EFFECT OF BREED ON CARCASS AND MEAT QUALITY OF HENS AFTER LAYING PERIOD

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Abstract – The effect of breed on carcass characteristics and meat quality in breast and drumstick cuts from Mos and Isa Brown genotypes after laying period was examined. A total of nineteen birds of Mos breed and twenty four of Isa Brown slaughtered at 72 weeks were used in this trial. Carcass characteristics showed significant differences between breeds. Live and carcass weight as well as carcass yield were higher in the autochthonous breed. The highly valued pieces breast and thigh, were also higher in Mos breed. Chemical composition displayed different results depends on the cut studied. However, only drumstick, showed significant differences between breeds. Textural parameters were not affected by genotype. Meat from both breeds could be considered "very tender" presenting shear force values below 36.2 N.

Key Words – autochthonous breeds, carcass, chemical composition, textural parameters

I. INTRODUCTION

Poultry meat production has been very dynamic over the last decades with a continuous increase in the world production. The success of poultry production has been strongly related to the improvements in growth performance, carcass yield and composition. Consumers of this type of product demand poultry production linked to upbringing and natural food, obtained with local breeds, because they associate meat from these animals with high quality products.

Mos is a native breed of Galicia (NW Spain), classified as an autochthonous endangered breed [1], and characterized by a great rusticity. This breed was very used for a dual purpose of production of meat and eggs [2]. Egg industry has associated common problems, the abundant availability of cull hens, which are considered a by-product of this industry. Generally, these hens are slaughtered and used in feed production or sold for domestic consumption [3]. Meat from cull hens is considered by some authors as a good protein source [4]. However, little research has been aimed on meat quality of hens after laying period. This new information could be useful for the research community, meat poultry retailers, chefs and final consumers.

Therefore, the aim of this study was to evaluate the breed of hens after laying period on the main attributes of quality, such as carcass and meat quality.

II. MATERIALS AND METHODS

II.1. Experimental design and animal management

For this study, a total of 43 hens, 24 of Isa Brown and 19 of Mos breed, after laying period were used. The hens had access "*ad libitum*" to a commercial feeding and water until the days of slaughter. Hens were exposed to natural light as a practiced in rural areas of NW Spain (Galicia). Previous to slaughtered, animals were weighted (LW) and live weight recorded.

The animals were place in crates and transported to a slaughter plant. The hens were weighed, hung on shackles on a slaughter line, and killed by electrical stunning in a water bath. After bleed out, the hens were suspended in a warm water bath and defeathered. The carcasses were eviscerated on line. The carcasses were chilled at 4 ºC for 24 h. The day after, the carcasses were weighed (CW) and the left side of the carcass was quartered according to the World´s Poultry Science Association recommendations [5]. The breast muscle was dissected from the carcass and weighed. The legs were disarticulated at the hip

and knee joints and the drumstick and thigh portions were weighed. The head, neck and feet were also obtained and weighed. Dressing percentage (DP) was calculated as DP = CW / LW. The *pectoralis major* and *peroneous longus* muscles were excised from breast and drumstick for analysis.

II.2. Analytical methods

To assess the meat quality: pH, colour parameters and chemical composition was measured in breast (*pectoralis major*) and drumstick (*peroneous longus*) samples, whereas water holding capacity and textural traits was only measured in breast. The pH of the samples was measured using a digital portable pH-meter equipped with a penetration probe. Colour parameters were measured using a portable colorimeter to estimate meat colour in the CIELAB space: lightness, (L*); redness, (a*); yellowness, (b*). The colour was measured in three different points of each sample. Moisture, protein and ash were quantified according to the ISO recommended standards [6-8]. Intramuscular fat (IMF) was extracted according to the AOCS Official Procedure Am 5-04 [9]. Breast cuts were cooked and water-holding capacity (WHC), Warner-Braztler (WB) and TPA test were conducted following Pateiro *et al.* [10].

II.3. Statistical analysis

An analysis of variance (ANOVA) of one way using SPSS package (SPSS 19.0, USA) was performed for all variables considered in the study [11]. The least squares mean (LSM) were separated using Duncan's t-test. All statistical test of LSM were performed for a significance level $P < 0.05$.

III. RESULTS AND DISCUSSION

III.1. Carcass quality characteristics

Carcass characteristics of Mos and Isa Brown hens are shown in Table 1. With the exception of carcass reminder, the results of carcass quality showed significant ($P < 0.01$) differences between breeds. Unlike other authors, the results of live and carcass weight as well as carcass yield were higher in the autochthonous breed [12]. These values were similar than those found by other authors in other native Poland breeds [13]. The carcasses of Mos breed were fatter than those obtained for commercial breed (3.39 *vs.* 0.84%). Our values were lower than the values found in other native breeds [13].

Table 1 Effect of breed (Mos *vs.* Isa Brown) on carcass characteristics of hens after laying period

	Mos	**Isa Brown**	**SEM**	**SIG**
Carcass quality				
Live weight (kg)	2.88	1.64	0.10	***
Carcass weight (kg)	2.01	1.02	0.08	***
Dressing percentage (%)	69.82	63.00	0.87	***
Carcass remainder (%)	30.48	30.82	0.64	n.s.
Fat of carcass (%)	3.39	0.84	0.45	**
Commercial cuts *(% respect to carcass)*				
Drumstick	11.81	12.33	0.15	n.s.
Thigh	16.70	16.10	0.15	*
Wing	9.63	11.32	0.19	***
Breast	19.70	15.43	0.41	***
Head	3.23	4.64	0.14	***
Neck	6.12	7.59	0.16	***
Legs	3.30	4.35	0.13	***

SEM: Standard error of the mean
SIG: Significance: *** (P<0.001), ** (P<0.01), * (P<0.05), n.s. (not significant)

Regarding commercial cuts, except drumstick, the percentages found showed significant ($P < 0.05$) differences between breeds. Higher values were obtained in commercial strain than in Mos breed. On the contrary, the highly valued pieces breast and thigh showed percentages significantly higher for Mos breed (19.70 *vs.* 15.43% and 16.70 *vs.* 16.10%; respectively).

