

The Production Systems, Phenotypic and Morphometric Diversity of the Local Hens "*Gallus Gallus Domesticus*" in Eastern Algeria

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Abstract: Our work consists in characterizing the breeding of local chickens "*Gallus Gallus domesticus*" in the wilaya of Guelma (East Algeria), as also the phenotypic and morpho-biometric characterization of this species.

To achieve this, a survey was carried out in the field between November 2016 and August 2017, the following points were analysed: the socio-economic situation of the breeders, the farming method based on the history of the livestock, with phenotypic and morpho-biometric characterisation of 231 chickens from this region.

According to the surveys, women are the main managers of livestock farms to meet certain living needs; the population average is 11 chickens per farmer and the creation of livestock farms by farmers over an average period of 2 years; 27.3% of the farmers surveyed buy domestic village chickens and 41.8% of the market, the results also show that 92.7% of farmers indicate that almost all farms are in open breeding mode with the purchase of adult birds; 5.5% of farmers involve a closed mode and 61.8% the reproduction mode with known parents, 38.2% unknown parents, so over half the farmers are aware of at least one parent.

The results obtained for 231 hens sampled show a very different source of characteristics: the most frequent feather colours are walleye with 11.53%, brown with 11.37% and wheat with 11.17%, red with 9.33% and white with 8.44%, the other colours are: mille-fleurs, herminé, black, copper black, partridge, salmon, stone, grey and cuckoo are at lower frequencies ranging from 2.52% to 7%. The dominant feather distribution on the body is normal with 77.72%, the skin color is distributed as follows: white 39.8%, pink 34.64%, yellow with a variability of 21.59%, but rarely a pigmented skin with 4.02%,

The body measurements under consideration (body weight, tarsal length and diameter, barbel length and crest height) confirm sexual dimorphism with higher values in males than females,

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I. Introduction

In parallel to commercial industrial poultry farming, there is a small-scale poultry farming system, which is very popular in the development process, this type of production called backyard poultry production (**Halbouche et al, 2009**) or family poultry farming practiced by local communities for many generations.

The domestic chicken (*Gallus gallus domesticus*), represents the most studied phasianid species, whose major economic importance is particularly in the context of genetic diversity. (**Groeneveld et al, 2010**).

In the forties, chicken was a luxury dish consumed only on festive days, thanks to intensive breeding, was propelled into the rank of everyday meat. (**McKenna, 2017**).

Traditional local chicken farming has obvious advantages over most other types of farming, in particular through its short production cycle and relatively low level of investment. **(Steinfeld et al, 2006)**

Traditional chicken farming is a way of providing a food supplement in the form of animal protein and provides food reserves to meet emergencies and basic needs **(Halbouche et al, 2009)**. **(Seré, et al, 1996)**.

In recent years, several developing countries have given particular emphasis to the local chicken, which has different characteristics depending on livestock objectives, climates, market and consumer existence. **(Guéye, 2005)**.

At the level of markets, local chicken is rare, and its price is higher than that of industrial chicken. Its flesh is red, although less tender, and is highly appreciated by the consumer. **(Galal, 2006)**, such as the Bateke chicken in Congo-Brazzaville **(Akouango et al, 2009)**, the Baladi and the Fayoumi in Egypt **(Galal, 2006)**, Baladi in Maroc.

The characterization studies carried out show low productivity due to the farming method used (habitats, food, etc.) and the poverty of the existing genetic material. **(Altieri, 2004)**.

In Africa, in general, family poultry farming is exploited by more than 80% of the population, most of them rural; it is an important part of both rural and urban economies, with a total of 1068 million hens in 1995 **(Guéye et Bessei, 1995 ; Sonaiya, 1997 ; Guéye, 1999)**.

In Algeria, the implementation in the early 1980s of a major poultry sector development programme based on intensive breeding of imported industrial hybrid strains resulted, in addition to genetic erosion, in the destruction of traditional rural poultry farming structures **(Bessadok et al, 2003)**.

As for the local breeds, exploited exclusively in traditional extensive livestock farming, they are very poorly known **(Feliachi, 2003)**.

Phenotypic characterization and study of the growth performance of local chickens in Kabylia **(Moula et al, 2009)**. As regards the local chicken populations of western Algeria, ensures that there is a phenotypic inventory of local poultry populations, carried out following surveys conducted in some villages in the wilayas of Mostaganem and Relizane **(Halbouche et al, 2012)**.

In Algeria, as in the other Maghreb countries, traditional poultry farming was, until the 1960s, the only source of poultry products **(Raach-Moujahed et al, 2011)**, But the development of the industrial sector has led to the progressive marginalization of the traditional sector based exclusively on the exploitation of breeds or local populations of hens that have proven their ability to adapt, enabling livestock projects to succeed in difficult rural conditions. **(Jabbar et al, 2004)** Often poorly known and little described in the literature, these local breeds are now largely threatened with extinction and their continued disappearance, in the absence of any

information on the state of genetic diversity, the structure and origin of local hen populations (**Ollivier et al, 2000**). Destruction of traditional rural poultry farming structures and heavy dependence on the import of commercial strains due to the lack of local production of basic genetic material (**Dessie, 2003**).

In Algeria, local chickens are commonly called village chickens, without any information on the structure of their population, most often, are classified according to their geographical locations (cradles of race or population) or their phenotypes. Unfortunately, these varieties are still very poorly characterized and their potential for production, adaptation to climates and breeding conditions and resistance to disease remain poorly studied.

However, these preliminary studies are insufficient to characterize the local chicken populations in Algeria, a country characterized by its great biological, geographical and bioclimatic diversity. From one region to another, the breeds and populations of local hens can be very different.

The objective of our study is to contribute to a better valorization of the local chickens of the wilaya of Guelma, to this end we have carried out through this work a series of surveys allowing us to establish on the one hand the characterization of the breeding and to appreciate the phenotypic and biometric characterization on the other hand.

II. Materials and methods :

Our research is carried out in the Wilaya of Guelma, which is located in the North-East of Algeria. The choice of this study area was based on the study of the importance of local hens as well as the variety of phenotypic characteristics.

Our study is based on the development of a questionnaire aimed at highlighting the socio-economic characterization of the breeder as well as the breeding characteristics of the local hen "*Gallus gallus domesticus*" in the Guelma region over a period of 10 months, another component consists of a phenotypic descriptive study and measurements on hens by practice based on different body values, the data collection was carried out in the period from June to September 2017 on the basis of several different types of hens.

Different local hen heads (population) are used for phenotypic characterization and body measurements.

The total number of employees who targeted 231 different heads per young and adult hen at approximately 6 to 8 months of age up to 1 to 2 years of age.

1- Farming method

55 livestock buildings were included in this study, and the parameters studied are developed in the results section.

2- The questionnaire

Before the field trip, the literature review on the characterization of the local hen in Africa ensured that a first questionnaire was prepared.

The final questionnaire was prepared and included certain characteristics for the knowledge of the farmer's socio-economic situation as well as data on the history of the herd, the type of farm, the creation and origin of the animals, productivity, the rearing method and local destination of the poultry, feed management.

No prior training on breeding sites, numbers...etc. The lack of collaboration with other sectors such as DSA, ITELV, so we based on the following procedures:

- The implementation of a primary characterization study with farm surveys.
- In each village, it was necessary to have a large number of local chicken breeders with direct contact.
- The carrying out of a simple sampling with a significant number of local adult hens per farm.

3- Phenotypic and morpho biometric characterization material:

Equipment used in the field for body measurements: gloves, notebook, tape measure, digital scale.

Equipment used in the field for phenotypic traits: Gloves, Description sheet, Digital camera or mobile phone, Animal numbering.

1. 4 - Sampling

2. 1. Location and season of samples

3. Our study was carried out during

- The period from November 26 to August 14, 2017 for the survey of 55 premises in the Guelma region, 16 to 17 remote villages were visited to conduct a representative sample of the population in the region in question.

- We asked questions:

On 17 November to 14 August 7 families in the village of ben tabouch, on 26 to 27 November 02 families in the centre of Guelma, on 3 December to 22 July 09 families in the village of Heliopolis (el fedjoudj) for 04 families in the village of Ain rihanna and 3 families in the village of Mechta N, on 3 December to 30 July 8 families in the village of medjez Ammar (Salah Salah Salah), on 22 December one family in the village of boumahra, 29 December 03 families in the village of Belkheir, 31 December to 3 August 3 families in the village of el khezara, 06 January one family in the village of medjez

Ammar, 12 March to 16 March 3 families in the village of oued zenatti (kifen el-assel), 15 March to 19 May 2 families in Oued Zenatti (Ain Toutta), 17 April to 5 May 7 families in Oued Zenatti also (ras el-agba), 7 July to 09 August 8 families in Bouatti Mahmoud village.

