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Research Article
Morphological and Zootechnical Characterization of the Local Chicken in the Urban Area of Abéché

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Abstract

Background and Objective: In developing countries, indigenous chicken production is very important as the first source of animal protein supply for the rural populations and a good income source for the rural farmer, particularly for women. The purpose of this study was to characterize the local chickens in the city of Abéché based on their morphological and production traits. **Materials and Methods:** This survey study was conducted in Abéché areas by using a structured questionnaire. A total, 44 households participated in the interview and 424 indigenous chickens were inventoried. The data collection focused mainly on the demographic data of farmers, the management of the flock, farming objectives, egg incubation, brooding procedures, the characteristics of the plumages and the color of the eyes, the color and the shape of the beak barbel, the crest and the legs color. **Results:** Results indicated that chicken farming was practiced largely by men and illiterates. The first farming objective was for family consumption and sales (52.16%), the second objective was for family consumption (25.27%) whilst the third objective was for sale only (22.57%). The criteria used for selection of breed of indigenous chicken was mainly based on growth performance, plumage color and hardiness. The average age of the first egg of the local chickens was 6.4 months but the average egg number laid per hen per clutch was 11.48±0.32 with 40.91±1.23 eggs per year and 3.56 clutches per hen per year. The hatchability of eggs from an indigenous chicken was 77.27%. The native chicken of the Abéché area had a partridge plumage color, black-brown eye and gray beak and tarsi colors. But the barbel and crest were red. The form of the barbel was round and the ridge type was simple. **Conclusion:** Traditional poultry farming in the Abeche shows phenotypic diversity and requires molecular characterization to improve production.

Key words: Abéché, animal protein, Chad, chicken production, growth performance, local chicken

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Indigenous chickens *Gallus gallus*, which is one of the components of animal genetic resources in sub-Saharan Africa, has emerged in recent years as a candidate to meet the increasing animal protein requirements of sub-Saharan Africa. More than 80% of the population of sub-Saharan Africa is practicing family poultry farming[1]. It is estimated that local chickens constitute 80% of poultry production in sub-Saharan countries[2]. In most countries of sub-Saharan Africa, where there is a shortage of animal protein coupled with the poverty of the rural populations, the indigenous chicken sector has several advantages. These advantages are attributed to its short production cycle as well as its relatively low cost investment[1]. Despite its low productivity (as a result of scavenging system), the indigenous chicken sector has been playing a very important role in rural livelihoods in sub-Saharan African countries[1]. In these environments, local chicken production is very important as the first source of animal protein and a good source of income for the rural farmers[3]. In addition, the indigenous chicken production has been playing a major role in poverty alleviation and particularly economic empowerment for women and children[3]. Several developing countries have given special importance to the local chicken to avoid the extinction of such a local genetic heritage (hardiness, color diversity, good incubator and good mother). Knowledge of these indigenous breeds with a view to their preservation as production animals is necessary. Numerous morphological and zootechnical characterization studies have been carried out in Chad. Granevitze *et al.*[4] have shown the extent of genetic diversity depends on the genetic founders of the populations as well as the management that these populations have undergone.

Most of these studies are carried out in Chad focused on the southern region and very little attention has been given to eastern Chad, more specifically in Abéché town. Thus, the identification of the farming method and the data on the morphological and zootechnical characteristics could contribute to the valorization of the local genetic potential and the improvement of the zootechnical performances of the native chickens. The objective of this study was to characterize the morphological and zootechnical diversity of local chickens in the city of Abéché.

MATERIALS AND METHODS

Description of the study area: This study was conducted in Abéché town. Abéché is the capital of the Ouaddaï region. It extends between 13°20′0″ North latitude and 20°40′0″ East longitude. This study area is under the influence of an intertropical climate with a dry season that lasts 9 months (October to June) and a rainy season of 3 months (July to September). The coldest months are November, December, January and February but the warmest months are March, April, May and June. The regime of these two seasons is defined by the fluctuations between the masses of dry air from the north (the harmattan) and the masses of moist maritime air from the southwest (the monsoon). Abéché town receives an amount of average annual rainfall of about 300 mm year^{-1}. The average annual temperature in Abéché is around 28°C with a variation in the cold season (December to February), between 16 and 35°C, in the dry season (April and May) between 25 and 41°C. The city is divided into seven districts and is populated by approximately 1,048,962 inhabitants[5].

