RESEARCH PAPER

Diversity of poultry farming units in urban and peri-urban areas of North Benin

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Abstract

The characterization of livestock farming systems is a tool for defining development actions. In order to characterize the poultry farms in Parakou town in northen Benin, 123 farms with a total of 58,665 heads of poultry were surveyed. Using the methods of factorial analysis of multiple correspondences (FAMC) and ascending hierarchical classification (AHC), a typology of poultry farmers of the town has been settled down. Thus, three types of poultry farmers have been identified. The first type corresponded to traditional poultry farmers, located both in urban and peri-urban areas. They raise only local chickens, with small number (33 ± 13 heads). Poultry farming is a secondary activity for all members of this group. The second type gathered young unemployed graduates. They are mostly located in the urban area of the town and raise chickens of exotic and local breeds. Poultry farming is the only source of income for these young people. The average number of animals in this group was 165 ± 14 heads. The third type was agricultural contractors, for whom poultry farming is a profession. They raise layers and broilers and are all located on the outskirts of the town. The average size of their animals was 937 ± 12 heads. The characterization of the three types of farming will allow proposing integrated development actions.

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Introduction

In Benin, poultry is the second largest source of meat (21%) after cattle (MAEP, 2011). Among the high avian species, chicken ranks first, followed by guinea fowl, duck, turkey and pigeons (FAO, 2015).

The Strategic Plan for Agricultural Sector Recovery (PSRSA) stresses that, though exposed to both exogenous and endogenous shocks, poultry farming is one of the major components in promoting food security (FAO, 2015). Local production activities account for more than 84% of employment generated by the poultry sector (Azamohou, 2014). This sector created 2,800 and 14,000 jobs in 2007 and 2009 respectively (FAO, 2015). Animal production contributed on average 5.9% over the period 1995-2005 to GDP formation (NEPAD, 2005). Despite the importance of this sector, poultry farmers still face many constraints (Siéwé *et al.*, 2017).

(Rekik *et al.*, 2000)Argue that taking into account the multitude of constraints that pastoralists face and their impact on production systems is fundamental to the comprehensive and detailed understanding of livestock operations. Thus, the multidimensional approach in the diagnosis of livestock farms has become necessary to the understanding of their dynamics (Roeleved and Van Den, 1999). For example, (Assani and Alkoiret, 2014) used multi-varied statistical analyzes to establish a typology of Goudali cattle farms according to the practices of the breeders in northern Benin. Similarly, in Senegal, to develop a typology of dairy farms based on a survey conducted at Linguère, (Dassou *et al.*, 2017) also used multidimensional methods for data analysis. The interest of such analyzes is to recognize the structure of the correlations between the variables; to distinguish those associated with those opposed; to identify groups of individuals that are homogeneous with respect to certain variables; and to finally reveal the differences between groups of individuals.

This work also intends to present a typology of poultry farms in the district of Parakou, in Benin in a context where there is no reliable information on poultry production in this area. This step would be a preliminary step in the description and analysis of these holdings, thus reinforcing the constitution of precise regional references, an essential prerequisite for any future development program.

Material and methods

Study area

The present study was carried out in Parakou town located in the Borgou Department. Regional capital of Northern Benin, the town of Parakou is located in the center of the Republic of Benin between 19° 2' north latitude and 2° 36' east longitude. It covers an area of 441 square kilometers of which about 30 square kilometers are urbanized and is limited to the north by the municipality of N'Dali, south, east and west by the municipality of Tchaourou at the same time. The town hasasudano-guinean climate marked by a rainy season that extends from April to October, and a dry season from mid-October to mid-April. The water level recorded annually varies between 1,000 mm and 1,500 mm for 75 to 140 effective days of rain. The lowest temperatures are recorded during the months of December-January.

Sampling and data collection

The study was conducted from September to December 2017 through surveys following a semi-directive interview using an interview guide with open or closed questions addressed to poultry farmers (local and exotic chickens). Since there is no exhaustive list of poultry farmers in Parakou town, the first actions have been to target the few poultry farmers of which we are aware.

A total of 123 poultry farmers participated in the survey. The «snowball» method was used mainly for this study. It relied on the social network of a first contact which guided the team to its next contact (Goodman, 1961).

