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Original Article

Performance, Livability, Carcass Yield and Meat Quality of Tunisian Local Poultry and Fast-Growing Genotype (Arbor Acres) Fed Standard Diet and Raised Outdoor Access

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Abstract

The objectives of the present study have therefore been to compare the performances, the carcass yield and meat quality from local Tunisian poultry and fast-growing genotype (Arbor Acres). Local poultry and Arbor Acres were raised for 16 and 8 weeks respectively. The performances of local chickens were lower than those of the Arbor chickens under identical conditions ($P<0.0001$). They have a weight at 16 weeks (1249g) and a total DWG weak (10.81 g/d), whereas the Arbor have a BW at 8 weeks (2383g) and a total DWG (41.66 g/d). The growth rate for local chicken ($K=0.156$/w) is lower than for Arbor ($K=0.354$/w). The feed intake of concentrates during 16w by local chicken are comparable with the Arbor chicken at 8w ($P>0.05$) thus showing a good valorisation of the pasture by local chicken (14.4%). Feed conversion ratio (FCR) for local poultry was relatively high (3.97) and their livability of is comparable to the Arbor ($P>0.0001$), this shows well thermo-tolerance of local chicken and its rusticity ($P<0.0001$). The ultime pH after 24h of slaughtering was relatively high (6.1) for local poultry compared to Arbor (5.79) and color parameters in the main muscles were particularly intense for local poultry. The carcass of local poultry is thin and low in fat ($P<0.0001$).

Key words: Local poultry, Arbor Acres, performances, meat quality, alfalfa.

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Introduction

In Tunisia, traditional breeding based on local poultry population is widely spread in the rural areas and around agglomerations. This activity provides about 9% of the produced poultry meat and quite 7% of eggs consumed by Tunisians (GIPAC, 2010). In addition, traditional poultry plays very important social roles. In deed, products from this sector represent further sources of income for poor or modest rural families, are sometimes presented as gifts to important guests (Bergaoui, 1990; Bessadek et al., 2003) and could be used as a mean of barter in some local markets or between neighbor's peasants.

However, the indigenous chicken seems to have low performances comparatively with exotic or hybrid or selected poultries. In this respect, most of the studies carried out in African and Middle Eastern countries on local poultries had shown that they have low size of eggs and chicks (Fotsa et al., 2007; Moula et al., 2009a et al.; Kingori et al., 2010) and low parameters relative to meat and eggs performances, comparatively to usual norms in industrial poultry. This may be attributed, in addition to genetic limits, to the extensive systems breeding generally practiced by farmers and which are marked by unbalanced feeding, inadequate housing and inappropriate veterinary cares and treatments (Bergaoui, 1990; Fotsa et al., 2007). In rural regions, local poultry feeding is based mainly on worms, mollusks, insects, stones, grasses and the various wastes mixed with the ground. The farmers provide some other supplements such as some cereal wastes, wet or dried bred, domestic wastes (Bessadek et al., 2003).

Tunisian poultry population are of low performances both for meat and eggs (Bessadek et al., 2003) comparatively with selected breeds and in spite of the genetic erosion, these populations had conserved a sufficiently important variability allowing not only to guarantee a minimum level of production of eggs and meat, but also to safeguard a rich reserve of different genes (color, form, rusticity…). In addition, indigenous chickens seems to have the advantage of being well adapted to the local stressful conditions in the rural areas such as high temperature, serious disease problems, poor farming hygiene and unbalanced diets (Bessadek et al., 2003; Fotsa et al., 2007; Kingori et al., 2010). Another merit of the indigenous chickens is the typically appreciated taste and flavor of products, more and more claimed by the consumers (Fanatico et al., 2005b; Moula et al., 2009b; Kingori et al., 2010). Consequently, a real demand of special products from heritage chicken breeds is currently requested in spite of their relatively high prices (Bessadek et al., 2003; Kingori et al., 2010). The consumers believe that rural egg is more delicious with its deeper yellow yolk than intensively produced eggs and that the meat of rural chicken is also tasteful (Bargaoui, 1990; Ekue et al., 2002; Fanatico et al., 2005b). A serious interest is given to valorize local poultry breeds especially for the positive impact that this activity could induce in rural poverty alleviation strategies. Based on the above considerations, the current experiment was initiated to characterize and compare growth performances, carcass yield and meat quality of the Tunisian rural chickens comparatively with fast-growing broiler raised outdoor.

