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Research Article
Characterization of Quail (*Coturnix japonica*) Production in Benin Republic

[1,3]K.J. Ekpo, [1,5]O.E. Oke, [2]G.E. Osseyi, [3]J. Dossou and [4]C.A.A.M. Chrysostome

[1]Regional Center of Excellence in Poultry Sciences (CERSA), University of Lomé (UL), BP: 1515 Lomé, Togo
[2]College of Biological and Food Techniques (ESTBA), University of Lomé, BP: 1515 Lomé, Togo
[3]Laboratory of Bioengineering of Food Processes (LABIOPA), Faculty of Agronomic Sciences (FSA), University of Abomey-Calavi, BP: 526 Cotonou, Benin
[4]UAC-FSA, Laboratoire de Recherches Avicoles et de Zoo-Economie, Abomey-Calavi, Benin
[5]Department of Animal Physiology, Federal University of Agriculture, Abeokuta, Nigeria

Abstract
Background and Objective: Despite the health benefits associated with the consumption of meat and eggs of quails, the management of the birds is still in rudimentary state in Benin. The aim of this study was to characterize quail production in Benin. **Materials and Methods:** A survey was conducted on thirty quail farmers through an interview supported by a structured questionnaire using the snowball method. The multiple correspondence factor analysis (MCFA) and ascending hierarchical classification (AHC) methods were used for statistical analysis. **Results:** The results showed that quails were raised for profitability, prestige and medicinal uses of their eggs. Quail farmers were predominantly male (93.3%) and the birds were reared in urban and peri-urban areas. Three types of quail production were identified as types I, II and III, with average flock sizes of 1288.3±955.02, 947.4±537.55 and 13171±6931.6, respectively. The majority of type I and III farmers were educated (100 and 80%, respectively) and trained in quail production (88.89 and 80.00%, respectively) unlike type II (educated: 11.76% and trained: 17.65%). **Conclusion:** There are on-going efforts to improve the productivity of quails in Benin Republic. Formal training is needed and more women should be encouraged to participate.

Key words: Quail farmeres, production system, flock size, farmers' characterization, quail meat, quail egg

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Corresponding Author: K.J. Ekpo, Regional Center of Excellence in Poultry Sciences (CERSA), University of Lomé (UL), BP: 1515 Lomé, Togo
Laboratory of Bioengineering of Food Processes (LABIOPA), Faculty of Agronomic Sciences (FSA), University of Abomey-Calavi, BP: 526 Cotonou, Benin
Tel: +228 99261800/+229 95 972480

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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

Production of poultry meat and eggs has continued to develop in some regions of the world[1]. In Benin, poultry production is a major source of meat[2]. There are mainly 2 types of poultry production in the country viz.: traditional and commercial poultry production. Traditional poultry is essentially practiced mainly in rural areas while the commercial poultry production is practiced in the southern region of the country, especially around big cities such as Cotonou and Porto-Novo and provides 78% of domestic egg production[3]. According to FAO[1], modern poultry production comprised about 1,200,000 birds of all species (Chicken, turkeys, ducks, guinea fowl and pigeons). The Atlantic and Littoral regions of Benin produce 54% of the national flock, followed by the region of Ouémé and Plateau (32%), Collines, Zou, Couffo and Mono with 11 and 5% in Atacora, Donga, Borgou and Alibori. Chicken is the highest poultry, followed by guinea fowl, duck, turkey and pigeons. However, quail production is disregarded due to the non-development of the sub-sector in Benin.

For a population of 10,260,155 people, poultry products provide only 22% of the total protein consumption estimated at 12 kg person^{-1} year^{-1}, compared to the 20 kg recommended by FAO[1]. Consequently, the supply does not meet the demand despite the observed increase in chicken production. It is therefore necessary to make up this deficit by developing other poultry sub-sectors, particularly quail production, which has been neglected for years.

