

LOCAL POULTRY POPULATIONS IN CHLEF (ALGERIA): PHENOTYPES, REARING SYSTEMS AND PERFORMANCES

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ABSTRACT

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The local chickens represent a very important source of income and high quality protein for rural households all over the world and especially in the poorest African countries. In Algeria, the local poultry populations is a valuable source of income and play a significant cultural role; they are thus offered as gifts and used during ritual sacrifices or ceremonies. Despite their economic and cultural importance, Algerian local breeds being exploited only in family farms, remain poorly known. In order to document and identify the phenotypic characteristics of the local poultry populations in the region of Chlef, several surveys were conducted on 72 families. Socioeconomic results showed that all women (100%) were housewives; and they were the key player (80%) in the chicken-farming activity. The chicken-rearing conditions were very rudimentary, characterized by an inadequate housing (73.5%), insufficient quantity of food (75%), uncontrolled reproduction scheme and a complete lack of veterinary assistance, leading to significant losses mainly due to diseases (52%) and predation (31%). The observation and analysis of 677 animals led to the identification of several phenotypes; the white, straw, red and golden were the most dominant plumage colors, the smooth feathers was the most frequent (92.8%) type of plumage and the normal distribution of plumage prevailed with 83.8%. The average weight comparison showed a very significant sexual dimorphism ($p < 0.0001$) in favor of males. The improvement of rearing conditions remains the best solution to improve productivity.

Keywords: local poultry, rural families, phenotypes, rearing systems

INTRODUCTION

The hens were the first bird domesticated by humans worldwide, and are a very important source of protein in the human diet (Crawford, 1992). Among farm animals, local chickens are the most widely disseminated in African countries, as they represent a very important source of income and high quality protein for rural households (Adebambo *et al.*, 2009). In addition, local poultry populations play a significant cultural role; they are offered as gifts and used during ritual sacrifices or ceremonies (Moula *et al.*, 2009). However most of the traditional poultry breeds have not been studied and significant efforts are therefore needed to assess the situation of these breeds (Moula *et al.*, 2014). In Algeria, since the poultry industry is based exclusively on intensive farming of exotic strains, local breeds being exploited only in family farms remain poorly known. In addition, due to the absence of a public policy for management of local poultry genetic resources, this sector is thus highly threatened by genetic erosion (Mahammi *et al.*, 2014).

Unfortunately, few studies have been conducted on the Algerian local chicken, and very little information is available on the family poultry production in Algeria, despite its importance in rural areas. The objective of this study

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conducted in Chlef region is to identify the different phenotypes of the local poultry populations present and to characterize their rearing systems and performances, for a future perspective for improvement and conservation.

MATERIALS AND METHODS

The study was conducted in the region of Chlef, located in the north western part of Algeria, between $0^{\circ}41'22''$ and $1^{\circ}43'15''$ of East longitude and $35^{\circ}50'33''$ and $36^{\circ}33'35''$ of North latitude.

The data were collected through a survey of 12 municipalities. Six families belonging to different villages far apart from each other were selected from each municipality. Thus, 677 animals (169 males and 508 females) of all ages were identified.

The data collection was carried out following well-structured questionnaires, focusing on one hand on the socio-economic profile of families, such as age, gender, marital status, occupation and education level of the persons in charge of farming, and on the other hand on the characterization of the local chicken rearing systems such as, housing type, feeding system, reproduction scheme, general health status of the flock and the destination of the local chicken products.

The phenotypic description of the encountered local poultry such as color and type of plumage, type and color of the comb, color of the eyes, skin and tarsus and animals weight were assessed through direct observations and measurements.

Finally, the collected data were subject to a simple descriptive statistical analysis (percentages and means) using the Excel software, while the Chi-square test of independence between phenotypic characteristics and gender using proportions and average weight comparison using t and z tests were performed through a trial version of XLSTAT 2015.1 (Addinsoft, 2015).

RESULTS AND DISCUSSION

Socioeconomic characterization of breeders

The results of the local chicken farming, showed a different participation threshold of all family members. The highest part of responsibility (80%) was on women, whereas, the responsibility of the remaining members (kids and men) did not exceed 20%, which is consistent with the observations reported by Wani *et al.* (2014). This unbalanced distribution of responsibility was justified according to Ayssiwede *et al.* (2013) by the fact that the traditional poultry represents a source of income for poor farmers in rural areas, especially women. Farmers age varied between 15 and 75 years, with an average of 45 years, among which 28.5% were without education, 31% with a primary school education and 40.5% with a secondary level education. All women (100%) were housewives and 63.5% of men were farmers. The historical breeding analysis showed that 10% of families have less than 5 years breeding experience, 33% from 5 to 10 years and 57% for more than 10 years, similar to earlier findings by Letebrhan *et al.* (2015).