Materials and Methods

Animals, housing and prophylaxis

A total of 160 chicks of local Tunisian poultry and 195 chicks arbor Acres were individually identified, weighed at day one and followed respectively during 16 weeks from June to September for local, and 8 weeks from June to July for Arbor Acres at the "Centre de Formation Professionnelle Agricole dans le Secteur de l'Aviculture à Sidi Thabet". They were bred on a fresh wood shavings litter in a two identical small building divided into 4 indoor pens containing 40 birds each for local and 49 birds each for Arbor Acres . Every pen was connected, through a doorway, to an enclosed outdoor area (28 m^2: 1.6 bird/ m^2) in which birds had free access to grazing on cultivated alfalfa. All chicks were vaccinated against Newcastle, Infectious Bronchitis and Gomboro diseases.

Feeding

Animals where fed ad libitum a starter during 4 weeks for local and 3 weeks for Arbor Acres and then passed to a growing concentrate ad libitum during 12 weeks for local poultry and 5 weeks for Arbor until slaughter. During the growing period (5^{th} week), birds have free access to outdoor alfalfa pasture during the daylight until the end of the experimental period. The alfalfa was irrigated during the summer (June-September). The ingredient composition and nutrient content of the commercial diet used in these experiments are presented in Table 1. Samples of alfalfa were collected from 1m² paddocks, by cutting it at 3 cm above the ground, for chemical analysis (Table 2). Water was available continuously throughout the experiment.

Table 1: Ingredient composition and calculated analysis of the cereal-based feed.

Ingredients (%)	**Starter**	**Grower**
Corn	64	69
Soybean meal 48	32	27
Mineral and vitamin premix[1]	4	4
Calculated nutrient content		
Energy (kcal ME/kg)	2895	2930
Crude Protein (%)	19.9	17.9
Fat (%)	2.5	3.1
Crude fiber (%)	2.3	4.7
Ash (%)	7.6	8.4
Methionine (%)	0.5	0.45

[1]Mineral-vitamin premix provided the following per kilogram of diet: vitamin A, 10 000 IU; vitamin D3, 2 500 IU; vitamin E, 20 mg; nicotinic acid, 30 mg; vitamin B12, 0.12 mg; calcium pantothenate, 11 mg; vitamin K3, 2 mg; thiamin, 1 mg; riboflavin, 4.2 mg; vitamin B6, 1.7 mg; folic acid, 0.5 mg; biotin, 0.5 mg; Fe, 172 mg; Cu, 20 mg; Mn, 110mg; Zn, 125 mg; Co, 0.3 mg; I, 2.4 mg; Se, 0.5 mg

Table 2: Chemical composition of alfalfa (% DM).

	Dry Matter	**Crude Protein**	**Fat**	**Ash**	**NDF**	**ADF**	**ADL**
alfalfa	24.9	19.1	1.6	10.2	44.8	35.2	7.1

Measurements

Performances

Weekly, feed consumption and individual body weights were recorded. Feed conversion ratio for concentrate feed was calculated by dividing the weight of feed consumed by the weight gain per pen, including the weight gain of any dead birds. Bird mortality was recorded daily. At the end of the experiment, at day 112 for local and day 56 for Arbor, one bird per pen was slaughtered and the crop content was collected. Forage particles were separated from cereal-based feed particles. The DM weights of the forage and concentrate fractions found in crop were measured. This allowed the estimation of pasture consumption by considering the intake of concentrate and the DM content of the pasture and the concentrate (Ponte et al., 2008a).

Carcass Characteristics and meat quality

At the end of the experimental period, on day 112, a sample of 20 birds (5birds x 4 floor pens) was slaughtered. Feed was withheld for 8 h before slaughter and birds were weighed individually. The carcasses obtained after defeathering, eviscerating, and removing the head, neck, and extremities, were refrigerated at 4°C for 24 h and weighed.

The pH was measured at different time postmortem (15mn; 1h; 2h; 3h; 4h; 5h; 6h; 24h) in the breast muscle at 2 cm depth. The used pH-meter (Hanna Instruments Inc., model HI99161) was equipped with an electrode calibrated at pH 4.0 and 7.0 before measuring and was coupled to a temperature control system.