The information collected was about the farmer (location, socio-cultural group, age, sex, level of schooling and literacy, occupation, training in poultry farming, family size, labor used, age of exploitation),

animals (numbers, breed) and farming practices (feeding, rearing methods, health monitoring).

Statistical analysis

The survey data were entered in the Excel 2010 software, before being imported into the R software (Core Team, 2017) for statistical analysis.

A Factorial Analysis of Multiple Correspondences (FAMC) allowed to obtain a representation of the farms in the form of projections on plans defined by the first factorial axis. An Ascending Hierarchical Classification (AHC), classification method (from the coordinates of the farms on the main factorial axis), allowed to group the farms according to their proximity to each other. The overall of individuals being represented in the form of a tree (dendrogram), we can therefore constitute the different groups of the typology corresponding to the main "branches" of the tree.

Descriptive statistics (frequencies, means, standard deviation, etc.) on the main quantitative variables characteristic of the poultry farms identified have been presented. A Chi-square test was used to compare the frequencies of the qualitative variables between the groups. One-way analysis of variance allowed to compare the groups to one another according to the quantitative variables. The Generalized Linear Models (GLM) procedure was used for the analysis of variance. Comparisons between averages were made in pairs by the test of Student.

Results

General characteristics of poultry farmers

The geographical distribution of poultry farmers in Parakou town was not identical. Thus, in the peri-urban area, more than 60% of the poultry farms surveyed are concentrated, against less than 40% in the urban area (Table 1).

Table 1. Variables describing the poultry farmers surveyed.

Variables	Modality	Frequency (%)
Location of the breeders	Urban area	36.48
	Peri-urban area	63.52
Ethnicity of the breeder	Dendi	20.53
	Bariba	26.36
	Nagot	24.27
	Fon	28.83
Sex of the breeder	Male	75.18
	Female	24.82
Age of the farmer	≤ 30 years	25.53
	30 − 50 years	26.24
	≥ 50 years	48.27
Age of breeding	≤ 10 years	71.63
	≥ 11 years	28.37
Household size of the farmer	≤ 10 years	92.20
	≥ 11 years	7.80
Level of education	Literate	12.77
	Illiterate	24.82
	Schooled	62.41
Training in poultry farming	Trained	74.47
	Untrained	25.53
Place of poultry farming in the professional activity of the owner	Main	64.32
	Secondary	35.68

The surveyed breeders are mostly Fon followed by Bariba and Nagot. The heads of the farms are relatively young and their average age is 40 years with a minimum of 20 years and a maximum of 65 years. They are mainly formed of men (75.18%).

The average family size was 6 people with a minimum of 1 person and a maximum of 16 people. The enrollment and literacy rates of the surveyed breeders were 75.18% against 24.82% of non-literate breeders (Table 1).

The majority of these farmers received training in poultry farming (74.47%). Among the poultry farmers surveyed, 64.32% practiced poultry farming as their main occupation (Table 1).

Elaboration of the typology of the farms
Three axes were chosen for the interpretation of the results of the factorial analysis of multiple correspondences. The cumulative contribution to the total inertia of these three factorial axis retained was 65.68% (Table 2).

Table 2. Cumulative contribution to the total inertia of the factorial axes.

Factorial axis	% of inertia	Cumulative %
1	39.42	39.42
2	14.17	53.59
3	12.09	65.68

The first axis is between breeders who have poultry farming for their main activity and who are rearing animals in cloistering, and breeders with poultry farming for secondary activity, practicing rambling rearing.

The second axis, on the other hand, opposes poultry farmers from urban areas to those of peri-urban areas. Finally, the illiterate breeders who have received no training are very well represented by the third axis.

Table 3. Frequency (%) of the terms describing the poultry farmers groups identified.