4. Investigation

On the basis of predefined criteria, the survey was completed in the 17 villages of the Guelma region, first 4 to 5 families up to 8 families were involved in this study sometimes only one to two families, because lack of availability of local hens in different breeding, contact with families specifies only the father if not the mother at the expense of type of breeder but rarely the children, the breeder was interviewed with the questionnaire translated into local accent that already prepared previously in French. The collected data were entered and analyzed using Word and Excel and sphinx Plus² software.

1- Socio-economic questionnaire of the breeder

This socio-economic survey is based on the following parameters: age and sex of the farmer, profession, number of children and type of exploitation

2- History of the herd

The parameters studied for animals are as follows: period of creation, description and origin of the first animals, number of animals, appearance, origin and introduction of new animals since creation.

3- Herd management

We have collected the following information: Identification of animals, number of females and males (youth/adults) and origin of adults currently present

4- The trend of the herd: Stable, Declining or increasing

5-Mode of reproduction: known and unknown parents

6- Types of reproduction: Natural or artificial

7- Choice of breeder

8- Reproductive performance: Concerning: the laying age

9- Mode of breeding and feeding

10- Number of care and pathologies

11- Bird destinations

12- The different risks

4. Sampling technique

Each breeder has a certain number of adult and young hens, so we were subjected to a direct phenotypic description, the collection of qualitative data focused on the determination of the sex of the animal, which was relatively easy given the very distinctive and very different external characteristics between males and females (presence of ergot, crest development, tail carriage), the plumage characteristics "colour, distribution was also well detailed", the shape and colour of the crest, barbels, tarsus, skin, mumps, beak and eyes, and measurements (bird body weight, crest height, barbels length, tarsus length and diameter, all this environmental information has been made using a digital scale and tape measure in addition to a photograph of each bird for a clear and precise description of the phenotype.

5. Statistical analyses

The statistical analyses were carried out in order to identify the local hen population of the wilaya of Guelma through the visible and morpho metric phenotypic profile, these analyses were carried out by Excel and sphinx Plus² software version 50.51 in two steps: descriptive and monthly analyses.

III. Resultats :

The field study has a duration of 10 months (from November 2016 to August 2017). A total of 231 birds (182 females and 49 males). A total of 55 herders visited in 6 communes between 17 different villages in the wilaya of Guelma in the three agro-ecological zones were sampled and analysed.

1. Livestock characterization

1. 1. Socio-economic situation of livestock farmers

- Age and sex of the breeders

Table 1 : Age and sex of the breeders.

	Age (Years)							Sex	
	<20	20-30	30-40	40-50	50-60	60-70	>60	Woman	Man
Number of breeders	2	5	13	13	11	6	5	37	18
Number of breeders (%)	3,6%	9,1%	23,6%	23,6%	20,0%	10,9%	9,1%	67,3%	32,7%
Average age	46 years							/	/

(years)			
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The table above shows that the age of the breeders is distributed as follows: 3.6% below 20 years old, 9.1% between 20 and 30 years old, 23.6% between 30 and 40 years old, 23.6% between 40 and 50 years old, 20.0% between 50 and 60 years old, 10.9% between 60 and 70 years old, 9.1% above 70 years old, the average age is 46 years old. For sex, the majority of herders 67.3% are women and 32.7% are males, the sector below shows the number of herders by sex (fig 1).

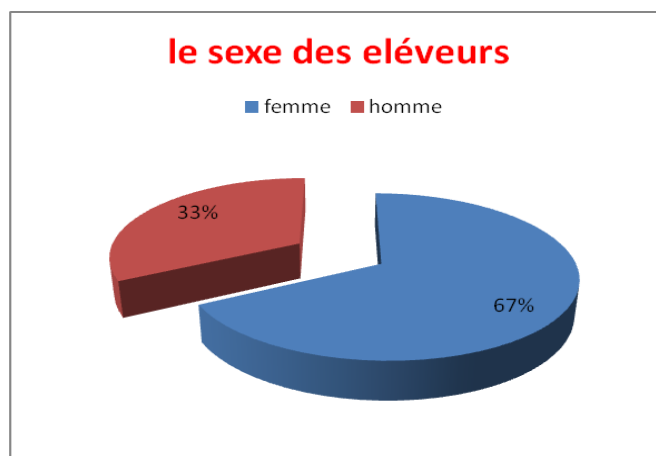


Figure : the gender of the breeders.

We have noticed a feminization of breeders including 37 women and 18 men with an average age of 46 years.

The oldest breeder is 82 years old and the youngest 14 years old, our results are similar to those of **Mahammi F Z, (2015)** who found (35 women and 13 men) an age range of breeders between 14 and 76 years with an average of 45 years. These women, despite this modesty, consume local hens for self-consumption much more, but sometimes they find in the clothing sold hens and eggs, to ensure certain life needs and especially of their children such as purchase such as school stuff and clothes... etc..

Men use local chickens in most of the time in buying and selling in the market and village of their residence, and recent **fosta, (2008) ; moula et al, (2012)** which give men this right to be responsible and manager of the family to the detriment of women.

1. 1. 2. Educational level

The 55 farms surveyed are managed by livestock farmers, whose educational level is distributed as follows:

- 14.5% without any level, illiterate.
- 32.7% with a primary level.

- 27.3% with an average level.
- 16.4% with a secondary level.
- 9.1% with a university degree.

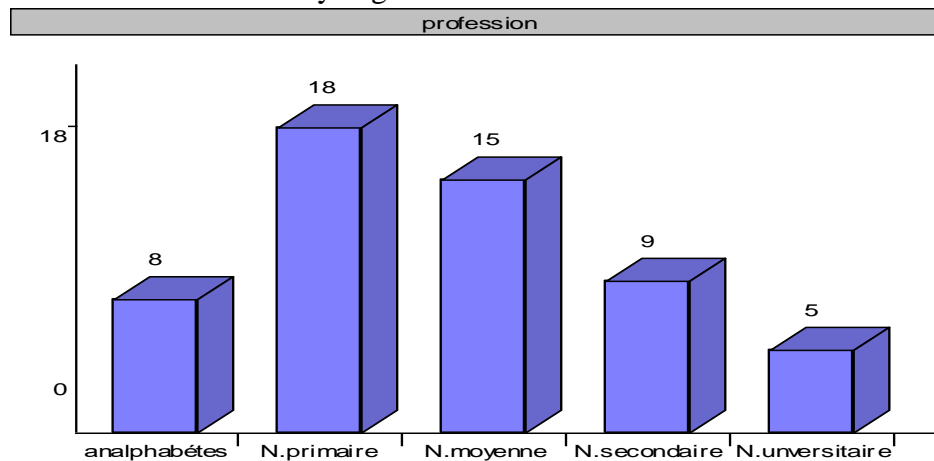


Figure : the number of breeders according to their level of education.

Either the farm is managed by 8 herders are illiterate and are generally old women who exceed 58 years of age, 18 have received primary education, 15 have completed medium studies and 9 have at a secondary level, with regard to the university level. Among the female breeders, 3 working in the field of education, is the majority of the others are housewives, concerning men, 2 men are academics, one worked in a private company and the other in the field of education and two breeders (14 years) are still following their average studies, 5 breeders were retired, the others are breeders had agronomic activities and breeders of different species.

Mahammi F Z, (2015) found respectively in the western Algerian region levels of 14.58% illiterate, 58.33% primary a high level of breeders compared to those in our study, 20.83% secondary, 6.25% have a university level among female breeders two working in the field of education, the others are housewives, concerning men, quarter breeders were retired, 7 had agronomic activities and two breeders even younger (14 and 15 years) while a level close to those in our study.

We have therefore observed that housewives are in the majority that they are interested in local livestock farming, this observation has also been recorded in most African countries **Akouango et al, (2004) ; Fosta, (2008) ; Gueye, (1998)** found that about 80% of local chicken farms in some African countries have been largely controlled by women.

1. 1. 3. Number of children

The average number of children is 3, however, a significant disparity for this criterion is noted: 16.4% of herders have one child or no children, 10.9% have between 2 and 3 children, 47.3% have between 3 and 5 children, 16.4% have between 5 and 6 children, 7.3% have between 6 and 8 children, 1.8% breeders have more than 9 children (fig).