The Color of skin and meat (breast and thigh) were determined at 24h postmortem using a Minolta chromameter CR-300 (Osaka, Japan). The readings were taken on equivalent positions. The tip of the chromameter measuring head was placed flat against the surface of the skin or of the meat for breast and thigh. For each reading, 3 measurements were performed and the average of these readings was considered as the final value. Skin and meat color were expressed in the CIELAB dimensions of lightness (L), redness (a), and yellowness (b).

Statistical Analysis

Descriptive statistical analysis was achieved for all the determined parameters. Effect of genotype on growth parameters was assessed through an analysis of variance, using GLM (General Linear Model procedure) of the SAS software (Statistical Analysis Software, 1999).

Growth curve parameters were estimated, according to the Gompertz equation:

$$Y = Ae^{-Be^{-Kt}}$$

Where Y = live body weight at age t, A = asymptotic final body weight, B= integration constant, and K = represents the growth rate. Additional parameters (Mignon-Grasteau and Beaumont, 2000) describing growth curves such as: Ti = age at the inflexion point, Yi= body weight at inflexion point, Ui = maximum weight gain at the inflexion point. Curves were fit for 16 weekly and 8 weekly for local poultry and Arbor respectively. Fitting quality was assessed via the coefficient of determination (R^2= 1 – (error sum of squares/total sum of squares). These parameters were estimated by non-linear regression using the NLIN procedure of SAS (1999), taking into account all available weights from birth to slaughter.

Results and Discussion

Lives weight variation

The performances of local chickens were lower (P<0.0001) than those of the Arbor chickens under identical conditions and compared with the same age (8 weeks), indicating that it is respectively of a genotype with slow growth and a genotype with fast growth. This was also confirmed by Blagojevic et al. (2009) by comparing the performances of the Hubbard with a Serb local poultry Farm Q and by Fanatico et al. (2005a) by comparing two genotypes with slow and fast growth raised in alternative system. Also Sizemore and Siegel (1993) noticed that the fast line was adapted to a rich energy diet, necessary to fill the needs for a fast growth. The reverse was checked for the line with slow growth.

At the age of 16 weeks, the mean live weight (1249g) was comparable to the values found by Bessadek et al., (2003) for the Tunisian local population at the same age (1010g for the females and 1303g for the males) and close to local thailand chicken (1280g: Jaturasitha et al., 2008) but lower than the Ardennaise (1335g to 1671g: Moula et al., 2009a), the Chinese local breed Gushi (1419g: Dou et al., 2009), the Fayoumi and the Sinai (respectively 1331.65 and 1316.38g: Saadey et al., 2008) and the Gauloise Noire (1485g) at 17 weeks of age (N'dri, 2006).

In addition, the performances recorded in our study of Tunisian local chicken, are relatively average compared to those obtained in the bibliography concerning the local populations of Africa or Europe. This variability could be explained by differences in the mode and control of the breeding and also by genetic variability rural chicken populations resulting from the various crossings as explained by Singh et al. (2001).

Dairy weight gain (DWG)

Dairy Weight Gain (DWG) evolution is illustrated in Fig. 1. For the Arbor Acres, the weight gain was significantly better (P<0.0001). The total DWG for all the period of breeding (8 weeks) was 41.66 g/d. The low values of the DWG are classic for the local races. Indeed, the total DWG during 16 weeks was 10.81g/d (Table 3). The local chickens generally presented slower growth and largely less than that observed in industrial poultry. This value is relatively close to those found by Moula et al., (2009a) for the Ardennaise (12.04 g/d) for 12 weeks of breeding and for the_varieties "bleue dorée" (11.24 g/d) for a period of 16 weeks breeding but was lower than that found by Iraqi et al., (2002) for Mandarah breed (16.14 g/d) measured during a period of 16 weeks.

The significant difference between local chicken and the Arbor chicken in the weight gain, confirms results of Fanatico et al. (2005a) by comparing two genotypes with slow and fast growing poultry raised in alternative system (2254 g vs 3370 g). Sizemore and Siegel (1993) also compared the performances of genotypes with slow and fast growth and they observed that food efficiency and weight gain are different and better at the genotypes with fast growth.