Variables	Modality	Group 1	Group 2	Group 3	Significance
Location of the breeder	Urban area	14.58	94.88	0.00	
	Peri-urban area	85.42	5.12	100	**
Sex of the farmer	Male	35.42	79.49	89.48	
	Female	64.58	20.51	10.51	*
	Dendi	41.67	5.12	14.81	
Ethnicity of the breeder	Bariba	20.83	23.07	35.18	
	Nagot	27.08	17.95	27.79	***
	Fon	10.42	53.84	22.22	
	literate	31.02	0.00	5.5	
Level of education	Illiterate	41.84	13.10	21.32	***
	schooled	27.14	86.9	73.18	
Training in poultry farming	Trained	10.25	87.18	100	
	Untrained	89.75	12.82	0.00	***
	Family	100	100	24.07	
	Family and salaried	0.00	0.00	44.44	
Workforce	salaried	0.00	0.00	31.48	***
Place of poultry farming in the professional activity of the owner	Main	0.00	100	100	
	Secondary	100	0.00	0.00	***
	Modern	0.00	0.00	89.74	
Type of building	Semi-modern	0.00	96.24	10.25	***
	Traditional	100	3.76	0.00	
	Table eggs	0.00	68.33	53.7	
	Broilers	0.00	0.00	27.78	
Type of production	Eggs and broilers	0.00	14.52	18.51	***
	Local chickens	100	17.15	0	
Breeding Mode	Confinement	0.00	89.12	100	
	Divagation	100	11.88	0.00	***
	Purchase	17.88	64.10	75.93	
Source of foodsupply	Made	0.00	35.90	24.07	***
	Nothing	82.12	0.00	0.00	
Type of feed distributed to animals	Provender	0.00	100	100	
	Seed and rest of cooking	100	0.00	0.00	***
	Veterinary treatment	0.00	97.12	100	***
Animal health monitoring	Endogenous treatment	78.13	2.88	0.00	
	Nothing	21.87	0.00	0.00	

*: p<0.05; **: p<0.01; ***p<0.001.

Definition of groups

In order to define more precisely the types of poultry farms from the Multiple Correspondence Analysis (MCA) review, an Ascending Hierarchical Classification (AHC), was carried out with all the data. It made it possible to differentiate 3 groups of poultry farms in the town of Parakou (Fig. 1 and 2).

The analysis of the distribution of the groups on the graphs of the CAH and MCA allow to identify the characteristics of each group. The frequencies of the different modalities of the variables related to the 3 groups of our typology are given in Table 3 and 4. The characteristics of the groups are as follows:

Group 1: Traditional poultry farmers

This group is made up of 39.02% of the surveyed breeders, most of whom live in peri-urban areas (85.42%). These breeders are mostly women (64.58%) and the socio-cultural group Dendi (41.67%). They are illiterate (41.84%) and they are the oldest of the surveyed breeders, with an average age of 54 years (Table 4).

The average size of their households is high (8 ± 2 persons). They use only the family workforce. They are all local chicken farmers. Poultry farming is a secondary activity for all individuals in this group.

Table 4. Quantitative variables describing poultry farmers surveyed by typology groups.

Variables	Group 1	Group 2	Group 3	
	Average ± SE	Average ± SE	Average ± SE	Significance
AGE	54 ± 1^a	28 ± 1^b	35 ± 1^c	***
AGEx	12 ± 3^a	5 ± 1^b	8 ± 2^c	***
SPFh	8 ± 2^a	3 ± 2^b	5 ± 2^a	***
NOC	33 ± 13^a	165 ± 14^b	937 ± 12^c	***

AGE: Age of the poultry farmer; AGEx: Age of exploitation, SPFh: Size of the poultry farmer's household, NOC: Number of chickens. The values of the same line, indexed with different superscripts are significantly different (p<0.05). SE: Standard error; ***: p <0.001.

The majority of them did not receive any training in poultry farming (89.75%). Their exploitation is the oldest with an average age of 12 ± 3 years (Table 4).

The number of the animals in this group is small (33 ± 13 heads). The farming method used is wandering, the animals are fed at times using leftovers and seeds (cereals) purchased (17.88%) or from the fields for the individuals of the group who are farmers.

The livestock buildings are of the traditional type. The majority of breeders in this group (78.13%) do endogenous treatments to animals and the remaining no treatment. Breeders of this group can be described as "traditional poultry farmer".

The major constraint encountered by the "traditional poultry farmers" is the high mortality rate of their subjects, especially during the harmattan period.