Methods of data collection: This survey study was conducted by using a structured questionnaire. A total, of 80 households participated in the interview and 424 indigenous chickens were inventoried. The data collection focused mainly on the profile of the farmers (sex, age, level of education, marital status, length of professional experience and other activities), the management of the flock, the number of males and females, breeding objective, egg incubation, brooding procedures and the weight parameter, the characteristics of the plumages (type, color, distribution on the body, etc.) and the color of the eyes, the color and the shape of the beak barbel, the crest and the legs color.

Statistical analysis: The data collected was analyzed using XLSTAT software (6.1.9). The descriptive analysis was used to determine the dispersion parameters (Mean±standard deviation, extremes and frequencies). The parameters measured were: duration of professional experience, duration of brooding, number of eggs per laying and year and weight. When the means of dispersion parameters were statistically different, the means were further compared using the Newman-keuls test (SNK) at a 5% threshold.

RESULTS

Breeder's profile: In Table 1, chicken farming was practiced mostly by men (52.27%). The number of women was significant lower (47.73%) than the men. The average age of poultry farmers was 41.18 years with 3.75 years of local chicken breeding experience. The majority interviewed are married and illiterate. In addition, agriculture was the major occupation followed by trade (Table 2).

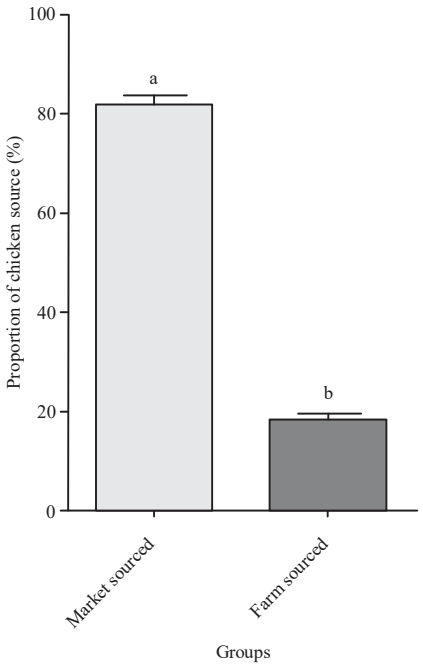

Fig. 1: Source of breeder local chickens

Data sharing no common letter are different (p = 0.0025)

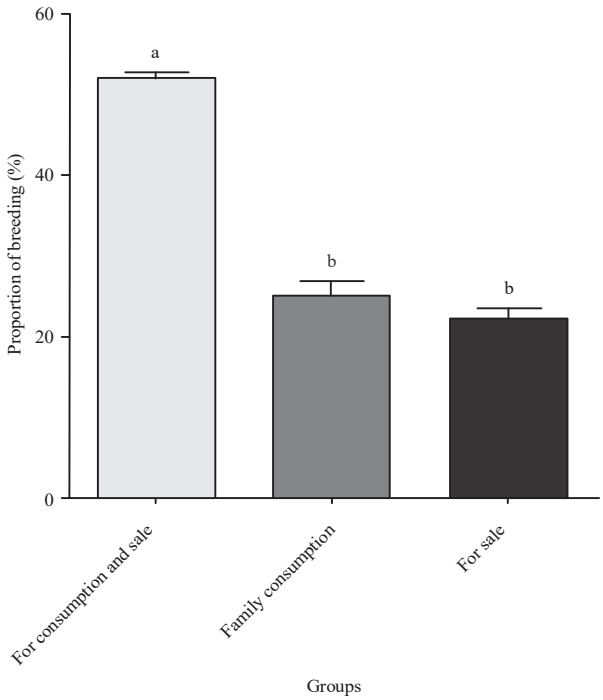

Fig. 2: Production objectives

Data sharing no common letter are different (p<0.05)

Table 1: Profile of respondent in Abéché area

Parameter	Number (n = 80)	Proportion (%)
Sex of respondents (%)		
Men	42	52.50
Women	38	47.50
Average age of respondents (year)	41.18±0.12	
Years of local poultry producers experience	3.75±0.21	
Marital status		
Married (%)	62	77.50
Single (%)	11	13.75
Widowed (%)	7	8.75
Educational level (%)		
Illiterate	51	63.75
Primary education	2	2.50
Secondary	9	11.25
High school	18	22.50

Table 2: Distribution of respondents by major occupation

Occupation	Number (n = 80)	Percentage
Trading	18	22.50
Driving	7	8.75
Farming	38	47.50
Civil service	7	8.75
Military	3	3.75
Student	7	8.75

Production objectives and breeding parameters: Most of the traditional poultry farmers have markets as their main source of supply for breeder birds (81.82%) (Fig. 1). In the present study, the traditional poultry farmers have three production objectives (Fig. 2), the first objective was family consumption and sales (52.16%), the second objective was family consumption only (25.27%) and the third objective was sales only (22.57%). This finding revealed that the majority of traditional poultry production was for sales and family consumption.

