lewis *et al*., 1997). Each cockerel was bled, plucked and weighed. The weight of the eviscerated carcass, neck, wings, breast, and thigh were recorded and expressed as percentage of live weight. The total eviscerated carcass was cut into four parts, namely, wing, neck, legs and breast. The weight of the cut-up parts were recorded and expressed as percentage of evisceration weight. Representative samples was taken from each of the breast meat of the chicks and milled to pass through 1mm sieve for proximate analysis. The milled samples were stored in airtight containers until required for chemical analysis. Dry matter (DM), crude protein (CP), ether extracts (EE), and total ash was determined according to (Mazanowski *et al*., 2003 & AOAC, 1990). The pH of the meat samples was measured using a pH meter calibrated daily with standard pH buffers of 4.0 and 7.0 at 25°C. Water holding capacity was determined by expressing cooked/ drip loss sample (B) weight as a percentage of precooked samples/pre drip loss sample (A) weight. For cooking loss determination breast meat sample was boiled to an internal temperature of 90°C for 30 min, surface dried, and weighed following the procedure of (Fanatico *et al*., 2005a). Drip loss was determined by weighing the samples before and after thawing, and calculated as the difference between initial and final weight, and expressed in percentage, according to a modification of the method of (Northcutt *et al*., 1994). The method of (Northcutt *et al*., 1994) consists in simulating retail conditions, i.e., cuts is stored at about 3°C for 72 h, after which weight loss is determined. The modification consisted in quantifying drip loss immediately after thawing.

Cooking loss (%) = [(A-B)/ (A)] ×100 and Drip loss (%) = [(A-B)/ (A)] ×100

Statistical analysis

The data collected were analyzed using the procedures suggested by (Hardy & Denman, 1975) using SPSS (Statistical Package for Social Science) software version 20. When the analysis of variance indicates the existence of significant difference among the treatment means at 5% level of significance for the quantitative data, Turkey's Honestly Significant Difference (HSD) test was employed to test and locate the treatment means that are significantly differed from the rest. The following model suggested (Nwosu *et al*., 1980) was used.

$$Y_{ij} = \mu + T_i + e_{ij},$$

Where,

Yij = is the overall observation (FCR, feed intake, body weight….).

Ti = effect of the ith breed (i=1, 2, 3)

μ = population mean

Eij = Random error

RESULT AND DISCUSSION

The carcass percentage of Novo Brown (50.55%) was significantly (P<0.05) lower than that of Lohman Brown (53.65%) and dominant Sussex (53.50%) cockerels (Table 5). The highest dressing percentage was recorded from Lohman Brown (53.6%) cockerels followed by dominant Sussex (53.5%). Such variations in dressing percentage could be due to their variation in genotype which leads to different offal percentage (proportion) that affects carcass percentage. The current result was lower than that of (King, 1984), who reported dressing percentage of 62.60% from crosses of Fayoumi male and RIR female in Pakistan. Closer result was also reported by the same author using RIR (57.50%) and Fayoumi (54.08%) chickens. The carcass weight of local chickens at 6 months of age was reported to be 559 g which was significantly lower than that of the 875 g reported for Leghorn (Zelenka *et al*., 2001) which was lower than that of the current result (968-1006 g). The carcass weight after 24 hours also significantly different among the three breeds ($P < 0.05$). Novo Brown (49.9%) cockerels had significantly lower dressing percentage than Dominant Sussex (51.9%) and Lohman Brown (53.3%) ($P<0.05$), but the latter two breeds did not differ significantly from each other's.

There was no significant difference between all the three breeds in mean evisceration percentage (neck, breast, thigh, and wing) among breeds ($p< 0.05$). However, Lohman Brown had slightly higher evisceration percentage (49.4%) than Novo Brown (48.2%) and dominant Sussex (47.9%) cockerels. Similarly, (Souza *et al*., 2011) reported non-significant difference of evisceration weight among different crosses of synthetic broiler. In contrast to the results of this study the evisceration percentage ranging between 60.72 and 69.33% (blood, feather, head, neck, back, wings, breast, shank, thigh, gizzard, testis, liver and heart) was recorded for different pure and crossbreds of strains of Nicobari cockerels in India (Chatterjee *et al*., 2003) (Chatterjee *et al*., 2004). This may be due to the variation in genetics and evisceration parts of cockerels from different studies. Even though there's no significant difference among the three breeds in evisceration percentage ($p<0.05$), there was significant difference between the three breeds in thigh and the drum stick meat weight ($P < 0.05$). The Novo Brown (17.1) and the Dominant Sussex (17.2) at one hand are significantly lower than that of Lohman Brown (18.2) ($P< 0.05$), which may be due to the higher carcass and evisceration percentage of Lohman Brown cockerels from the other two breeds. The thigh and the drumstick meat weight of the Dominant Sussex and Novo Brown are similar.