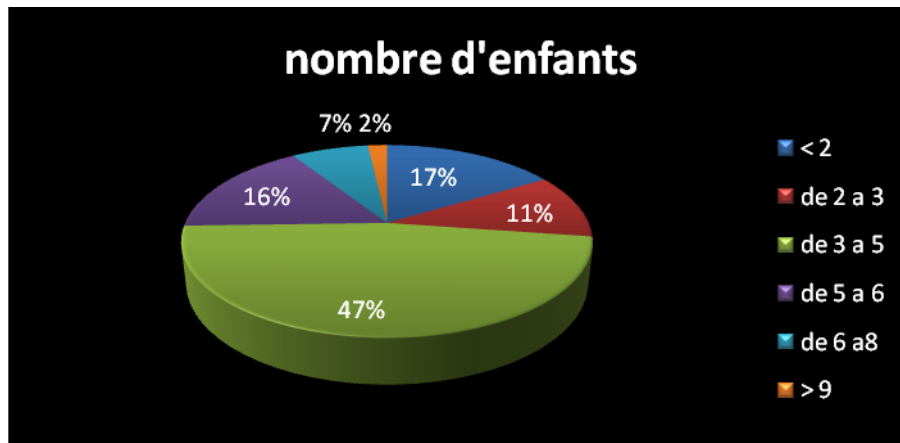


Figure : Number of children

It was found that the average number of children is 3, the largest number of which is 8 and 9 children and the smallest number is no children present young people who have not yet married. These children are involved in this type of farming, as assistants to their mothers and fathers for the distribution of food and the collection of eggs but rarely in the sale.

1. 4. Types of exploitation

The most numerous activities of the breeders are from different farms with a percentage of 72.7% against 27.3% of the breeders which contains the breeding only of local chickens (fig).

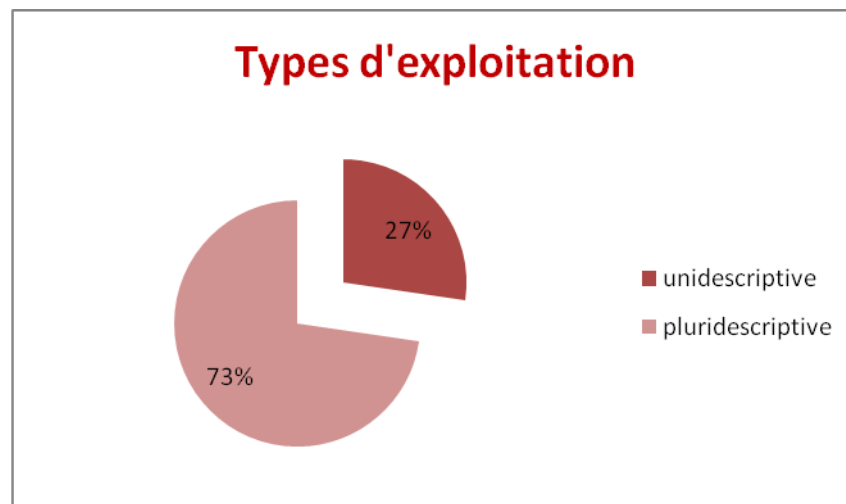


Figure : Type of exploitation.

For the type of farm most (73%) of the breeders are drinking different species, the majority of which are men, while (27%) of the breeders, most of whom are women, only drink birds. These men are more involved in the breeding of ruminants (especially cattle), which explains why ruminants have priority over local chicken breeding.

1. history and management of the herd

2. 1. number of chickens

Represents the total number of 55 families studied, the distribution of birds of each breeder, which explains that 12.7% presents the number of hens months of 6, 21.8% presents the percentage of number of hens between 6 and 8, 14.5% between 8 and 10 hens, 16.4% between 10 and 12 hens, 9.1% between 12 and 14 hens, 10.9% between 14 and 16 hens and 14.5% for 16 or more (fig).

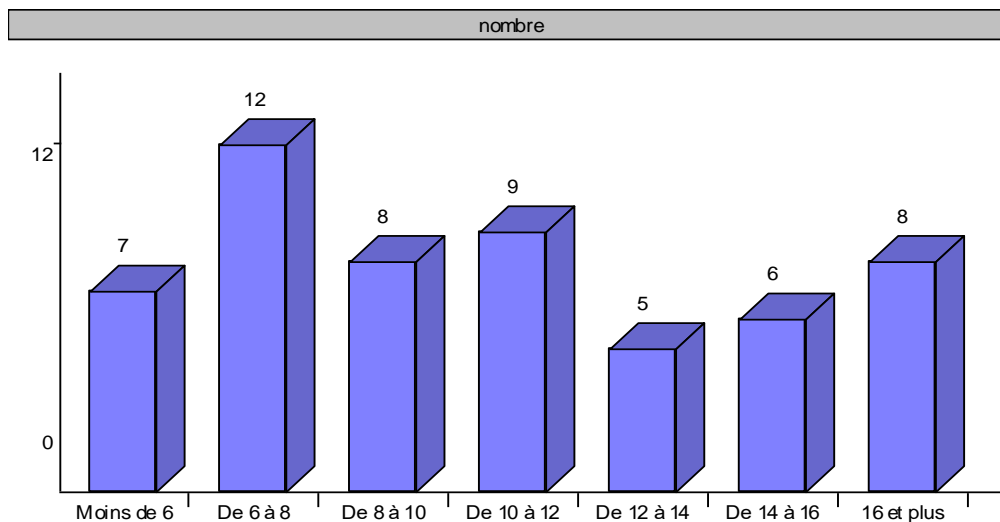


Figure : Total number of breeders contains local chickens.

Our results show that in the premises studied, the average number of hens is 11 local hens with a variation in the minimum number of 4 hens per farmer and a maximum number of 36 hens per farmer (including chicks), the average number of hens per farm is 31 with a variation of 7 to 80 so the number of industrial hens is still the highest in Algeria **Mahammi F Z, (2015)** , These numbers are rather high compared to what is reported in our study, but include the **(Gueye, 2002)** , who stated that herd sizes in African villages generally vary between 5 and 20 birds per farm.

On the other hand, the number of local hens was estimated in 2004 at 27-87 million heads in Senegal, 31-94 million heads in Burkina Faso, 15-27 million heads in Mali and 15-36 million heads in Benin. **Alders, (2005) ; Bebay, (2006) ; Pousga, (2007)**. Traditional poultry farming remains the most widespread in poor African countries in Senegal and sub-Saharan Africa **(Missohou et al, 2002 ; Aboe et al, Fosta et al, 2007 ; Halima et al, 2007a)**, As a result, herd sizes and farm sizes have increased, and intensive livestock farming has begun. **(Document de référence, 2003)**.

II-2-2- Creation period

The figure above shows that the creation of farms by farmers has an average of 2 years, 27.3% have created their farms at a period of one year, 36.4% have a period of 2 years, 30.9% have a period of 3 years, 5.5% have a period of 4 years, so the creation goes back on average to 2.5 years to 3 years and maximum 4 years.

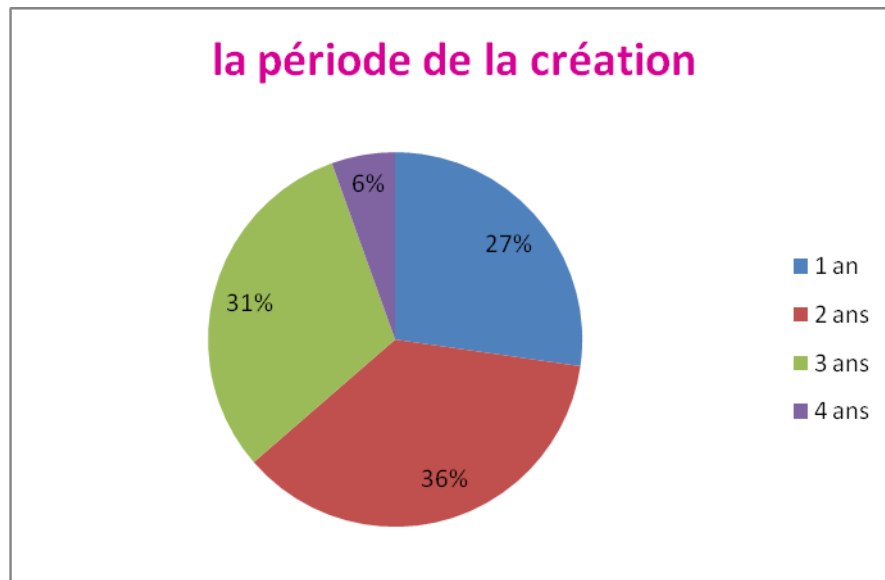


Figure : The period of creation of chicken breeding by breeders..