Figure 3 presents the distribution of breeders according to breeding criteria. The result indicated that the choice criteria of indigenous chicken breeders (cock and hen) are mainly based on growth performance, plumage color and hardiness but a small proportion is devoted to plumage color and hardiness. The present investigation revealed the age of the first egg was 6.4 months. The average egg number laid per hen per clutch in the present study was 11.48±0.32 with a total of 40.91±1.23 eggs per year at 3.56 clutches per hen per year (Table 3). The incubation of eggs from local hens in the study area was natural in all farms (100% by hens) with an average of 77.27% hatchability. The majority of respondents affirmed that the rainy season was period of good reproduction (Fig. 4). The body weight of adult males was heavier than those of adult females (p<0.05). (Fig. 5).

Qualitative traits of indigenous chicken: Table 4 presents the distribution of colors of plumage, eye, beak and beak shape of indigenous populations of chickens.

Table 3: Performance of local chicken

Parameters	
Age at first egg (month)	6.40±0.24
Egg number per clutch	11.48±0.32
Clutch number per hen per year	3.56±0.2
Egg number per hen year^{-1}	40.91±1.23
Hatchability (%)	77.27±3.02

Table 4: Distribution of colors of plumage, eye, beak and beak shape of indigenous populations of chickens

Qualitative traits	Number	Proportion (%)
Plumage color		
Partridge	106	25.00
Golden Salmon	32	7.55
Red	81	19.10
Ermine	101	23.82
Gold with red border red	34	8.01
White	43	10.14
Mahogany	27	6.36
Eye color		
Black brown	197	46.46
Yellow	47	11.09
Orange red	180	42.45
Beak color		
Gray	192	45.28
Yellow	163	38.44
White	69	16.27
Beak shape		
Curved	97	22.87
Straight	327	77.12

Plumage color: The present investigation showed that the dominant plumage color was partridge. Ermine color and red color were the second and the third highest plumage color, respectively, observed in the study area. In addition, red, golden salmon, white and gold with red borders were also observed with low proportions.

Eye color: The present finding revealed that the black-brown color was the predominant eye color followed by yellow and orange red color at a low level.

Beak shape and color: Two beak shapes were observed in the local chicken. The straight beak shape was the most prominent than those of the curved shape. Regarding beak coloration, three colors were observed (gray, yellow and white), the gray color was the dominant beak color followed by the yellow color.

Tarsal color: The dominant color of the tarsal was gray. The white color was the second tarsi color observed in the study area. Black and white colors were also observed at low proportions (Fig. 6).

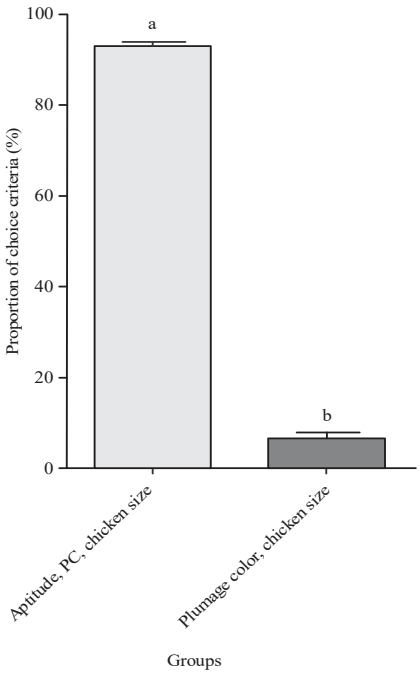

Fig. 3: Criteria for choosing indigenous chicken breeders
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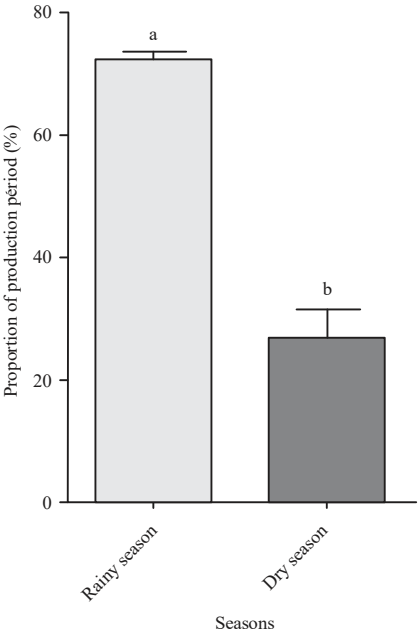

