Phenotypic Characterization Of Two Portuguese Autochthonous Chicken Breeds: Growth

M. L. Soares[*‡], J. C. Lopes[*], E. Barbosa[*], N. V. Brito[*], J. Carvalheira[‡,†]

Introduction

It is generally agreed that the single ancestor of poultry is the Red Jungle Flowl (RJF) (*Gallus gallus)* and the European populations are the ones best closely related to the RJF (Crawford, 1984, Hillel *et al*., 2003, Moiseyeva *et al*., 2003). In Portugal there are 3 breeds of chickens, Preta Lusitânica (PL), Amarela (AM) and Pedrês Portuguesa (PP) classified as endangered with less than two thousand females operated in pure line per breed. Originated in the North of Portugal, they have an important role in the economy of rural populations. They are rustic birds, well adapted to the environment, explored in extensive small family farm systems, focused on self-consumption of meat and eggs (Costa *et al.*, 2006). Phenotypically their main difference lies in the color of the plumage, AM being characterized by her rust to yellow-straw tone, PL by black with green nuances and PP by tinted gray and white.

Due to indiscriminate breeding and introduction of more productive exotic breeds a decrease of number and reduction of ethnical original characteristics is, actually, verified (Leite *et al*, 2003). The lack of productive data has prevented a better assessment of the breeds performance, hence the need to carry out further research. Growth simulation of a population, using mathematical models, allowing the estimation of weight at a given time and also a series other of information (daily gain, mature weight, feed conversion, and others), is very important in helping poultry producers to decide on management, feed and selection (Freitas *et al*, 1983). This study aims to evaluate the growth of two of those breeds, PL and AM.

Material and Methods

The study was held at the Escola Superior Agrária of Ponte de Lima (ESAPL). The birds were housed, by breed, in a confined space with $9m^2$, with access to a fenced outside area with 21 m^2. Water and food were supplied *ad lib.*, following the traditional diet: starter food until 21 days of age, then broken maize and, in adult age, corn grain and various vegetables.

The study was carried out with two flocks produced at different times. The first group, produced between September 2008 and January 2010, consisted of 17 chicks PL and 15 AM, offered by a Breeders Association. The second group, produced between July 2009 and January 2010, resulted from the incubation of fertilized eggs produced by the first group and eggs purchased at breeders. 30 chicks PL and 56 AM were obtained. In these two flocks individual weights were taken, weekly, until 27 weeks in the breed AM and 31 weeks in the breed PL. Each bird was identified with a metallic ring on the right wing. The first and

* - IPVC - Escola Superior Agrária de Ponte de Lima, Refóios, 4990 -706 Ponte de Lima, Portugal
‡ - ICBAS-University of Porto, Largo Prof. Abel Salazar 2, 4099-003 Porto, Portugal
† - CIBIO-University of Porto, Rua P. Armando Quintas, Crasto, 4485-661 Vairão, Portugal

second flock of the PL breed were analyzed together, totalizing 47 birds (18 males and 29 females), and the same with the AM breed, totalizing 71 birds (30 males and 41 females).

Statistical analysis. For the characterization of the growth curve, the Gompertz function was chosen as the most appropriate equation for describing growth for avian species (Freitas;2005; Mignon-Grasteau e Beaumont, 2000; Goliomiytis, M. *et al.*2003):

$$M=A.e^{-e\text{-}B.(t-C)}$$

M = body weight (g), t = age (days), A = mature weight (g), B = relative growth at the inflection point (g / day), C = age at inflection point (days), *e* = 2.718281828459.

Growth rate was estimated by the first derivative of the Gompertz function. For statistical analysis we used SPSS 18.0 for Windows. The weights at 20 weeks of age were used to compare the breeds and sex (between and within breed) with $P < 0.05$ as the level for significance.