Phenotypic description of the indigenous poultry populations

Different unequally distributed phenotypes were identified throughout the region; some were common to all the study area, whereas others were strictly limited to certain regions. The plumage of the local poultry populations varied between the unicolor and the multicolor (Table 1); the most common colors were white (21.7%), straw (20.2%), red (18.9%) and golden (17.9%). Although, less frequently (from 0.44 to 6.94%), other colors such as gray, stoat, cuckoo, multi-colors, mottled, brown and black were also encountered. The roosters were mainly golden (24.3%) and red (21.9%); whereas hens were mostly straw (25%) and white (24%) in color (Table 1). This multiplicity of colors within Algerian traditional poultry is consistent with what has been reported earlier by Azón and Francesch (1998), Fotsa *et al.* (2010), Moula *et al.* (2009) and Ould Ahmed and N'Daw (2015). The emergence of all these plumage colors in the local poultry populations may be the result of a non-controlled reproduction schemes among animals of different feather colors (Akouango *et al.*, 2004).

As indicated in Table 1 and in agreement with the reports of Ngeno *et al.* (2014) and Ould Ahmed and N'Daw (2015), the smooth feathers in the current chicken population was the most frequent (92.8%) as compared to the frizzle type (7.24%). Considering the feathers coverage of the body, four phenotypes are listed in the investigated chicken populations (Table 1). As reported by Keambou and Manjeli (2009) and Bembide *et al.* (2013), the normal plumage prevails with 83.8%, followed by the crested one (10.6%) (Table 1). According to Bembide *et al.* (2013), the scarcity

of certain phenotypes, such as the naked neck (3.55%) and the feathered tarsus (2.07%), is due to the fact that some chicken breeders consider mutant characters as fetishes and eliminate them from their flocks. These low frequencies could be a sign of threat of extinction (Keambou and Manjeli, 2009).

Table 1. Characteristics of color, type and distribution of plumage in males, females and overall surveyed poultry population.

Color of plumage	Males (169)		Females (508)		Total (677)	
	N	%	N	%	N	%
White	25	14.8	122	24	147	21.7
Straw color	10	5.91	127	25	137	20.2
Red	37	21.9	91	17.9	128	18.9
Golden	41	24.3	80	15.7	121	17.9
Black	20	11.8	27	5.31	47	6.94
Brown	14	8.3	20	3.94	34	5.02
Mottled	10	5.9	10	1.97	20	2.95
Multi-colors	7	4.14	10	1.97	17	2.51
Cuckoo	2	1.18	10	1.97	12	1.77
Stoat	3	1.78	8	1.57	11	1.62
Gray	0	0	3	0.59	3	0.44
Type of plumage						
Smooth	140	82.8	488	96.1	628	92.8
Frizzle	29	17.2	20	3.94	49	7.24
Distribution of plumage						
Normal	137	81	430	84.6	567	83.8
Crested	5	3	67	13.2	72	10.6
Naked neck	20	11.8	4	0.79	24	3.55
Feathered tarsus	7	4.14	7	1.38	14	2.07

Within the Algerian chicken populations, male's skin color is mostly white (56.2%) and female's skin is almost equally distributed between yellow (41.3%) and white (34.6%) colors. It was noted that the pink skin color, largely represented in females (24%), was very rare in males (5.32%) (Table 2). This dominance of yellow and white skins was also highlighted by Ngeno *et al.* (2014) in the local poultry of Kenya. Contrary to the skin color, the male's tarsus were mainly yellow in color (52%), whereas those of the females were mostly white (44.7%). Other tarsus colors such as gray (16%) and black (7.53%) also characterize poultry in the study area (Table 2).

The observed skin color variation in our poultry population may be attributed to basic food. Indeed, according to Bembide *et al.* (2013), yellow skin may be associated with the presence of carotenoids (xanthophyll) in food rations; good laying hens export the xanthophyll pigments in the egg yolk and consequently have less yellow legs and skin.

As reported by Grimal and Gómez (2007) and Deneke *et al.* (2014), almost (90%) of the studied flocks were of the red-colored simple comb type. Finally, the eye color examination showed the dominance of the red-orange color (80.4%), compared to yellow (19.6%) (Table 2). According to Crawford (1990), the color of the eyes usually depends on the pigmentation (carotenoid pigments and blood supply) of a number of structures within the eye.

Table 2. Characteristics of skin, tarsus, comb and eyes of males, females and of overall surveyed poultry population.