Dominant Sussex (6.07) had slightly high PH value than the Lohman Brown (5.93). But, there's no difference between Lohman Brown and Novo Brown (5.9) chick. This result indicates that the cockerels have well treated before slaughter which affects and change of PH level and meta type, since produce high quality products (fall in the pH range of 5.7 to 6.0) (Zollitsch *et al*., 1997 & Northcutt *et al*., 1994) stated similar average pH at 24 h post-mortem 6.0 and 6.4 in meat from A44 and A55 strains of ducks. Moreover, (Ali *et al*., 2007) in Korea reported that the pH of chicken meat was not significantly different after 24 h storage.

There was no significant difference between the meats of three breeds in water holding capacity (drip loss and cooking loss) ($P<0.05$). The meat from the Novo Brown Sussex (1.94%) cockerels had higher drip loss in contrast to the dominant Sussex (1.93%) and Lohman Brown (1.69%) breeds. But, the difference in the drip loss of the meat from the Novo Brown and dominant Sussex breeds is very negligible. (Çelen *et al*., 2016) reported that lower (1.68%) drip loss occurred in turkey breast meat after two days of storage and higher results (2.38%) occurred after 3 days of storage at 4 0c in Turkey. Lower drip loss of 0.72% was also reported in Carolina USA using turkey breast for after 2 days of storage (Qiao *et al*., 2002).

However, the cooking loss of the Novo Brown (11.1%) was numerically higher than the others. In contrast to this, higher result (21- 26%) was reported in Carolina USA using turkey breast, (Qiao *et al*., 2002 &

Teket, 1986) also reported that higher (29.63%) cooking loss using Cobb broiler breast meat in Brazil, this all difference may due to genetic, storage time and before slaughtering management, which is responsible for the occurrences of DFD and PSE meat. This is confirmed by (Bee *et al*., 2007), who reported that water holding capacities of chicken meat different among genotypes which can be hold the water molecule in meat.

The protein content of the meat of Lohman Brown is significantly higher than that of Novo Brown and Dominant Sussex. This variation could be attributed to differences in genotypes of the cockerels used for the experiments. But, there was no significant difference between the meat of Novo Brown and Dominant Sussex in protein content. Crude protein content of 44.05, 44.8 and 42.9% was calculated for the meat of Novo Brown, Lohman Brown and Dominant Sussex respectively, which is responsible for building and repairing tissues. Protein also helps to maintain the body's structure, speeds up chemical reaction in the body, serves as chemical messenger, fight infection and transport oxygen from the lungs to the body tissue. These results are higher than that of (Sundrum *et al*., 2001) who reported crude protein content of about 22% from meat of normal and pale broiler breast meat. On the contrary, the crude protein content of the meat of the current study was lower than that of (Padhi *et al*., 1997) who reported crude protein of 51-69% from local chicken, exotic chicken and turkey in Nigeria.

There was no significance different in fat content among the meat of the three breeds studied ($P < 0.05$). Crude fat content of 2.01, 2.06 and 2.09 % was determined from the meat of Novo Brown, Lohman Brown and Dominant Sussex respectively, which probably is responsible for their juiciness and sweet aroma upon cooking. Fats play an important role in building the membranes that surround our cells in helping blood to clot. The presence of fat in the right proportion in the body helps the body to absorb certain vitamins and prevent the body from extreme cold and heat. Relatively higher value of fat of 18.06, 3.7, and 11.76% was determined in Nigeria from Turkey, exotic chicken and local chicken respectively (Padhi *et al*., 1997). Differences may be due to the facts that exotic chicken feeds mainly on concentrates and are hardly fat-rich, while both Turkey and local chicken are scavengers which makes them accessible to more fat-rich foods than the exotic chicken which are usually kept in floor and cages. The crude fat content determined in the current study is close to the crude fat content (2.87%) of exotic chicken reported from Nigeria by (Owens *et al*., 2000). In addition, (King, 1984) reported that higher fat content (6% in breast and 18% in thigh) was found at the age of 20 week in exotic cross breeds in Pakistan.