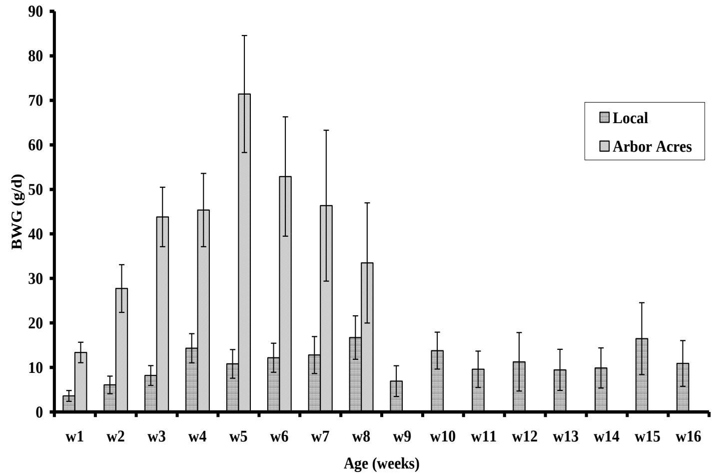

Fig. 1: Evolution of Body Weight Gain (BWG) for local poultry and Arbor.

Table 3: Comparison of performances for local poultry and Arbor broiler

Parameters	Local (16 weeks)	Arbor (8 weeks)	SEM
Body weight (g)	1248.86[a]	2382.88[b]	64.77
Weight gain (g)	1211.16[a]	2333.09[b]	65.38
BWG (g/d/bird)	10.81[a]	41.66[b]	0.94
Feed Intake (g/d/bird)	43.28[a]	91.13[b]	1.96
Total feed Intake (g/bird)	4847	5103.4	158.5
Forage Intake (%/DM)	14.4[a]	0b	6.4
FCR (g/g)	3.97[a]	2.19[b]	0.14
Mortality (%)	9.37	5.64	3.85

[a,b]Values with different letters in the same line are statistically different (P<0.0001).
SEM: Standard error of the mean.

Feed Conversion Ratio (FCR)

Total FCR for all the breeding for the local population is 3.97, whereas for the Arbor, it is 2.19 (Table 3). These results are in agreements with those found by Fanatico et al. (2005a) when they compare the FCR of slow growing (3.37) and fast growing (2.19) led in alternative system.

The overall value found for the FCR during the measurement period (FCR=3.97) was lower than that found by Dou et al., (2009) for the Chinese local breed Cushi (4.41) and by Fotsa et al., (2007) for different local populations in Cameroun (4.34 to 5.34) at the same age.

It’s worth noting that local poultry breeds presented generally low efficiency of feed utilization (Momoh et al., 2010). However, the Tunisian studied population seemed to be enough interesting, since FCR remained far lower than several other local population such as the Gasconne (6.58) and the Bresses (4.59) in France (Tixier-Boichard et al., 2006), the Fayoumi (4.61 at 9 to 14 weeks of age) in Egypt (Azharul et al., 2005) and a Nigerian local poultry (from 5.06 to 6.8 at 12 to 16 weeks, Momoh et al., 2010).

Gompertz curve parameters

Parameters calculated for the growth curve are presented in Table 4. The local chicken had a lower speed of maturation than the Arbor. This result is confirmed by Knizetova et al. (1985) by comparing chickens with slow growth and broiler. The difference is marked even if one compares animals selected for a strong weight with those selected for a weak weight (Anthony et al., 1991a; Mignon-Grasteau et al., 1999). But the latter have a higher age at the inflection (Knizetova et al., 1985). Lastly, we can note that, in spite of an age with the weaker inflection, animals selected for a strong speed of growth (Arbor) weights with the inflection, higher reach (Mignon-Grasteau and Beaumont, 2000). According to Tholon et al. (2009), other variables can affect the parameters of the curve of growth such as system of production, genotype, the sex and their interactions.

Such differences are in concordance with the results recorded by Mignon-Grasteau and Beaumont (2000), Pedersen et al., (2003) and Gous et al., (1999) in commercial broiler.

The speed of maturation (K=0.15/week) was lower than that found for the varieties of the Ardennaise (K=0.0259 to 0.0289/d, Moula et al., 2009a) and for Algerian local poultry (K=0.026/d, Moula et al., 2009b). Associated to dairy weight gain, this parameter may explain the relatively low live weight registered even at 16 weeks of age and could be considered as a selection criterion in an eventual selecting program.