The surveys revealed that the farms are of recent creation with an average creation dating back 2 years, and at most 4 years, on the other hand when we compare our results with the results of **Mahammi F Z, (2015)** has noticed that the latter are all different, the average is 3.5 years, and at most 10 years.

II-2-3- The appearance and provenance

After the field study it was distinguished that the appearance is normal for local chickens. The figure above shows that the majority of the farmer in the survey buy local village hens with 27.3% for 15 farmers and the market with 41.8% for 23 farmers but rarely local city hens with 1.8% for one farmer only and 1.8% between the market and the city for one farmer and 3.6% between the village and the city for two farmers (fig).

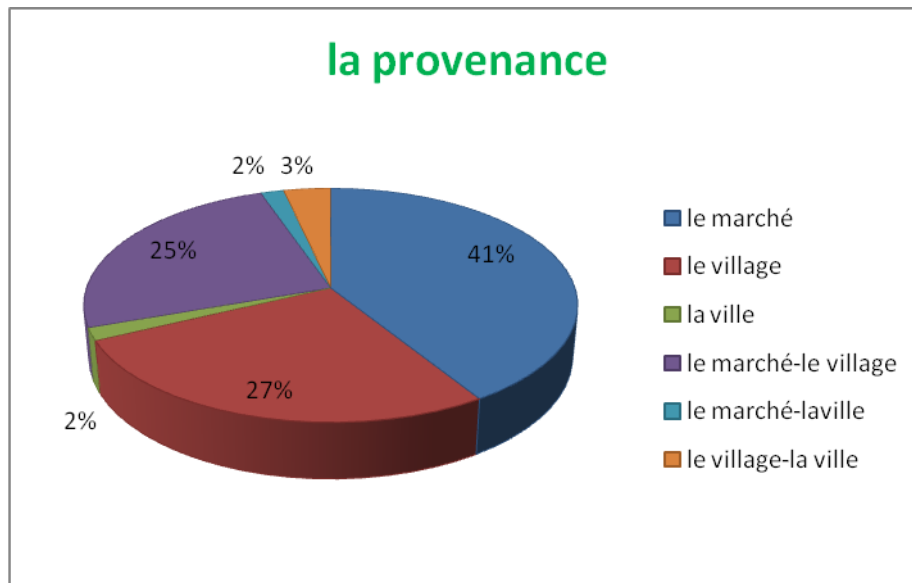


Figure : Different origins of local chickens by the breeders.

II-2-3-2- Introduction of new topics after creation

The figure shows the number of breeders who entered new subjects after their creation of the herd, 12.7% of breeders who added local village hens, 16.4% of breeders who added market subjects and 7.3% of breeders who added subjects from the villages and the market at the same time, compared to 63.6% who did not have new hens after the first creation (fig).

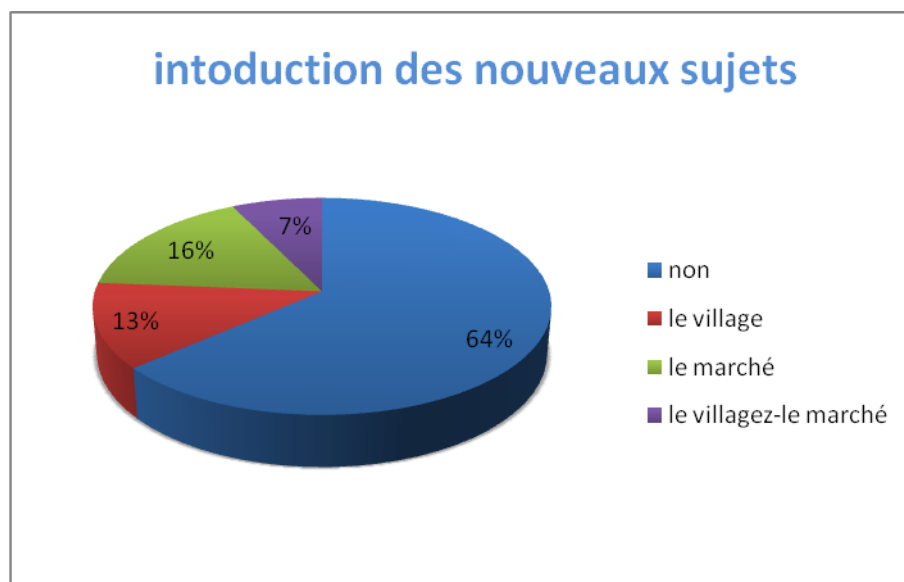


Figure: Number of breeders who introduced new subjects at the first creation.

According to the breeders, the majority of the birds are all purchased at the market and neighbouring villages but also the village of their residence, sometimes the city with a low percentage of 1.8%. Generally breeders after creation buy new subjects to increase a large number for themselves and for sale, but rarely leave the herd stable.

II-2-4- The size of the population

The following figure shows the size of each breeder in the survey by different numbers between male and female, this table shows that 87.3% of breeders have between 0 and 3 adult cocks, 12.7% of breeders have between 3 and 5 adult cops, 20% of breeders have between 0 and 2 young cocks and 80% have between 2 and 4 young cocks, for adult females 23,6% of breeders have less than 2 adult females, 74.5% have between 2 and 8 adult females, 3.6% have between 8 and 12 adult hens, 1.8% have 12 or more adult hens, for young females breeders have 3.6% months of 2 young hens, 25.5% between 2 and 4, an average of 50.9% between 4 and 8, 14.5% between 8 and 12, 5.5% of breeders have 12 or more young females.

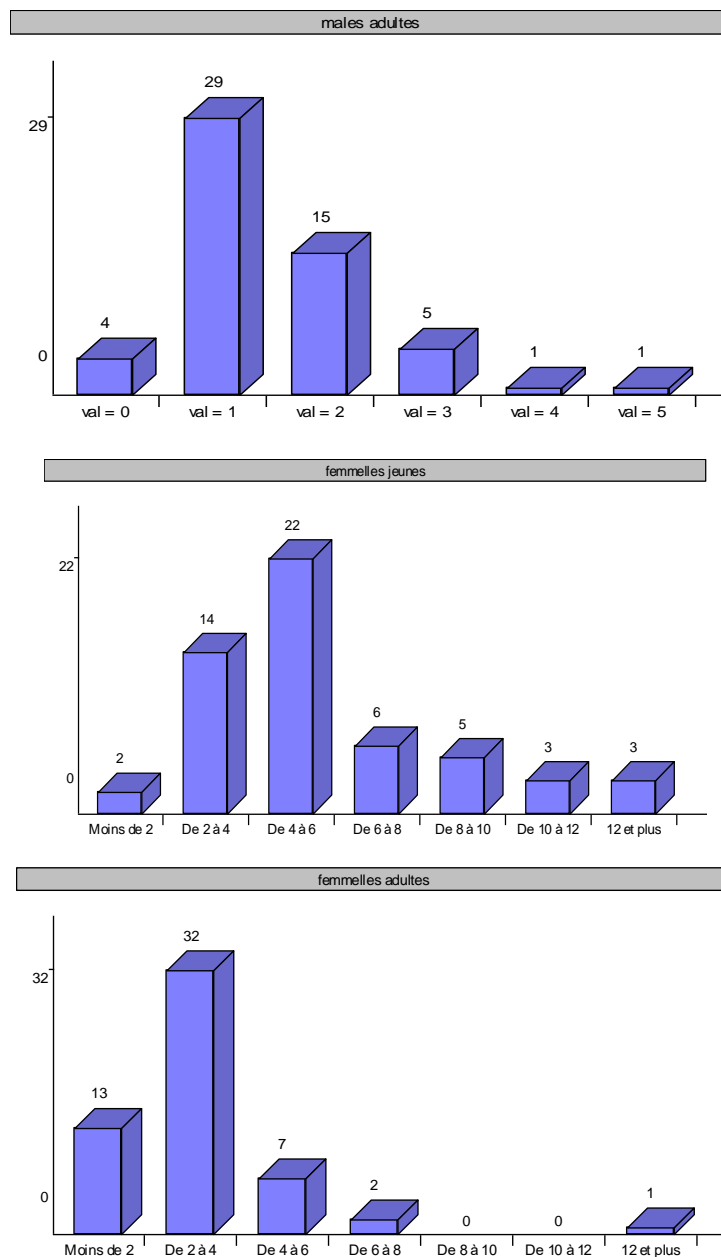


Figure: The size of the livestock population.