III.2. Meat quality

Chemical composition and color parameters of meat from hens after laying period are shown in Table 2.

In all cases, the pH values were within an acceptable range. Similar values were found by other authors in indigenous breeds [12,14]. The pH values of breast were lower than values obtained for drumstick. This could be due to the different activity of each muscle, in this way the muscles that had lower pH values could be related to the existence of a higher concentration of glycogen and less activity in the muscle [15]. This

behavior was previously reported by other authors in other native Spanish chickens [16].

Table 2 Effect of breed (Mos *vs.* Isa Brown) on meat quality of hens after laying period

	Mos	Isa Brown	SEM	SIG
Breast				
pH	5.81	5.88	0.02	n.s.
Water (%)	72.46	72.81	0.12	n.s.
IMF (%)	0.29	0.28	0.04	n.s.
Protein (%)	25.54	26.63	0.12	n.s.
Ashes (%)	1.35	1.32	0.02	n.s.
Lightness (L*)	56.52	57.58	0.48	n.s.
Redness (a*)	0.97	2.41	0.32	*
Yellowness (b*)	14.74	14.16	0.25	n.s.
Drumstick				
pH	5.89	6.06	0.02	*
Water (%)	72.56	74.03	0.24	**
IMF (%)	3.81	2.60	0.24	*
Protein (%)	22.24	22.05	0.14	n.s.
Ashes (%)	1.27	1.31	0.01	n.s.
Lightness (L*)	44.15	46.12	0.54	n.s.
Redness (a*)	10.39	9.38	0.25	*
Yellowness (b*)	13.13	13.03	0.30	n.s.

SEM: Standard error of the mean
SIG: Significance: *** (P<0.001), ** (P<0.01), * (P<0.05), n.s. (not significant)

The results from chemical composition showed different results based on the cut studied. Breast samples did not show significant ($P > 0.05$) differences between breeds. Regarding drumstick, only water and IMF showed significant ($P < 0.05$) differences between breeds. Concerning IMF content, the lowest values were noticed in breast samples. In addition, the values obtained for breast and drumstick were lower than those reported for other authors in native Spanish breeds [12,14,16]. In agreement with previous studies [17], breast showed a higher protein content than drumstick. Mean protein contents were inside the range obtain for breast (21.0-26.2%) and drumstick (18.7-22.2%) previously reported by other authors in other autochthonous breeds [12,14,16]. The contents of water and ashes were similar to the values found by other authors [12,14,16].

Color parameters showed that redness was the only one that reflected significant ($P < 0.05$) differences between breeds in both cuts (breast and drumstick). As expected, the values were higher in drumstick (10.39 *vs.* 9.38 for Mos and Isa Brown breeds, respectively) than in breast piece (0.97 *vs.* 2.41 for Mos and Isa Brown breeds, respectively).

WHC and textural parameters of meat from of hens after laying period are shown in Table 3. WHC has a great importance in the final value of the meat and in the consumer acceptance. We found that breed was not a factor that affected cooking losses. Mean values were in the same range than the results found in Mos chickens breed [12].

Table 3 Effect of breed (Mos *vs.* Isa Brown) on textural parameters of hens after laying period

	Mos	Isa Brown	SEM	SIG
WHC				
Cooking loss (%)	12.55	12.84	0.40	n.s.
Texture parameters				
Firmness (N/s)	5.80	5.80	0.02	n.s.
Total work (N·m)[1]	8.78	7.96	0.76	n.s.
Shear force (N)	21.10	21.70	0.12	n.s.
TPA test				
Hardness (N)	63.70	56.70	0.26	n.s.
Springiness (m)[2]	0.52	0.52	0.01	n.s.
Cohesiveness	0.51	0.55	0.01	n.s.
Gumminess (N)	31.80	30.90	0.12	n.s.
Chewiness (N·m)[1]	1.69	1.69	0.08	n.s.

SEM: Standard error of the mean; SIG: Significance: n.s. (not significant); [1] Results expressed as $N \cdot m \times 10^{-2}$; [2] Results expressed as $m \times 10^{-3}$

Accordingly with other authors, textural parameters obtained in WB and TPA were not significantly ($P > 0.05$) affected by genotype [12]. The main textural parameters, shear force (21.10 *vs.* 21.70 N for Mos and Isa Brown breeds, respectively) and hardness (63.70 *vs.* 56.70 N for Mos and Isa Brown breeds, respectively) showed a tendered meat in commercial than in native breed. In accordance with classification of Lyon *et al.* [18], meat from hens was very tender presenting shear force values lower than 36.2 N. These values were higher than those obtained in previous studies [12,13].

IV. CONCLUSION

The results obtained in terms of carcass and meat quality could be interesting for producers from an economic perspective. The autochthonous breed allow to obtain greater amount of noble pieces than commercial strain.

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