Intake

The intake of concentrate per week of local poultry and Arbor is illustrated by Table 3. The total concentrate intake for 16 weeks for local poultry was comparable to Arbor for 8 weeks (P>0.05). The value found by local poultry (16 weeks) is much lower than that found by Fanatico et al., (2005a) for 12 weeks (7568 g) in slower-growing birds with outdoor access. Nielsen et al., (2003); Ponte et al., (2004) and Fanatico et al., (2005a) reported that slow-growing broiler used the outdoor area more than fast-growing broilers. In the current study, the local birds were observed to be more active and appeared to forage more than the Arbor. Indeed, Arbor birds did not appear to forage but rested or grouped around the feeder. Gordenn and Charles (2002) found slow-growing birds to be moderately active compared with the inactive fast-growing broilers. Lewis et al. (1997) and Fanatico et al. (2005a) also found slow-growing genotypes to be more active than fast-growing genotypes. Active birds are more appropriate for extensive production on pasture than sedentary birds in order to make use of the forage. However, activity also has a negative impact on feed efficiency, therefore further affecting production costs in a system than already has higher costs.

The legume pasture was estimated by weighting digestive tract gut content. At 16th week of age, alfalfa DM intake varied between 9.4 and 22.3% (averaged 14.4 %) of the total intake (Table 3). Our results are close to those found by Ponte et al., (2008b) in the case of dehydrated forage (11.1% of the total intake) offered ad libitum to broiler chicks from day 1 to 28. However, our values are very higher than those found in slow growing birds by Ponte et al., (2008a) at the 8th week. In this study, legume intake varied between 2.5 and 4.5% on DM basis of total feed intake. In the same connection, Fanatico (2006) suggested that pasture could replace 5 to 10% of the total diet.

Pasture intake of birds has rarely been measured and results are difficult to be explained since bird behaviour in pasture is not well known and differences between observations could be related by one hand to the nature, the physical form and the height of the forage and by another hand to the format of the birds themselves. In addition, intake measurements in pasture represent an estimation of pasture consumption at a specific moment of the growth period and forage consumption may vary during the experiment (Ponte et al., 2008a). Consequently, intake values of birds on forage grazing, even very interesting to be examined, should always be relativised.

Table 4: Estimate parameters of the growth curve of local poultry and Arbor.

	A(g)	B	K(/w)	Ti (w)	Yi (g)	Ui (g)	R^2
Local	1778.86	3.52	0.156	8.53	654.41	95.8	0.998
	(661.90)	(0.29)	(0.034)	(2.56)	(243.50)	(17.30)	(0.001)
Arbor	3282.74	4.68	0.354	4.42	1207.65	419.69	0.999
	(686.10)	(0.41)	(0.05)	(0.60)	(252.40)	(65.51)	(0.0005)

A = asymptotic final body weight, B= integration constant, K = represents the growth rate, Ti = age at the inflexion point, Yi= body weight at inflexion point, Ui = maximum weight gain at the inflexion point. R^2=coefficient of determination. ( ): Standard deviation

Mortality

Mortality was 5.64% for the Arbor Acres (8 weeks) and of 9.37% for the local population (16 weeks) (Table 3). There is no significant difference for mortality between the two genotypes (P=0.22). Compared with the same age (8 weeks), mortality of the local population is identical to Arbor (5.63 %). This result is close to that found by Fanatico and al. (2005a) for a slow- growing genotype (5%), but, it is weaker than that recorded by Lewis et al. (1997) and Castellini et al. (2002a) by comparing slow-growing genotypes with fast growing genotypes. The total rate death (9.37%) is higher than that found by Moula et al. (2009a) for the Ardennaise (4.38%), by Sauveur (1997) for Label Rouge (2.5%) and standard (5.1%). On the other hand, it is lower than that obtained during the evaluation of the aptitudes of growth of the Belgian local race, la Famennoise (15.25%; Moula et al., 2009c) and with Sonali (7.84%) and Fayoumi (9.8%) between 9 and 14 weeks of age (Azharul et al., 2005). These differences may be related to hygiene conditions and some health care that may be or not practiced in some of these breeding. The variability of results in local breeds observed in all over the world may be related to genetic, management, feeding and hygiene level variations. Also, some differences between recorded values could be related to the fact that performances measured in research stations, compared with those usually met in province, were probably higher, because of a more regular quantitative and qualitative feeding supply and probably further health cares and control.