Our results showed that all the farms studied, which are the majority of the time components of a large number of females according to age, are representative of different life periods between adults and young compared to males who were born at various degrees.

The study of **Mahammi F Z, (2015)** est similaire de notre étude avec 271 femelles et 63 males ce qui explique la grande différence dans la diversité entre femelles et males dans les exploitations dont elle a étudiés, aussi en kabyle 315 têtes entre 162 femelles et 153 males **Moula et al, (2009)**.

II-2-5- The tendency::

The figure above shows the trend of populations, 87.3% declare that their breeding is increasing, while 1.8% of the farms considered were in decline, 10.9% were stable (fig).

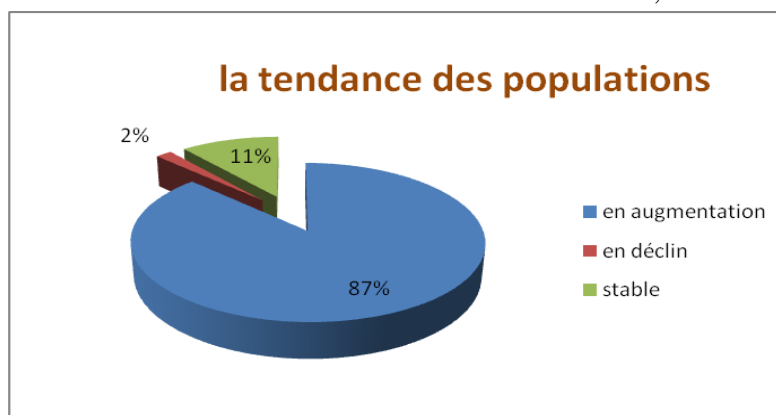


Figure : Population tendency.

Our results show that 87.3% of breeders have an increasing population, 10.3% are stable, and only 1.8% are in decline, **Mahammi F Z, (2015)** found in western Algeria almost the same results as us, 46.15% of breeders declare that their breeding is increasing, 38.46% being stable and 13.46% considered as declining. The number of local hen populations has continued to increase from 13 million in 1990 to more than 35 million in 2001 (**Ngou Ngoupayou, 1990 ; INS-Cameroun, 2001**).

II-2-6- The mode, type of reproduction, and choice of breeder

The following figure shows that 92.7% of farmers indicate that almost all farms are in open breeding mode with the purchase of adult birds; 5.5% of the three farmers imply a closed mode and also present a breeding mode of 61.8% of known parents, 38.2% of unknown parents, so more than half of the farmers know at least one parent (fig).

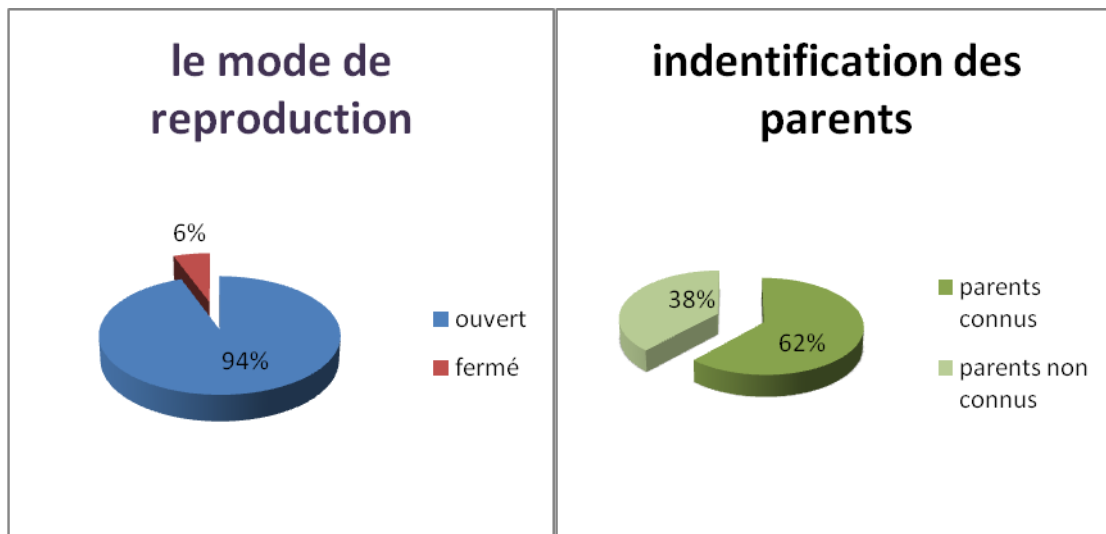


Figure : The mode of reproduction

The declaration of the breeders is totally indicative that the reproduction of the farms is done by a natural incubation. The choice of breeders is made without declared criteria. According to the surveys carried out, the breeding mode is generally open from a response of 92.7% of breeders with purchases of adult birds and 27.3% in closed breeding mode with at least one known parent, compared to **Mahammi F Z, (2015)**, almost all farms are run in open mode, with purchases of adult birds. Only two farms (3.84%) were in closed internal breeding mode with a known parent, No choice of breeder by the breeders, production is always in natural incubation.

The low productivity of the local hen could be explained by the condition in which it is high. In general, the performances found in this study are in the range of those reported for the local hen in northeast Algeria. **Moula et al (2009)** and those of neighbouring countries and African countries (**Bessadok et al, 2003; Benabdeljalil et Bordas, 2005 ; Fotsa, 2008 ; Akouango et al, 2010**). According to these authors, these poor performances could be improved by improving breeding conditions and by implementing management and genetic selection plans.

II-2-7- The breeding period

This table shows the breeding period of the hens according to the breeders, most of them show that the laying hen at 6 months old has a percentage of 50.9% and at 8 months old has a percentage of 61.8% whereas 1.8% of the breeders said 9 months and 3.6% said one year.

Table : The breeding period.

		The breeding period			
		6 months	8 months	9 months	Year
Number	of	28	34	1	2
breeders					
Number	of	50,9%	61,8%	1,8%	3,6%
breeders (%)					

The breeding period that have been declared by the breeders, the hen lays eggs with an average age of 8 months this age of the first week is equal to that observed in Sudan (**Yousif et El tayeb, 2011**) but it is higher than that observed in Ethiopia (5 months) and in Kabyle according to (**akouango et al, 2010**) et en kabyle selon (**A Ait kaki et N Moula, 2013**).

According to the breeders, the local hen in the surveyed regions incubates, 2 to 7 times a year, a number of 5 to 16 eggs per incubation with an average number of 65 eggs/year. (**Ait kaki A et Moula N, 2013**) observed that the hen lays an average of 173 eggs per year.

This average of our studies is lower than the production of some local breeds such as the Fayoumi (134-216 eggs/72 weeks of laying) (**Hossary et Galal, 1995**) and the average annual egg production is observed in Morocco (**Benabdeljelil et Arfaoui, 2001**) and higher than the annual egg production reported in the literature for local hens varies between 25 and 150 eggs/year (**Fotsa et al, 2010**) per year. Egg laying begins at an average age of 166 days, laying an average of 173 eggs per year. Often a free-range hen will lay the first eggs at the age of 22-28 weeks depending on (**village poultry farming**).

However, it is around half of the average observed in the local hen in Egypt (**Zaza, 1992**) and the local chicken in Tunisia (**Bessadok et al, 2003**). The annual egg production reported in the literature for local hens varies between 25 and 150 eggs/year (**Fotsa et al, 2010**) by year.

II-2-8- The farming method (habitat)

In the table above represents the breeding method of the 55 breeding rooms studied are built in 69.1% wood, 21.8% of the free range farms in the environment, 10.9% mesh, 29.1% reed, 34.5% freedom on the ground, 23.6% are built in different construction remains and 36.4% zinc.

Table: The habitat of the hens according to the building materials.

Construction materials	Number of farmers	Number of farmers (%)
Wood	38	69,1%
Environment	12	21,8%
Grill	6	10,9%
Reeds	16	29,1%
Soil	19	34,5%
Construction remains	13	23,6%
Zinc	20	36,4%

Concerning the habitat, from the herders who built the premises surveyed by local hens, 21.8% were free (environment), 34.5% were in semi-freedom, the shelters provided are built in total of local materials: wood, wire mesh, reeds, zinc, all construction remains (recovered material) placed directly on the ground and covered with tarpaulins and old clothes. The mother hens and their chicks are separated from the rest of the flock during breeding and a few weeks after hatching. For the latter, the shelter is generally made up of tires or boxes and plastic cans as well as cardboard boxes (fig).