The development of quail production in Benin requires knowledge of the benefits and nutritional value of the eggs and meat of the birds. Tunsaringkarn *et al.*[4] reported that quail eggs are rich in vitamin D, which according to Sahin *et al.*[5] improves the quality of food of animal origin in terms of color, oxidative toxicity, acidity, stability and tenderness. Its regular consumption helps to fight against many diseases, including disorders of the digestive tract and anemia by increasing the level of hemoglobin in the body while eliminating toxins and heavy metals[6]. The nutritional value of quail eggs is 3-4 times higher than that of chicken eggs[4]. The consumption of eggs strengthens the body of women during the prenatal and postnatal periods as well as after surgery and radiotherapy[6]. Poor knowledge of the various nutritional and therapeutic benefits of the birds implies that the consumers may not be able to exploit the advantages and thus creating a huge loss of income among quail farmers, thereby slowing down the development of quail production. Therefore, this study aimed to characterize and categorize quail production in order to identify the areas of improvement of the birds to optimize their potential.

MATERIALS AND METHODS

Study area: The study was conducted in the poultry development areas of Benin including PDA7 (Avrankou, Adjarra, Porto-Novo, Akpro-Missérété, Adjohoun, Cotonou, Abomey-Calavi and Ouidah), PDA5 (Lokossa) in the south and PDA4 (Parakou) in the south of northern Benin (Fig. 1). These areas were identified as the locations of quail production in Benin after a pre-survey phase. Benin is a country in West Africa with a total area of 114,763 km^2. In the South, the climate is sub equatorial with two rainy seasons and two dry seasons. In the North, the climate is tropical with a single rainy season and a single dry season. Rainfall varies from 900-1450 mm of water per year and temperature varies between 22 and 37°C[7].

Collection of data: A survey was carried out between November 24, 2018 and January 11, 2019 following a semi-direct interview using a questionnaire with open or closed questions. Data were collected on the identification and location of quail production and the socio-economic characteristics of farmers. The questionnaire was previously validated after a pre-survey phase. The quail farmers were identified according to the non-probabilistic method known as a "snowball"[8]. This method was chosen because of the low level of quail production in Benin. All quail farmers identified in an area were surveyed.

Statistical analysis: The survey data were coded and entered using the Microsoft Excel version 2010 spread sheet. R software[9] was used for descriptive statistical analysis and characterization analysis of the data. Typological analysis was done using Factorial Analysis of Multiple Correspondence (FAMC) and Ascending Hierarchical Classification (AHC). A chi-square test was used to compare the frequencies of qualitative variables. One-way analysis of variance was used to compare the groups based on quantitative variables. The generalized linear models (GLM) procedure was used for the analysis of variance. Comparisons between means were made in pairs using Student's t-test.

RESULTS

General characteristics of quail farmers: The general characteristics of quail farmers are presented in Table 1. The results obtained revealed that quail production was