Fig. 4: Period of good reproduction
Data sharing no common letter are different (p = 0.0015)

Shape and color of barbel and crest: The round shape and red barbel color were the most represented than those of pink barbel color. With regard to the crest, the proportion of simple shape and red color of the

Table 5: Distribution of colors and forms of crest and barbel of indigenous populations of chicken

	Colors		Forms		
Qualitative traits	Red	Pink	Single	Double	Triple
Crest					
Number	299	125	326	67	31
Frequency (%)	70.52	29.48	76.88	15.80	7.32
	Red	Pink	Round		Oval
Barbel					
Number	318	106	343		81
Frequency (%)	75	25	80.89		19.11

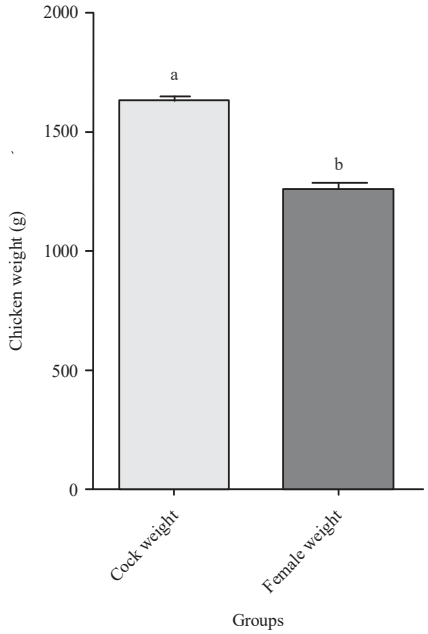

Fig. 5: Local chicken weight

Data sharing no common letter are different (p = 0.0053)

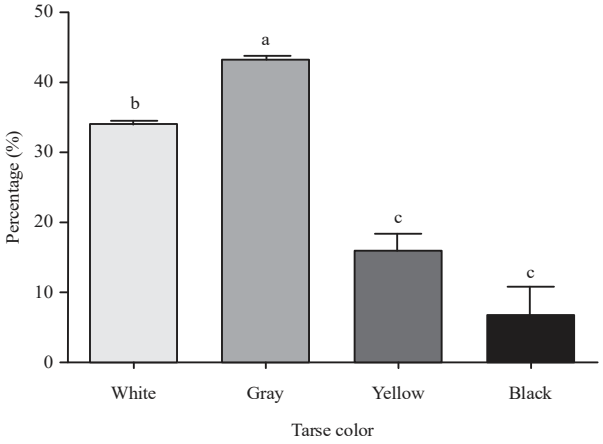

Fig. 6: Tarse color

Data sharing no common letter are different (p<0.05)

crest were the highest followed by the pink color and the double and triple shape of the crest (Table 5).

DISCUSSION

The results of the breeder's profile in the present study indicated that farming was practiced largely by men (52.27%). This result was similar to a previous study conducted by Mekonnen[6] who reported that the proportion of male respondents was higher (86.2%) than female. However, this result contradict with a previous study[7] which reported that women activities are predominated in village chicken husbandry system. The average age of poultry farmers was 41.18 years with 3.75 years of local chicken breeding experience. The majority of the respondents were married and illiterate but agriculture was the major occupation of the respondents in the survey followed by trade, this result agrees with the findings of Granevitze *et al.*[4] who conducted the study in the southern part of Chad. The result indicated that the choice criteria of indigenous chicken breeders (cock and hen) are mainly based on growth performance, plumage color and hardiness. This result could be attributed to the economic significance of chicken traits like plumage color and body size. In addition, in African traditional bird markets, morphological traits of chickens (cock and hen) like plumage color, body size and comb type heavily determines live chicken prices. Similar results were reported by Dana *et al.*[8], who stated that morphological traits are an important factor in the selection criteria under traditional livestock breeding practices. The study showed that 81.82% of the farmers started chicken breeding by buying chickens from poultry markets. This result is inconsistent with previous findings of Larbi *et al.*[9], who reported that 80% of farmers purchase chickens from neighbors to start traditional chicken breeding. The result showed that the objective of traditional production was for sales and family consumption which is in consonance with the previous findings of Tadelle *et al.*[10], who reported that income generation and consumption constitute the main production objectives of chicken farming. Halima *et al.*[11] indicated that in southern and Northwestern Ethiopia the objective for keeping chickens was income generation. The current investigation revealed that age at first egg was 6.4 months which is close to