	Males (169)		Females (508)		Total (677)	
	N	%	N	%	N	%
Color of skin						
Yellow	65	38.5	210	41.3	275	40.6
White	95	56.2	176	34.6	271	40
Pink	9	5.32	122	24	131	19.4
Color of tarsus						
White	47	27.8	227	44.7	274	40.5
Yellow	88	52	156	30.7	244	36
Grey	10	5.91	98	19.3	108	16
Black	24	14.2	27	5.31	51	7.53
Type of comb						
Simple	153	90.5	443	87.2	596	88
Rose comb	8	4.73	45	8.86	53	7.83
Pea comb	8	4.73	20	3.94	28	4.13
Color of comb						
Red	149	88.1	408	80.3	557	82.3
Pink	20	11.8	100	19.7	120	17.7
Color of eyes						
Red-orange	130	77.0	414	81.5	544	80.4
Yellow	39	23.0	94	18.5	133	19.6

According to the Chi-square test of independence (Table 3), all the studied phenotypic characteristics are related to gender, except the comb type and color and the eyes color.

Table 3. Chi-square test of independence between gender and phenotypical characteristics by using proportions.

	χ^2 Observed	χ^2 Critical	p-value	Significance
Color of plumage	23.75	18.31	0.0083	HS
Color of tarsus	20.58	7.82	0.0001	HS
Distribution of plumage	17.61	7.82	0.0005	HS
Color of skin	17.13	5.99	0.0002	HS
Type of plumage	9.27	3.84	0.0023	HS
Color of comb	2.32	3.84	0.1276	NS
Type of comb	1.39	5.99	0.4998	NS
Color of eyes	0.64	3.84	0.4256	NS

As for the weight of the local poultry populations, roosters ranged from 1.3 Kg to 2 Kg with an average of 1.78 ± 0.22 Kg, and were heavier than hens which ranged from 1.0 Kg to 1.6 Kg with an average of 1.37 ± 0.19 Kg (Figure 1). Indeed, the comparison of the average weight using the t and z tests showed a highly significant difference ($p < 0.0001$) between males and females average weight.

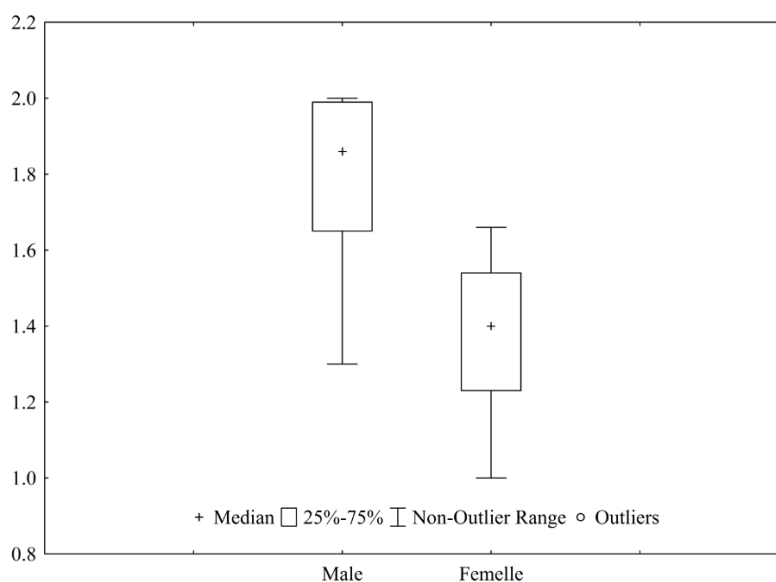


Figure 1. Box plots expressing the sexual dimorphism in the surveyed local poultry populations.

These results confirm the sexual dimorphism reported in a large number of investigations such as those outlined by Keambou and Manjeli (2009), Bembide *et al.* (2013), Wani *et al.* (2014), Ould Ahmed and N'Daw (2015) and Dahloum *et al.* (2016). This may be due to the manifestation of gender related genes, differently distributed and expressed between males and females (Ayoub and Merat, 1972).

Indigenous poultry populations rearing systems

According to questionnaires responses, only 6.5% of families provided a day/night shelter to their hens, 20% left them in a total wandering, whereas 73.5% of the families ensured them with only a nocturnal shelter. In 85% of the cases, these shelters were without litter and constructed with whatever locally available material (wood, plastic, Zinc sheets, roasting, bricks...), whereas in 15.0% of the cases, old families dwellings were used as chicken coops. The major drawback of these shelters is the lack of space, adequate ventilation and not being high enough to allow appropriate cleaning. Thus, the absence of adequate housing is in agreement with the findings of Wani *et al.* (2014) and Ould Ahmed and N'Daw (2015).

Furthermore, feeders and drinking troughs were in 70% of the cases old and rusted or broken household containers (cans, basins...) or other utensils (30%) made out of clay or aluminum (plates, pans, old pots, terrines...). Recovery equipment used by families as feeders and waterers were also reported by Mugumaarhahama *et al.* (2016) in the Republic of Congo.