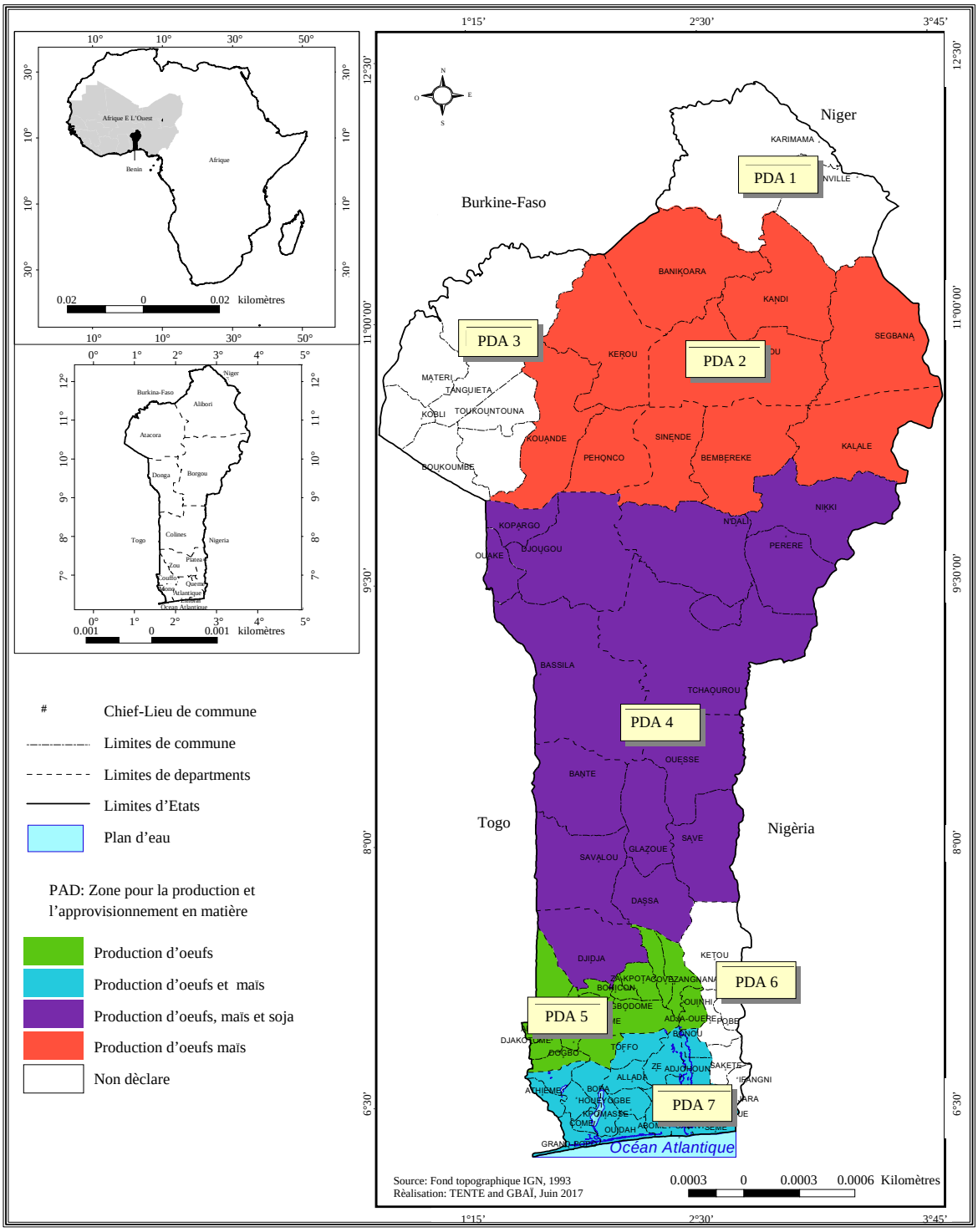

Fig. 1: Poultry development areas for egg and cereal production in Benin (Source: Fond topographie IGN, 1993)

predominantly carried out by male farmers (93.3%). The average age and years of experience of the farmers were 40±13 and 9±8 years, respectively. Quail production was practiced by 90.1% of Beninese, out of which 63.3% were not in their place of origin and 9.9% by the Nigeriens residing in Benin. The quail farmers belonged mainly to the socio-cultural groups: Gun (30%), Fon (13.3%), Yoruba (10%), Mina (10%) and Djeman (10%). Farmers' educational levels were