According to **Djelil H, (2012)** in the Oran region are different, the chickens are delivered to themselves, in the wild. No suitable habitat is provided for them. During the day they hang out in the field and as soon as the sun sets they bury themselves in shelters, such as: crowded crates, vegetation, storage, inside the breeder's house, fence or most often on tree branches, The number of herders providing shelter for their hens is significantly higher than reported for some African countries, for example, in Botswana and Ethiopia, only 36% and 39%, respectively, of herders provide habitat for their hens (**Badubi et al, 2006, Halima, 2007**).

II-2-9- Type of food

The figure shows the different types of feed provided by farmers and eaten by hens in the 55 breeding premises, 76.4% use wheat, 90.9% distribute wheat bran, 96.4% distribute water, 14.5% use barley, 43.6% provide bread, 14.5% provide grass, 7.3% use seeds, 70.9% give kitchen remains, and 16.4% of insects eat by hens (fig).

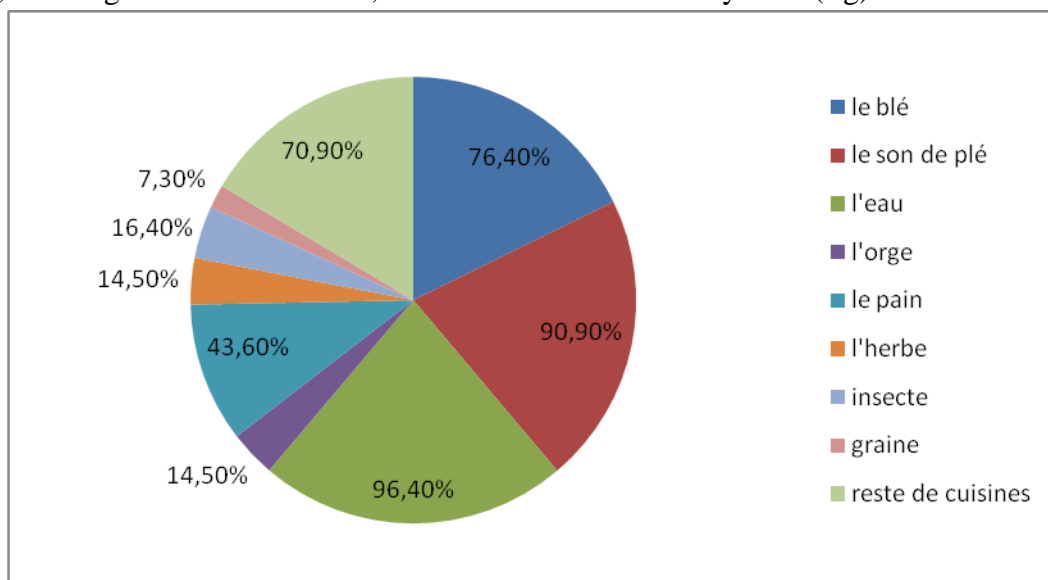


Figure: the feed of the hens provided by the breeders.

Chickens feed on what they find in their environment (grass, insects, seeds) and in addition to what the breeders provide them once or twice a day. Generally, farmers distribute kitchen scraps (cooked bread, rice, couscous, etc.) and also wheat, wheat bran, barley, water. Our results showed that there was no feeder or watering trough in the studied premises made of various materials: old abandoned kitchen utensils such as pots, plates, pots, metal buckets, paint and plastic cans (fig 40).

Poultry feed is generally limited to feed gleaned during divagation in and around the rugo (family enclosure); insects, greens, wild seeds and household waste. Sometimes chickens can receive some cereal grains and sorghum grains, especially when they are clausured during certain growing seasons. Chickens reared by households with large banana or cattle plantations generally find a sufficiently varied diet to cover their needs and this results in a significant improvement in productivity (**Food and agriculture organization of the united nations, 2009**).

Chickens left out in the wild feed on food debris - kitchen waste, crop residues, grain, insects and greens - in their immediate environment or from households (**Tadelle et Ogle, 2001 ; Kondombo et al, 2003b ; Halima et al, 2007a**). They are thus dependent on their ecological system because the availability of their food is linked to the seasons and/or the capacity of households to produce waste. (**Agbédé et al, 1995 ; Tadelle et Ogle, 2000 ; Sonaiya et Swan, 2004 ; Konaré, 2005**).

According to **Mwalusanya et collaborateurs, (2002)** in Tanzania and **Konaré (2005)** in Senegal, local chickens are fed 75-80 % of the time by cereal threshing and pickling products during divagation. In general, the feeding of traditional chickens by farmers is insufficient or even absent under certain conditions. Food supplements are provided on a regular basis during the harvest seasons and occasionally during the lean season, as households generally no longer have cereal reserves during wintering. This period, in the majority of cases, remains the most difficult for the feeding of local poultry (**Konaré, 2005**). In northwestern Ethiopia, almost all village poultry farmers supplement their chickens at least once a day. However, the type and quantity of food provided depends on the crop yield and the season or time of year. (**Halima et al, 2007a**).

In rural Gambia, 44% of the farmers surveyed almost do not feed their chickens, compared to 53% once a day and only 3% twice a day. **Bonfoh et al, (1997)**. Similar results have been observed in Burkina Faso **Pousga et al, (2005)** and in Cameroun (**Iyawa, 1988**). These foods, usually served on the ground, are either charred or in good condition cereal grains (corn, millet or sorghum) (**Sonaiya, 1997 ; Farrell, 2000**).

II-2-10- Bird destination

The figure above shows that in 70.9% of the regions surveyed, the destination of hens is 70.9% of farmers consume the hens for themselves, 29.1% of farmers use the hens for self-consumption and marketing at the same time (fig).

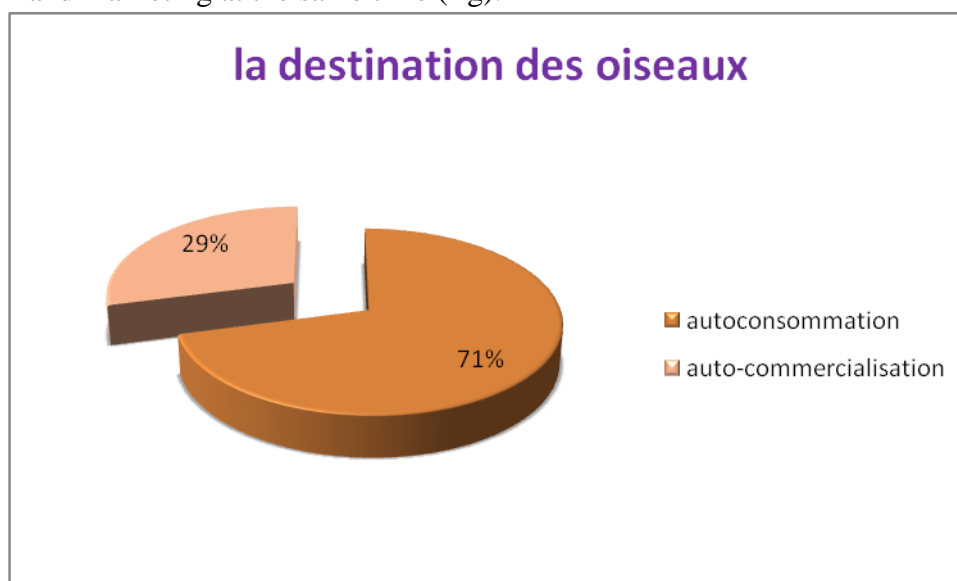


Figure : The destination of the birds surveyed.

In order to raise chickens traditionally in the regions surveyed, we noted that 70.9% of cases for own consumption alone, in 29.1% for own consumption and sale of eggs and live animals. On the other hand, those of (Mahammi F Z, 2015), of which 17.30% for own consumption, and 51.92% for own consumption and sale of eggs and live animals.

In some African countries, local chicken farming is strongly influenced by farmers' preferences related to socio-cultural and ritual considerations (Fotsa, 2008). A study in Ethiopia showed that 26.6% of the birds were raised for sale, while 25% were used for sacrifice or healing, 20.3% for trade, and 19.5% for home consumption (Dessie et Ogle, 2001).

II-2-11- Pathologies

The following figure shows the parasitic species observed by farmers that cause pathology in local hens, which are those related to fleas by 16.4% farmers, lice by 52.7% farmers and other external species by 30.9% farmers (fig).