The results also showed that rummage of insects, earthworms, seeds, herbs and soil waste remained the main source of food within the studied populations regardless of age group. In 25% of farms, hens fed by total scavenging (no supplementation), whereas in 75% of cases, families distributed a dietary supplementation based on wheat bran, barley or wheat grains, ground or wet dry bread and kitchen scraps (couscous, pasta, rice...) once a day (80.5%) to rarely twice a day (19.5%). Commercially prepared foods, vitamins and minerals being very costly were totally absent throughout the studied populations. Water supply is much underestimated among the studied families and most of it (88%) comes from the drinking water network. The same food supply practices were reported in Algeria by both Mahammi *et al.* (2014) and Alloui *et al.* (2015), and by Wani *et al.* (2014) and Letebrhan *et al.* (2015) in other countries.

With a sex ratio of 1 rooster for 4 hens and a non-controlled reproduction, the average age of sexual maturity of the local hens as reported by farmers was around 6 months; the number of annual and exclusively natural broodings varied from 2 to 6, each brooding involved 6 to 18 eggs. Eggs production of local poultry population oscillated between 60 and 80 eggs/year, which is well above the production reported by Fotsa *et al.* (2010), Ould Ahmed and N'Daw (2015) and Mugumaarhahama *et al.* (2016) who reported yearly production of 49 to 54 eggs in Cameroon, 40 to 50 eggs in Mauritania and 25 to 50 eggs in the Republic of Congo. This variability in production depends on the genetic

potential of the chickens and food availability (Wondmeneh *et al.*, 2016), rearing conditions, climate, seasons and livestock areas (Ayssiwede *et al.*, 2013).

During the investigation, chickens health was one of the major concerns of the families. Indeed, the lack of veterinary assistance and hygienic measures in the coops created a favorable environment for many diseases and epizootics. The most commonly described diseases within our chicken's community are those affecting the respiratory system (69.4%), the plumage (18%) in addition to other symptoms (12.6%) such as diarrhea, apathy, sudden death and cystic eyelids appearance, reported especially in chicks. In response to these diseases, the alternatives available to the rural women remained limited; 48% took no action (relying on the natural hardiness of their local chickens), 13% preferred slaughtering sick animals to avoid spread and to minimize losses, the last category (39%) used herbal decoctions, a knowledge acquired through generations. This traditional treatment, without any precise or known dosage, is based on the use of Aloe vera, thyme, carob, fenugreek, pepper, cumin and olive oil for respiratory symptoms, and sulfur, henna, ashes and vinegar for the plumage. Similar observations were reported earlier by Ben Larbi *et al.* (2013). The use of traditional medicine is guided by its availability, ease of use and low cost compared to modern veterinary medicine. In addition to diseases, predation is responsible for 31%, robberies 7.8%, traffic and domestic accidents 9.2%. Dogs, snakes, domestic and wild cats are the most frequently reported predators. The same causes of losses were reported by Letebrhan *et al.* (2015).

Finally, the choice of the local chicken breeding is guided, according to the interviewed families, by its adaptation to all environments (100%), resistance to diseases (80%), low cost of production (88%), in addition to its use in ritual sacrifices and family ceremonies (100%), as gifts (55%) and in traditional medicine (45%). In 17% of the cases the poultry products are intended to the family's consumption, sale of eggs and owner family's consumption in 29% of the cases, and eggs and chicken sale in 54% of the cases. Sale took place mostly at home (70% of the time) and to a lesser degree at the market (30%), where the average selling price of a rooster is around 6.77 USD (750 DZD), 4.96 USD (550 DZD) for a hen and 0.14 USD (15 DZD) for an egg.

Despite its modesty, the income generated by this sale is used to cover some of the household expenses; such as the daily family needs, the children school fees and clothes. This trend is well comparable to the results reported earlier by Bett *et al.* (2014).

CONCLUSION

The traditional poultry rearing and breeding remains a very important socio-cultural and economical element within the rural households, primarily maintained by women. It serves as a source of proteins and generates additional subsistence income, thus fighting poverty by the rural families.

In the region of Chlef, local hens are reared exclusively under an extensive system, characterized by an inadequate henhouse, an irregular feeding system and an uncontrolled reproduction scheme. Despite these limitations the local poultry populations revealed a rich genetic diversity, highly adapted to the environmental conditions and resistant to diseases and stress. Nevertheless, the performances of our local poultry remain low compared to commercial strains, but very interesting compared to the local chickens of some African countries.

The improvement of rearing conditions remains the best solution to a better productivity and would enhance guaranteeing the transformation of the rural poultry products into a highly productive economic sector.

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