Meat quality

pH

The variation of post mortem pH values in breast of local poultry and Arbor is illustrated by Table 5. The ultime pH value reached at 24h was 6.1 for local poultry higher than for Arbor 5.79 (P<0.0001). The value of local poultry is higher than the values relative to the Thai native (5.77) at the same age (Jaturasitha et al., (2008), the Label (5.73) as reported by El Rammouz et al., (2004) and slow growing broiler (5.66) cited by Jehl et al., (2003). Our finding is likely surprising because several studies have indicated decreases in meat pH values in outdoor-reared chicken, reflecting better welfare conditions, reduced preslaughter stress and thus reduced consumption of glycogen (Castellini et al., 2002).

However, the relatively high value of pH in our experiment are in line with the finding of Husak et al., (2008), who found that breast meat from organic broilers had a higher pH (P<0.05) than conventional broilers. Moreover, Alvarado et al., (2005) reported that free-range raising system resulted in high pH of meat. In addition our value could be related to the late age of slaughtered birds (16 weeks), since meat from old age birds had consistently high pH values (Ponte et al., 2008a)

According to Husak et al., (2008), the rate and the extent of pH decline have a large influence on meat quality characteristics and variation in meat pH is likely to influence color and the ability of meat to hold water. Higher meat pH is more effective for retaining desirable color and moisture absorption properties (Husak et al., 2008).

Color

Results relative to color characteristics of local poultry and Arbor meat are presented in Table 6. Local poultry had a paleness breast meat than Arbor (P<0.0001), a redder skin breast (P<0.0001) and a more yellow breast (P<0.0001).

There was no difference in Luminance (L*) and redness (a*) values between thigh and breast (62.54 to 66.42 and 12.54 to 12.64 respectively). Breasts of local poultry are paler than the thigh (66.42 vs 62.57) and the yellowness was much lower in thigh than in breast (7.53 vs 15.44). The breast presents a higher L* value than that found in Label (55.36) by Ponte et al., (2008a). The redness color (a*) in the breast of the studied population was more intense than which in the label poultry (-1.059) and the yellowness was higher in the breast of the local population (15.44) than that (9.42) in the Label (Ponte et al., 2008a).

Our values CIE lab for breast are higher than those found by Lonergan et al., (2003) for Fayoumi breed at the age of 8 weeks (L*=40.31, a*=6.08, b*=12.52). On the other hand the values of the yellowness (b*) for breast and the thigh were similar to those found by Jaturasitha et al., (2008) in local chicken Thai native at the same age (13.6 and 7.8 respectively).

Colour is generally influenced by animal related factors, mainly the genotype (Fletcher, 1995) and the age of animals (Fanatico et al., 2005b). However, it could be influenced by other management factors such as feeds and feeding systems (Fanatico et al., 2005b; Ponte et al., 2008a). This effect could vary between different muscles. Indeed, Ponte et al., (2008c) found that in Red Bro poultry, pasture improved breast skin pigmentation (P<0.001), so influenced breast skin yellowness but not skin Luminance and redness. In addition, Grashorn and Serini, (2006) found that skin showed lower redness but higher yellowness in organic poultry carcasses. The same tendency was observed in the colour of breast meat.

Table 5: Evolution of the pH *postmortem* of Arbor and local poultry

	pH_{15mn}	pH_{1h}	pH_{2h}	pH_{3h}	pH_{4h}	pH_{5h}	pH_{6h}	pH_{24h}
Arbor	6.29	5.94^a	5.75^a	5.75^a	5.74^a	5.68^a	5.69^a	5.79^a
Local	6.31	6.16^b	6.11^b	6.06^b	6.05^b	6.04^b	6.04^b	6.10^b
SEM	0.18	0.18	0.11	0.11	0.10	0.10	0.08	0.08
Level of significant	NS	**	***	***	***	***	***	***

[a,b]Means within the same line with different letters were significantly different.
(***: P≤ 0.0001; **P<0.001; NS: P >0.05). SEM: Standard error of the mean.