the finding of Abiyu[12], who stated that in Ethiopia the age at first egg was 6.09 months. However, Magothe *et al.*[13] noted that the age of the first egg was 7.4 months in Kenya. The variation in the age of chicken at first egg might be due to the environmental condition, availability of the feed resource and variation of genetic potentiality.

The egg number laid per hen per clutch in the present study was 11.48±0.32 per year with 40.91±1.23 eggs per year and 3.56 clutch per hen per year with 77% average hatchability. This finding was close to the previous result of Addisu *et al.*[14], who reported that in Eastern Gojjam the number of eggs/clutch/hens was 12.3 eggs and the egg number/clutch/hen/year was 44 eggs, whereas, Yadessa *et al.*[15] reported a high egg number and clutch number per hen per year. The observed variations in the production traits of indigenous chickens in African countries might be due to environment, feeding aspects, variation of genetic potentiality, housing and management systems. The result showed that the incubation of eggs from local hens in the study area was natural on all farms (100% by hens). Magothe *et al.*[13] also reported that in Kenya, natural incubation with brooding hens was practiced in all production systems. The result indicated that the hatchability of indigenous chicken eggs was 77.27%. This is consistent with Abiyu[12] who observed 78.6-81.6% of egg hatchability but slightly lower than the results of Magothe *et al.*[13], who reported 80% hatchability in Kenya. The majority of the respondents affirmed that the rainy season was good reproduction period. This result might be due to the rich feeding source during the rainy season as nutrition influences reproduction performance.

The male adult birds have significantly higher body weight than those of the adult females, which agrees with the findings of Dana *et al.*[16], who reported that males are heavier and taller than females. The cocks were observed with higher sexual dimorphism than the hens are in agreement with the previous finding of Halima *et al.*[11] and Dana *et al.*[16].

The dominant plumage color in the study area was partridge. Ermine color and red color were the second and the third highest plumage color respectively observed in the study area. This result is inconsistent with the findings of Moreda *et al.*[17] who reported that indigenous chickens from the southwest and South parts of Ethiopia showed brown plumage colors.

The present findings revealed that black-brown color was the predominant eye color. This result is not in agreement with the finding of Egahi *et al.*[18] from Nigeria.

The eye color values obtained from the present study are also inconsistent with the observation of Guni and Katule[19] who noted that orange eye color was the most exhibited among the indigenous chickens of Tanzania. Concerning the shape and color of the beak, the straight beak shape was more noticeable than the curved shape. The gray colored beak was the dominant color however the yellow color was the second. These results are not in accordance with the observations of Rajkumar *et al.*[20], who reported that curved beak shape and yellow colored beaks were the most dominants. The gray tarsi color was the predominant color, which is inconsistent with the observation of Dao *et al.*[21], who found that white tarsi are the most common in Togo. Results of the present study showed that in Abéché, the predominant barbel shape was the round. In contrast, Yacouba *et al.*[22] pointed out that the majority of barbel shape was oval. The barbel colors of the chickens in Abéché was red. This result is in accordance with a previous study conducted in Burkina[22]. The proportion of simple ridge type was higher than those of the double and triple shape of the crest. Similar opinion was expressed by Hassan *et al.*[23], who reported that the simple crest type is predominant in the chicken population in Nigeria. The red color of the crest is more dominant in the indigenous chicken population of Abéché. This result is consistant with a previous study conducted by Faruque *et al.*[24], who reported predominant color in the chicken population in Bangladesh.

CONCLUSION

In Abéché, chicken farming is practiced largely by men who are illiterates. The choice criteria for indigenous chicken breeders (cock and hen) are mainly based on growth performance, plumage color and hardiness. The indigenous chicken breeder's age at first egg was 6.4 months with 40.91 eggs per hen per year and 3.56 clutch per hen per year. The native chicken of Abéché town had a partridge plumage color, black-brown eye and gray beak colors but the barbel and crest are red in color. However, the tarsi color is gray. The form of the barbel is round and the ridge type is simple. It is important to explore the molecular characterization and potentiality of indigenous chicken.

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