Results and Discussion

The predicted growth curve and growth rate for body weight in AM breed are shown in Fig. 1. Body weight was increasing until age at the inflection point, (76 days for ♀ and 91 ♂); at which maximal growth rate was attained (15.9g per day for ♀ and 20.1 ♂). Body weight at this age was estimated at 782g ♀ and 1217g ♂. Beyond this age, growth rate declined, approaching zero by the end. Final weight was estimated at 2155g and 3417g, for females and males respectively.

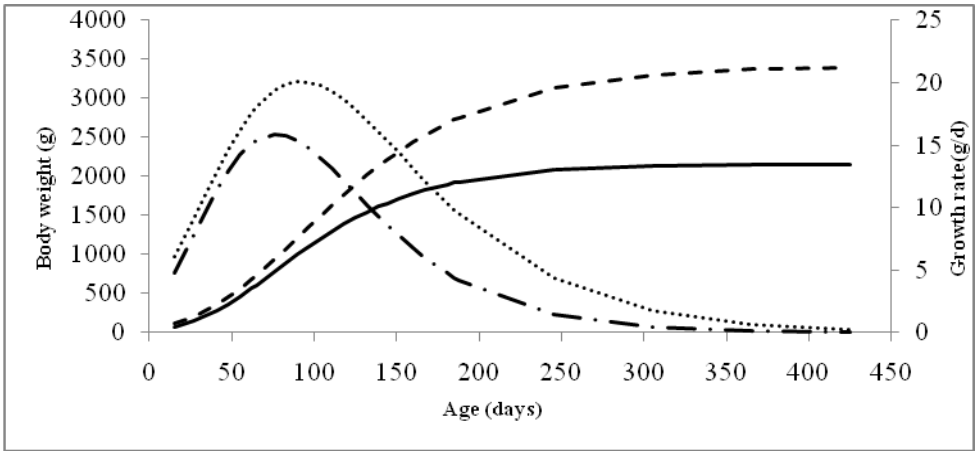

Figure 1. Growth curve and growth rate for AM breed: estimated growth curve ♂ (– –) ,estimated growth curve ♀ (——), estimated growth rate ♂ (…..), estimated growth rate♀ (— - —).

For PL breed the results for age in inflection point was 81 days for ♀ and 85 ♂ when maximal growth rate was attained (16.3g ♀ and 19.3g ♂). Body weight at this age was

estimated at 932g ♀ and 1450g ♂. Final weight was estimated at 2613g and 3500g, for females and males respectively (Fig. 2). The shape of the growth curve predicted was typically sigmoid (Goliomiytis *et al.*, 2003).

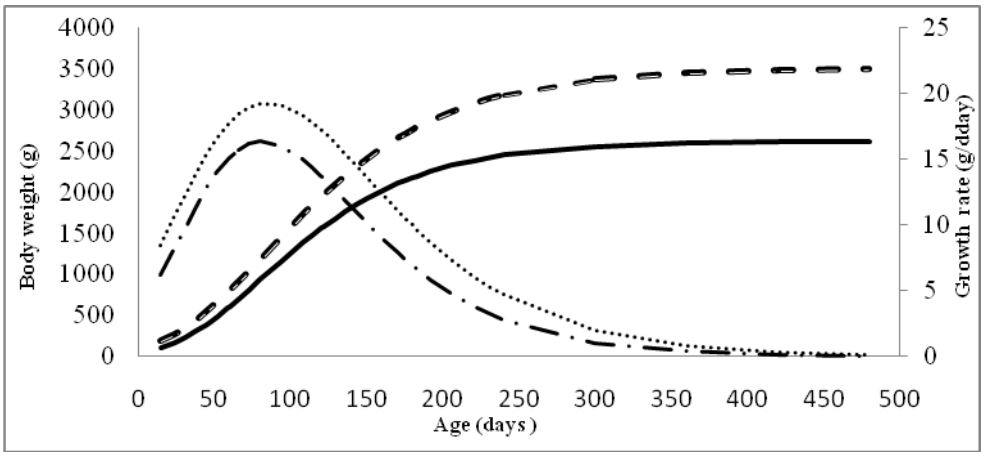

Figure 2. Growth curve and growth rate for PL breed: estimated growth curve ♂ (– –) ,estimated growth curve ♀ (——), estimated growth rate ♂ (…..), estimated growth rate♀ (— - —).