Group 2: "Semi-modern poultry farmers"

Farmers in this group represent 31.70% of the breeders surveyed with a high proportion of men than women (Table 3). They are largely located in the urban area (94.88%) of the municipality and are mainly of the socio-cultural Fon group. They are people under 30 years for whom poultry farming was the only professional activity. Their farms are fairly recent (5 years old). Most of them are young unemployed graduates and almost all have received training in poultry farming (87.18%). Breeders in this group raise exotic chickens and local chickens.

The number of animals in this group is relatively small (165 ± 14 heads). The farming method practiced is the cloister, the animals are fed with feed, purchased (64.10%) or manufactured (35.90%) by the poultry farmer himself. The livestock buildings are of a semi-modern type.

Almost all farmers in this group treat animals with veterinary products. Breeders in this group can be described as "semi-modern poultry farmers". The major constraints faced by the individuals in this group are: the non control of the breeding of layers, the lack of credit from micro-finance institutions to expand their exploitation.

Group 3: Modern poultry farmers
The farms of this group are located in the peri-urban area. They represent 29.28% of the breeders surveyed, and are mainly Bariba and Nagot (Table 3). It is a group of relatively young breeders (35 years old), all of whom have been educated. They are mostly "agricultural contractors". The average size of their household was 5 ± 2 persons. The breeders in this group use both family and wage labor for the upkeep of animals and breeding premises, which are of a modern type. Poultry farming is a main activity for almost all individuals in this group. They have all been trained in poultry farming. In this group, 18.51% are mixed (laying hens and broilers) and the rest are laying hens (53.70%) or broilers (27.78%).

Their exploitation is old, with an average age of 8 ± 2 years (Table 4).

The average number of poultry flocks is 937 ± 12 heads (Table 4). The cloistering mode has been adopted by all breeders in this group and the animals are fed only with the feeds produced or purchased. All breeders in this group treat animals with veterinary products following a prophylaxis plan. Breeders in this group can be described as: "Modern poultry Farmers". Like the previous groups, "modern poultry farmers" also face certain constraints, mainly the competition in the market especially related to the high rate of imports of meat products.

Discussion
General characteristics of poultry farmers
In Parakou, the poultry farming is practiced in both urban and peri-urban areas, but with dominance in peri-urban areas. This result is congruent with those of (Kouakou *et al.*, 2012; Faihun *et al.*, 2017). It is mostly practiced by male individuals.
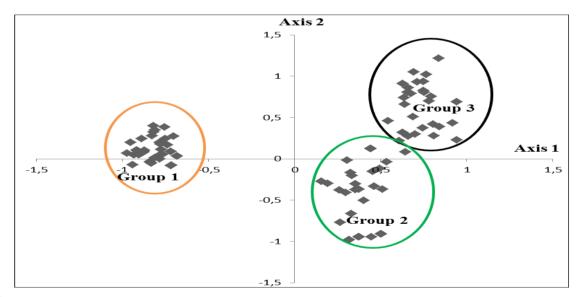

Fig. 1. Projection of poultry farms surveyed on factorial axis 1 and 2.

This result is opposite to those reported by Guèye, (2002) and Ndayisenga, (2010) in rural areas in the Saint-Louis region but are congruent with those encountered in Chad (Issa, 2012) and in urban and peri-urban areas of Thiès (Moumbangou, 2005). In African societies, men are responsible for livestock management, women with very few property rights

usually accompany men in different activities (Baroin and Boutrais, 2009).

The average age of poultry farmers recorded in this study is close to those obtained by Fall *et al.* (2016) in Thiès, Senegal and Issa *et al.* (2012) in N'Djamena, Tchad.