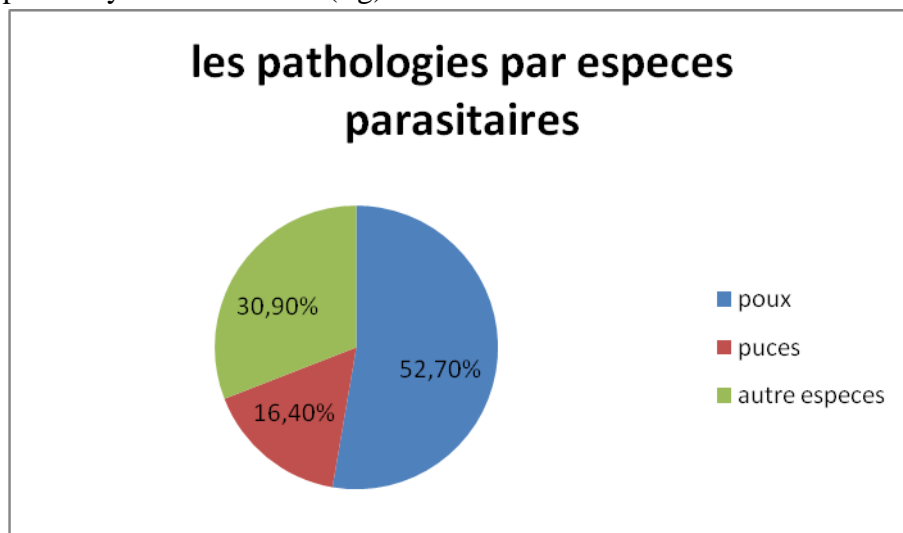


Figure : Parasitic species are present in the field.

During our sampling we identified a large number of mallophagus (lice) with a total of 52.7% per farmer and 16.4% of farmers observed fleas and 30.9% for breeders who are declared that there are other external species.

The results of the study conducted by Hamammi F Z, (2015) are the same as what was found, which she mentioned that the pathologies most observed by breeders are those related to fleas, lice and other external parasites.

Also to the results observed by Djelil H, (2012), identified eight species of mallophagous mites, seven species of mites and three types of haemoparasites in these chickens, (Yousif, 2012) has revealed a diversified parasitic fauna composed of cestodes, nematodes, trematodes and acanthocephalus.

II-2-12- The different risks

The risks we found in the field:

- Poor construction of livestock facilities.
- Food poverty.
- No identification.
- The absence of treatment.
- Thefts.
- dogs and cats.

Among the causes of poultry loss as reported by farmers, predation, usually caused by poor construction of breeding premises, poverty in the diversity of feed, no identification of subjects, lack of treatment if there are patients and let them die in the majority of the time, chicken theft in the majority of the time, domestic dogs and cats use local hens as an easy source of food, the results of the study conducted by **Mahammi F Z, (2015)** are contradictory to what we found, of which she mentioned only the risks of cats and dogs, thefts.

II-3-2- Weight and body measurements

The tables below present the analyses by Pearson correlation and the average standard deviation between the different body measurements and body weights of local hens in each of the three agro-ecological zones studied in the wilaya of Guelma.

II-3-2-1- correlation analyses by gender and region

Table: the correlation between the different body measurements by gender of the mountain area.

The Mountain Area								
Gender	Male				Female			
Measurements	Body weight	Barbel length	Tarsal length	Crest length	Body weight	Barbel length	Tarsal length	Crest length
Tarsus diameter	0,312757435*	0,723634989**	0,669277448**	0,58214667**	0,21952245*	0,383216043*	0,209186954*	0,264271222*
Crest height	0,531877202**	0,788671864**	0,57606121*	1	0,352303035*	0,687735528**	0,325112187*	1
Tarsal length	0,312757435*	0,575843139*	1		0,219474324*	0,358886696*	1	
Length of the barbillon	0,63620423**	1			0,312281463*	1		

*: $p < 0,05$; **: $p < 0,01$; ***: $p < 0,001$

The inner zone								
Gender	Male				Female			
Measurements	Body weight	Barbel length	Tarsal length	Crest length	Body weight	Barbel length	Tarsal length	Crest length
Tarsus diameter	- 0,256610467	0,549551708**	0,677755026**	0,24800252*	0,106007401*	0,173305539*	0,258120577*	0,413960643**
Crest height	- 0,480114019	0,707198148***	0,036179353**	1	0,08089507*	0,506935945**	0,310820407*	1
Tarsal length	- 0,08881815	0,499480882**	1		0,057907393*	0,171793773*	1	
Length of the barbillon	- 0,329480065	1			0,066453164*	1		

*: $p < 0,05$ ** : $p < 0,01$ *** : $p < 0,001$

Tableau : la corrélation entre les différentes mensurations corporelles par sexe de la zone intérieure.

The lower zone								
Gender	Male				Female			
Measurements	Body weight	Barbel length	Tarsal length	Crest length	Body weight	Barbel length	Tarsal length	Crest length
Tarsus diameter	0,714252167***	0,220374197*	0,680831513**	0,205166162*	0,205455911*	0,219486568*	0,240794367*	0,22372315*
Crest height	0,398845712*	0,940572317**	0,212162584*	1	0,198859119*	0,776990486**	0,060768139*	1
Tarsal length	0,500677519**	0,207981249*	1		0,285946155*	0,187919239*	1	
Length of the barbillon	0,460538256**	1			0,159857107*	1		

*: $p < 0,05$ ** : $p < 0,01$ *** : $p < 0,001$

Tableau : la corrélation entre les différentes mensurations corporelles par sexe de la zone basse.

The table above shows the correlation between the different body measurements in the mountain area according to gender.

In males, the length of the barbel is highly significant ($p < 0.001$) and strongly correlated (0.78) with the height of the crest, the body weight is significantly correlated ($p < 0.01$) with the length of the barbel (0.63) and the peak height (0.53), significantly ($p < 0.05$) correlated with the diameter and length of the tarses, the latter correlates significantly ($p < 0.01$) with the diameter of the tarses.

In females, the length of the barbel is significant ($p < 0.01$), (0.68) correlated with the height of the crest, the body weight is significantly ($p < 0.05$) correlated with the length of the barbel (0.31), the height of the crest (0.35), the diameter and length of the tarses (0.21), the length of the corral tarses (0.20) significantly ($p < 0.05$) with the diameter of the tarses.

Therefore, the correlation is positive between weight and other body measurements in both sexes, implying that the choice for one of these body parameters would lead to an indirect increase in body weight in this area.

Table (29) above shows the correlation between the different body measurements in the inner zone according to sex.

In males, the length of the barbel is strong (0.70), highly significantly ($p < 0.001$) correlated with the height of the crest, the body weight is negative correlated with the length of the barbel (-0.32), the height of the crest (-0.48) and the diameter of the tarsus (-0.25), the diameter of the corral tarsus (0.67) significantly ($p < 0.01$) with the length of the tarsus.

The correlation in this case is negative, which explains why there is an indirect decrease in weight from a selection for one of these parameters.

In females, the length of the barbel is significant ($p < 0.01$) correlated with the height of the crest, the weight is significantly ($p < 0.05$) correlated with the length of the barbel, the crest height, the diameter and the length of the tarses, this correlated parameter (0.25) significantly ($p < 0.05$) with the diameter of the tarses.

The correlation of females in this area is positive between weight and other different body measurements, while there is an indirect increase in body weight.

Table (30) above shows the correlation between the different body measurements in the lower zone according to sex.

In males, body weight is significant ($p < 0.005$) correlated with barbel length (0.46), crest height (0.39), tarsal length (0.50), and highly significant ($p < 0.001$) correlated with the diameter of the tarsus (0.71), also for the length of the barbel (0.94) and strongly correlated with the height of the crest, the length of the tarsus correlated (0.68) significantly ($p < 0.01$) with their diameter.

For females, the length of the barbel is highly significant ($p < 0.001$) correlated with the height of the crest and strongly (0.70), the body weight is significant ($P < 0.05$) correlated with the crest (0.19), the length of the barbel (0.15), the diameter and length of the tarsus (0.21) vs (0.18) respectively, the latter parameter is significant ($p < 0.05$) correlated with the diameter of the tarsus (0.24).

The correlation is positive between weight and other body measurements in both sexes suggests that selection for one of these body parameters would result in an indirect increase in body weight at this area.

Our correlation results in both areas (mountain and low) are similar to what was reported from **Mahammi F Z, (2015)** in western Algeria for the study of three populations, **Moula et al, (2009)** in Kabyle, **yapi-Gnoare et al, (2010)**, **Francesch et al, (2007)**, **Bembide et al, (2013)** et **Keambou et al, (2007)**, but differently from the population studied in the inner zone for males.