Table 6: Changes in colour characteristics (L*-, a*- and b*- value) of meat and skin of Arbor and local poultry

Diets	**Arbor**	**local**	**SEM**
L*- value			
Skin thigh	67.30 (3)	66.31 (2.77)	0.27
thigh	64.92 (3.26)	62.57 (4.28)	0.31
Skin breast	69.64 (3.76)	68.2 (4.07)	0.32
breast	62.57^a (1.80)	66.42^b (3.50)	0.27
a*- Value			
Skin thigh	10.40 (2.08)	9.71 (1.35)	0.19
thigh	11.92 (1.06)	12.54 (2.05)	0.21
Skin breast	7.88^a (1.59)	10.17^b (1.28)	0.22
breast	11.87 (1.35)	12.64 (1.66)	0.20
b*- Value			
Skin thigh	18.84^a (4.5)	12.79^b (3.37)	0.33
thigh	9.92 (3.13)	7.53 (2.28)	0.26
Skin breast	14.89 (2.82)	13.79 (3.08)	0.29
breast	11.37^a (2.74)	15.44^b (2.64)	0.27

[a,b]Means within the same line with different letters were significantly different (P<0.0001). SEM: Standard error of the mean

Fanatico et al., (2007) reported that birds with outdoor access, which had green forage available for consumption, displayed more deeply pigmented skin. In our study, the relatively high values of yellowness of skin and breast meat, comparatively with different observations reported in literature may be due to the access of outdoor and the natural pigments present in the legume-based pasture (Ponte et al., 2004; Ponte et al., 2008c; Fanatico et al., 2005b; Grashorn et Serini, 2006; Mourâo et al., 2008). In deed, Alfalfa and grass are widely known as natural sources of xanthophylls for poultry diets (Ponte et al., 2004). The non significant difference of redness between the two genotypes in our study would be due to the system of production (access to the pasture and ingestion of the alfalfa only by local chicken), with the diets used very rich in corn (more than 60%) and at the age of slaughter (16 weeks) (Grashorn and Serini, 2006).

Carcass yield

The Arbor had higher overall carcass yield as a percentage of live weight compared to local poultry (P<0.0001; Table 7). Local poultry had a much slower and less efficient pattern of growth and was much less heavily muscled. Our results are similar to they cited by Fanatico et al. (2005a).

All our results concerning the performances and the quality of the carcass confirm those of Fanatico et al. (2006 and 2007) which compared two genotypes with slow and fast growth. On the other hand, they contradict those of Jaturasitha et al. (2002) which found similar values between local poultry and the Arbor into 12 weeks, in particular for the carcass yield (64.54% vs. 65.64%), the liver (2.17% vs. 2.11 %) and the gizzard (3.71% vs. 3.23%). This variability could be explained by genetic differences between the local populations on the one hand and between the Arbor and local poultry on the other hand. It comes out from our study that the local poultry presents a weight at slaughter and a carcass yield weaker than those of the Arbor. This difference in weight is also observed for breast and thigh.

In a similar study, Sizemore and Siegel (1993) also noticed that the Label rouge was more active than the Standard and this activity can explain the differences on performance and carcass between the two lines. The most active line expends more energy on activities, what decreases the quantity of energy available for the development of the muscles.

Table 7: Carcass characteristics and digestive organs for Arbor and local poultry

	Arbor Acres	Local	SEM	Level of
weight at slaughter (g)	2975.3[a]	1364.1[b]	315.1	***
éviscerated Carcass (g)	2204.95[a]	938.2[b]	243.7	***
carcass yield (%)	74.1[a]	68.61[b]	1.85	***
abdominal fat (%)	2.19[a]	0[b]	1.02	***
gizzard fat (g)	12.4[a]	0.8[b]	5.21	***
thigh (g)	658.5[a]	291[b]	75.39	***
breast(g)	594.1[a]	186.1[b]	71.57	***
gizzard(g)	39.85[a]	31.11[b]	7.79	**
heart (g)	12.3[a]	5.75[b]	2.72	***
liver (g)	57.5[a]	30.94[b]	10.82	***
gastrointestinal tract (g)	276.8[a]	140.35[b]	47.34	***
small intestine (cm)	196.8[a]	128[b]	17.74	***

a,b: Means within the same line with different letters were significantly different.
(***: P≤ 0.0001; **P<0.001; * P≤ 0.05). SEM: Standard error of the mean.

Conclusion

The Arbor had superior growth performance and carcass yield whereas local poultry had comparable mortality and more foraging, which is important in an alternative system.

In the light of the found results, it was concluded that comparatively with other local poultry breeds in several countries; Tunisian local population presented potentially interesting growth parameters and meat quality characteristics. In addition to the high potential of selection and crosses possibilities, they could represent a strong argument to develop local production systems for rural populations.

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