The majority of the poultry farmers surveyed are educated. This high rate of education could be explained by the fact that the majority of the poultry farmers surveyed raise layers and broilers, and this breeding requires a minimum of education. The activities practiced by the respondents are of different types. Poultry farming was the main dominant activity for the majority. Trade, agriculture, civil service, handicraft are also activities carried out by the poultry farmers of Parakou. These results are similar to those obtained by Youssao *et al.* (2013) in the study on the diversity of Borgou cattle breeding systems in the Sudanian zone of Benin. The diversity of the activities of the poultry farmers surveyed testifies that poultry farming is not the only means of livelihood for the breeders. Indeed, livestock is one of the many integrated and complementary activities of the farming system that contributes to its overall well-being (FAO, 2004; Youssao *et al.*, 2013). In this context, poultry farming in Benin allows the diversification of the incomes of the populations.
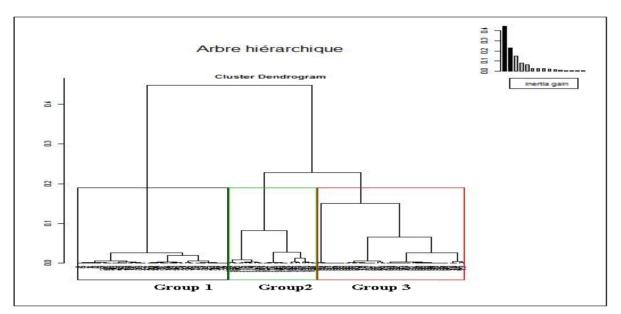

Fig. 2. Dendrogram showing the distribution of groups of poultry farmers.

Typology of poultry farms

The results allowed to identify three (03) types of poultry farmers in Parakou commune: "Traditional poultry farmers", "Semi-modern poultry farmers" and "Modern poultry farmers". These poultry farmers are distinguished by the location of their farm, the place occupied by poultry farming in their professional activity and their type of production. This typology obtained is similar to that identified in Senegal's poultry sector at the Louga-Dakar axis (Sikangueng Mbouba, 2011) and in the Cape Verde region (Arbelot *et al.*, 1997). Indeed, the lack of space in the urban area obliges the "modern poultry farmers" with large numbers of poultry to settle on the edges of the town, unlike the poultry farmers of group 2 (semi-modern poultry farmers) with small numbers of animals installed in an urban environment.

This same observation has been made by several authors (Fotsa *et al.*, 2007; Yapi-Gnaoré *et al.*, 2009; Dassou *et al.*, 2017).

The "traditional poultry farmers" are pluriactives, made up of farmers, tradesmen, workers, craftsmen and consider poultry farming as a secondary activity. They raise only local chickens with low numbers. These results corroborate those of several authors (Ravelson, 1990, Ly *et al*, 1999; Missohou *et al.*, 2002; Tadelle *et al.*, 2003; Halima *et al.*, 2007; Fall *et al.*, 2016). Poultry farming is the main activity for poultry farmers Group 3 (modern poultry farmers). Most of them are people who have taken out loans from micro-finance institutions and have received training in agronomy or Songhai Centers in the country.

They are all located on the edge of the town. As for group 2 poultry farmers (semi-modern poultry farmers), they are not strictly speaking individuals with poultry farming as a professional activity. Graduates and unemployed, they decided to undertake, and having no other source of income for the moment besides the poultry farming they do, they consider this activity as the main one.

Typologies have the ambition to constitute a type game that simplifies reality while respecting the main characteristics (Perrot and Landais, 1993; Djenontin *et al.*, 2004; Alkoiret *et al.*, 2009). Typologies of farms allow to compare groups of farms among themselves, to judge their functioning, to identify possible solutions to problems encountered and to develop adapted recommendations (Perrot and Landais 1993; Djenontin *et al.*, 2004; Alkoiret *et al.*, 2009; Youssao *et al.*, 2013).

The purpose of the typologies is therefore to provide decision-makers with an image of local agricultural activity to guide development actions (Roybin, 1987). For example, based on the constraints encountered in each group, actions can be oriented in this direction, in order to remove these constraints and allow individuals in each group to cheerful.

Conclusion
From the analysis of the survey data on the typology of poultry farms in the town of Parakou in Benin, three (03) types of poultry farmers were identified: the "traditional poultry farmers", the "semi-modern poultry farmers" and the "modern poultry farmers".

These three types of poultry farms differ in their geographical location, the place poultry occupied as the main or secondary activity of the farmer, the mode of rearing and the level of education of the farmer. This study should be supplemented by works on aspects that take into account the zootechnical and financial performance of poultry farming. These works will allow to quantify the potentialities of different systems and the animals that one finds there.

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