The estimated values for these two breeds were slightly higher (except for AM ♀), compared to those found by Vilalba *et al.* (2007) to a Spanish local breed, Menorca. For Menorca breed, the age at inflection point was 67days for ♀ and 64 ♂, maximal growth rate 13g ♀ and 19g ♂, at this age, body weight 663g ♀ and 884g ♂, and final estimated weight at 2210g and 2834g, for females and males respectively.

The weight average was evaluated at 20 weeks and showed significant sexual dimorphism ($P < 0.05$) in both breeds, with males being on average 34% and 24% heavier for AM and PL, respectively (Table 1).

Table 1. Average body weight for two breeds (20 weeks of age).

Breed	Sex	Mean ± standard error*
Amarela (AM)	Male	2198.21 ± 32.678 [a]
	Female	1641.21 ± 32.248 [b]
Preta Lusitânica	Male	2188.89 ± 93.923 [a]
	Female	1768.89 ± 53.510 [c]

* Different letters between rows indicate a significant difference ($P < 0.05$).

Among the Iberian autochthonous chicken breeds (Table 2), the 2 Portuguese breeds may be considered of average weight. Portuguese females are in general heavier than their Spanish counterparts (except for Gallina de Mós). On the other hand, males are lighter with only one exception, the Menorca breed.

Table 2. Body weight for the 5 Spanish breeds (20 weeks of age).

Breed	Weight 20 weeks(g)		References
	♂	♀	
Mós	3235	2482	Rivero *et al.* (2007)
Menorca	2076	1495	Vilalba *et al.* (2007)
Empordanesa Roja	2840	1490	Francesch, 1998
Penedesenca Negra	2660	1515	Francesch, 1998
Prat Leonarda	2675	1520	Francesch, 1998

Conclusion

The present study is part of a larger project aiming the preservation of the Portuguese chicken breeds that are near extinction. It is important to preserve their genetic diversity as a safety feature for future needs. These breeds are a valuable complement in the present rural economy of Portugal and some market niches are being developed. Other studies aiming a more complete genetic characterization of these breeds, including evaluation of meat and egg quality, QTL identification, among others, are warranted.

References

Crawford, R.D. (1984). Longman, London: 298-311.

Francesch, A. (1998). *Arch. Zootec*. 47: 141-148.

Freitas, A.R., Albino, L.F., Rosso, L.A. (1983). *Embrapa-CNPSA*. Comunicado técnico, 68.

Freitas, A.R. (2005). *R. Bras.Zootec*., v.34, nº3: 786-795.

Goliomytis, M. , Panapoulou, E., and Rogdakis, E. (2003). *Poultry science* 82:1061-1068.

Hillel, J.;,Groenen, M.; Tixier-Boichard, M. *et al.* (2003). *Gen. Sel. Evol.* 35: 533-557.

L.Costa, J.V.Leite, J.C. Lopes *et al* (2006). *In Proc 8th WCGALP*. CD-ROM:10-08.

Leite, J. V. Dantas, R. Dias, L. Ramalhete, R .(2003). PMA. Amiba, Portugal.

Mignon-Gastreau S., Beaumont C. (2000). *INRA Prod. Anim.* 13: 337-348.

Moiseyeva, Romanov, Nikiforova *et al.* (2003). *Genet. Sel. Evol.* 35: 403-423.

Rivero, C. J., D. Rois, M. Fernandez *et al*. (2007). *Arch. Zootec*. 56(Sup.I): 529-534.

Vilalba, D., A. Francesch, A.Pons, *et al. (*2007). *Arch. Zootec*. 56(Sup.I): 545-550.