The result of this study showed that there was no significant difference between the meat of the three breeds in ash content ($P<0.05$). This similarity might be explained due to same composition of feed being offered to the birds during experiment. However, the ash content of the meat of Lohman Brown tended to be slightly higher than the others, which might be explained by their reaction for feed minerals being offered to the birds during the trial. The ash content of food determines largely the extent to which the dietary minerals would be available in a particular food sample. It also determines the rate at which food substances would make available the amount of energy locked in it. This implies that Lohman Brown and Novo Brown could furnish relatively more energy and some viable minerals than the dominant Sussex meat. The ash content of the meat of the three breeds (3.2-3.8%) recorded from the current study are higher than the common values (0.7-1.3%) reported for poultry meat (Ogunmola *et al*., 2013). But, the result of the total ash content of the meat of this study

(3.2-3.8%) was lower than that of [24] who reported 6.50 and 4% of total ash content from Turkey and exotic chicken meat in Nigeria but, higher than that of 2.0% local chicken.

Table 1: The meat quality and chemical characteristics of breast meat

Parameter	Nova Brown (Mean ± SE)	Lohman Brown (Mean ± SE)	Dominant Sussex (Mean ± SE)	Sig.
Live weight(g/h)	$1.69^{a}\pm0.173$	$1.54^{b}\pm0.02$	$1.543.2^{b}\pm0.49$	0.002
Carcass weight (%)	$50.55^{b}\pm0.35$	$53.65^{a}\pm0.31$	$53.5^{a}\pm1.67$	0.016
Carcass weight after 24h (%)	$49.9^{b}\pm0.37$	$53.3^{a}\pm0.28$	$51.9^{a}\pm1.06$	0.002
Evisceration percentage (%)	$48.2^{a}\pm0.4$	$49.4^{a}\pm0.7$	$47.9^{a}\pm1.3$	0.100
Wing weight (%)	$4.86^{a}\pm0.07$	$4.97^{a}\pm0.05$	$4.98^{a}\pm0.07$	0.634
Tight weight (%)	$17.1^{b}\pm0.36$	$18.2^{a}\pm0.03$	$17.2^{b}\pm0.3$	0.004
Breast weight (%)	$23.8^{a}\pm0.21$	$23.4^{a}\pm0.63$	$23.3^{a}\pm1.03$	0.203
Neck weight (%)	$2.43^{a}\pm0.15$	$2.78^{a}\pm0.18$	$2.5^{a}\pm0.2$	0.244
Drip loss (%)	$1.94^{a}\pm0.22$	$1.69^{a}\pm0.61$	$1.93^{a}\pm0.29$	0.151
Cooking loss (%)	$11.1^{a}\pm0.76$	$10.9^{a}\pm0.2$	$10.7^{a}\pm0.9$	0.739
PH	$5.95^{a}\pm0.46$	$5.93^{a}\pm0.06$	$6.07^{a}\pm0.02$	0.065
Fat (%)	$2.01^{a}\pm0.25$	$2.09^{a}\pm0.11$	$2.06^{a}\pm0.23$	0.889
Moisture (%)	$84.4^{a}\pm0.06$	$83.7^{b}\pm0.00$	$84.4^{a}\pm0.00$	0.042
Ash (%)	$3.8^{a}\pm0.54$	$3.8^{a}\pm0.65$	$3.21^{a}\pm0.3$	0.277
Protein (%)	$44.05^{b}\pm1.5$	$48.8^{a}\pm0.6$	$42.9^{b}\pm1.8$	0.006

a, b: Means with different superscripts in a row are significantly different at $P < 0.05$.

As Shown in the Table, the moisture content of the meat Novo Brown, Lohman Brown and Dominant Sussex was 84.4, 83.7, and 84.4% respectively, showing that the moisture content of the meat of Novo Brown and Dominant Sussex are comparable and slightly higher than that of Lohman Brown. Moisture content of food determines the keeping qualities of food. It also enhances the rate at which absorption takes place within the digestive system and influences the rate at which enzyme activities takes place on the food. The results of the current study showed that the meat of Novo Brown and Dominant Sussex meat is easily absorbed by the body than that of Lohman Brown. Similarly, Fujimura *et al.,* (1996) suggested that water contents differed significantly with breeds, whereas according to Zollitish *et al*. (1997) there was no significant difference in dry matter content between breeds in Organoleptic traits of breast meat. (King, 1984) , also reported lower moisture content of 74 and 72% from breast and thigh of exotic crossbred in Pakistan. Generally, poultry meat quality attributes may be affected by several factors such as genotype, rearing condition and feeding that impact the muscle metabolism and chemical composition.

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