Apuno et collaborateurs, (2011) ensure the positive correlation between weight and other different body measurements, which explains the indirect improvement in weight over time of the increase in one of these parameters (crest height, barb length, length and diameter of the tarsus).

II-3-2-1- Mean standard deviation analyses by gender and region

Gender	The Mountain Area			The Inner Zone			The Low Zone		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Measuring									
Body weight	±783,391003 5	±565,722656 3	±681,9082457	±790	±473,4375	±634,240362 8	±684,2975207	±506,111411 6	±623,525377 2
Tarsus length	±10,5259515 6	±8,03215	±8,53558909	±11,76	±5,90625	±7,24036281	±6,74418605	±6,18181818	±6,77366255
Tarsus diameter	±6,375	±4,34570313	±5,203125	±6,8	±5,916015 63	±6,44217687	±6,70748299	±4,94375338	±5,89536204
Length of the barbillon	±15,4532872	±8,21044922	±10,07407407 4	±12,24	±7,03125	±8,34693878	±8,09221201	±6,2892562	±7,85082305
Crest height	±13,7024221 5	±9,05566406	±10,06462429 5	±12,96	±7,224609 38	±10,7278911 6	±7,791917793 4	±5,63636364	±7,61694102

* : $p < 0,05$ ** : $p < 0,01$ *** : $p < 0,001$

Table: Standard deviation analysis results for body measurements by sex and region for local hens in Guelma.

The table () above presents the analysis of the mean and standard deviation of each quantitative variable measured for the population of each study area.

II-3-2-1-1- Body weight

Birds from different populations have practically the same weight with highly significant values ($p < 0.001$) in all areas (LM : ±681g ; LI : ±634g ; LB : ±623g).

The cocks of the three populations are practically the same ($p < 0.001$) (LM : ±783g ; LI : ± 790g ; LB : ±684g), and so are the hens ($p < 0.001$) (LM : ±565g ; LI : ±473g ; LB : ±506g). Thus, males in the three populations are significantly heavier than females ($p < 0.001$).

Our results are significantly higher than those of **Mahammi F Z, (2015)** in the study of three populations and also to those of **Messabhia M, (2016)** for four populations, found in order a weight ($p < 0.01$) of the roosters (LM : ± 283g ; HP : ± 280g ; PI : ± 347g) vs (PN : ± 195.4g ; CN : ± 379.4g ; TH : 449 ,9g; TE : ± 156,0g) and females (LM : ± 255g ; HP : ±172g ; PI : ± 244g) vs (PN : ± 172g ; CN : ± 214,9g ; TH : ± 145,3g ; TE : ±166,4g).

II-3-2-1-2- Diameter of the tarses

Birds from different populations have the same diameter of tarsus significantly ($p < 0.05$) in the totality (LM : ± 5.20 mm ; LI : ±6.44mm ; LB : 5.89mm). Their males also ($p < 0.05$) (LM : ±6.37mm ; LI : ±6.8mm ; LB : ±6.70mm), as well as their females ($p < 0.05$) (LB : ± 4.34mm ; LI : ±5.91mm ; LB : ±4.94mm).

Males in all three populations have significantly larger tarsal diameters than females ($p < 0.05$).

This same result is described in the **Monnet et al, (1980)** ; **Keambou et al, (2007)** ; **Moula et al, (2009)** ; **Francesch et al, (2011)** et **Egena et al, (2014)**.

The diameter of our subjects is significantly smaller than that of subjects characterized by **Messabhia M, (2016)**. So the males have significantly larger tarsal diameters than the females, this thing has been confirmed by **fosta et al, (2010)** ; **Yapi-Gnaore et al, (2010)** ; **Alabi et al, (2012)** ; **Ige et al, (2012)**, inversely by **Rouvier et Ricard, (1965)** which find the same tarsal diameters in both genders.

II-3-2-1-3- The length of the tarsus

All three populations have significantly all tarsus of the same length: (LM: $\pm 8.53\text{mm}$; LI: $\pm 7.24\text{mm}$; LB : $\pm 6.77\text{mm}$).

Roosters have significantly longer tarsus lengths ($p < 0.01\text{mm}$) than hens ($p < 0.05$) in all three populations, (LM : $\pm 10.52\text{mm}$; LI : $\pm 11.76\text{mm}$; LB : $\pm 6.74\text{mm}$) versus (LM : $\pm 8.03\text{mm}$; LI : $\pm 5.90\text{mm}$; LB : $\pm 6.18\text{mm}$). Therefore, females of LM, LI, LB have significantly shorter tarsi ($p < 0.05$) than males ($p < 0.01$).

Virtually females have the same length of tarsus between themselves and even males between them, similar to what has been reported **Yapi-Gnaore et al, (2010)** ; **Bembide et al, (2013)** et **Sri-Rachma et al, (2013)**, but differently to the descriptions made by **Luc et al, (2012)**, found a difference between the different subjects.

Our results are the same as those of **Mahammi F Z, (2015)** et **Keambou et al, (2007)** which find in their studies males with significantly longer tarsi than females.

II-3-2-1-4- The length of the barbillon

Birds from different populations have the same barb length significantly ($p < 0.01$) (LM : $\pm 10.07\text{mm}$; LI : $\pm 8.34\text{mm}$; LB : $\pm 7.85\text{mm}$) in the total of each population.

The barbels of the males are highly significant ($p < 0.001$) of almost identical length (LM : $\pm 15.45\text{mm}$; LI : $\pm 12.24\text{mm}$; LB : $\pm 8.09\text{mm}$), the same finding can be observed for females (LM : $\pm 8.21\text{mm}$; LI : $\pm 7.03\text{mm}$; LB : 6.28mm).

Males in all populations have significantly ($p < 0.001$) long barbels compared to females.

Keambou et al, (2007) ; **Moula et al, (2009)** et **(2011)** ; **Aklilou et al, (2013)** ; **El-Safty, (2012)** find the same results as us on the other hand, the cocks as well as the hens of the different populations have the same length of barbels found by **(Luc et al, 2012)**.

II-3-2-1-5- The height of the ridge

The same peak height found in the different populations that is highly significant in total (LM: $\pm 10.06\text{mm}$; LI: $\pm 10.72\text{mm}$; LB: $\pm 7.61\text{mm}$).

Males in populations have a significantly high peak ($P < 0.001$) (LM : $\pm 13.7\text{mm}$; LI : ± 12.96 ; LB : $\pm 7.79\text{mm}$) to that of females which is significant ($P < 0.01$) (LM : $\pm 9.05\text{mm}$; LI : $\pm 7.22\text{mm}$; LB : $\pm 5.63\text{mm}$).

Females in LM, LI, LB populations have significantly short peaks ($p < 0.01$) compared to males ($P < 0.001$).

Yakubu et al, (2009) described the same ridge heights as our subjects, **Moula et al, (2009)** ; **Messabhia M, (2016)** have a higher peak height than our results.

Finally, it is concluded that males are heavier than females, similarly, other measurements confirm sexual dimorphism with significantly higher values in roosters than in hens, which explains the faster growth in males compared to females.

Conclusion and recommendations

After carrying out this study on the local chicken breeding system in the wilaya of Guelma. With the approach of morpho-biometric characterization on three populations in three different Agro-ecological zones among several regions investigated, we have drawn the following conclusions:

- The majority of herders are primary school or illiterate.
- Raising local chickens is a rather feminine activity.
- The type of operation of the 55 premises studied is generally multi-discriminatory, with the resulting product intended for self-consumption and sale.
- The performance of the local Algerian hen is low compared to that of the industrial populations, due to the constraints of the breeding method, which is characterized by open reproduction with unknown parents, and also to introduce new subjects with purchases.
- The use of very few inputs (food and drugs).
- A significant attributable morphological diversity has been observed such as the colour of the plumage (wheat, pebbles, mille-fleurs...) and their distribution (bare neck, crested...) with the absence of others (curly, dwarfism...) identified in other developing countries (mainly African).
- The body measurements considered (body weight, length of tarsus and barbels and length of crest) confirm the great sexual difference known for this species with higher values in cock than in hen.

It is therefore recommended for countries like ours to:

- An improvement of:
 - The presence of this hen in the Algerian poultry industry.
 - Conditions of breeding of these animals.
 - This type of farming can ensure quality and quantity production (eggs/meat).
- The study of the phenotypic diversity of other populations on a larger scale in Algeria should be carried out to complete the information on the overall diversity of this hen at the national level and study the climatic and genetic effect on the frequency of certain phenotypes.

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