Table 1: General characteristics of quail farmers in Benin

Variables	Modalities	Quail farmers (%)
Sex	Male	93.3
	Female	6.7
Age (years)	Average	40±13
Years of experience	Average	9±8
Nationality	Benin	90.1
	Niger	9.9
Area of origin	Indigens	36.7
	Non indigens	63.3
Socio-cultural groups	Adja	6.7
	Bariba	3.3
	Djeman	10.0
	Fon	13.3
	Gun	30.0
	Kotafon	3.3
	Mina	10.0
	Nago	3.3
	Popo	3.3
	Sahoue	3.3
	Xlaa	3.3
	Yoruba	10.0
Level of education	Non educated	9.1
	Secondary	9.1
	High education	81.8
	Years of study	12±5
Marital status	Single	26.7
	Married	73.3
Religion	Christianity	90.1
	Islam	9.9
Household	Household size	4±3
	Number of children	3±2
	Number of wives	1±1
Main activity	Agriculture	13.3
	Quail production	56.7
	Trade	10.0
	Crafts	3.3
	Public service	3.3
	Private company	13.3
Reason for main activity	High Time Spent	96.7
	Brings in more money	3.3
Professional training	Trained	46.7
	Not trained	53.3
Association membership	Yes	13.3
	No	86.7
Role in association	Floor member	75.0
	Executive member	25.0
Advantages of the association	Credit purchase of inputs	50.0
	Training	50.0
Economic categories	Rich	16.7
	Poor	83.3

secondary (9.1%) and higher education (81.8%) with an average of 12±5 years of study but others were uneducated (9.1%). Christian (90.1%) and Muslim (9.9%) farmers were married (73.3%) with a household size of 1-7 people with 1-5 children and 1-2 wives. The farmers spent more time on quail production (56.7%), agriculture (13.3%), trade (10%) and other private activities (13.3%). They were trained (46.7%) by vocational training centers such as the Songhai center in Porto-Novo, the Médji high school in Sékou, the SAIN school

Table 2: Cumulative contribution to the total inertia of factor axis

Factorial axis	Inertia (%)	Cumulative (%)
1	39.42	39.42
2	16.17	55.59
3	14.09	69.68

farm in Adjohoun, the"Jardin des oliviers" training and production center of Avrankou, etc. A minority of them belonged to professional associations (13.3%) of which they were simple members (75%). They benefited from poultry training (50%) and purchased with poultry inputs credits (50%). Quail farmers had little financial means (83.3%) for their activity.

Characterization of quail production: The three factorial axis obtained from the Multiple Correspondence Analysis (MCA) made it possible to have a cumulative percentage of variance (69.68%) and were therefore taken into account for the interpretation of the results (Table 2).

From the first, second and third factorial axis of Fig. 2, three types of quail production in Benin were identified with their characteristics:

- The type I quail farmers lived together at the regions of Borgou (33.3%) and Mono (44.44%) (Table 3) and more specifically, the municipalities of Parakou and Lokossa. They were mainly from the socio-cultural group Adja (22.2%) who practiced agriculture (55.56%) in addition to their quail production. Farmers of this type had professional training (88.89%) in quail production and formulated feed on their own farms. They reared quail in hard, semi-closed buildings (55.56%) and in cages (88.89%). They were experienced farmers (9±4 years) (Table 4) whose average flock size varied from 300-3940 quail of all categories, with an average laying rate of 67.11±4.09%. Regarding health management, they often prevented and treated coccidiosis (88.89%). They did not vaccinate their birds but used medicinal plants such as *moringa oleifera*, *oxymum*, *vernonia*, etc. Despite these prophylactic and therapeutic measures, they still recorded an average mortality of 1.19±0.75%
- Type II farmers who were quail producers found at the region of Ouémé (66.70%) (Table 3), was of socio-cultural group Fon (44.49%) and Gun (22.20%). These farmers had their farms located in the urban area (94.45%) and were neither trained (83.35%) nor educated (88.90%). They raised quails because of the prestige of these birds (66.70%) in semi-closed hard buildings (72.25%) and in cages (100%). They had an average experience of 8±2 years (Table 4) with a flock size of 170-2700 quails on

Table 3: Proportion (%) and comparison of different methods describing quail farmers surveyed according to characterization groups

Variables	Modalities	Type I (%)	Type II (%)	Type III (%)	χ^2	p-value
Department of quail production	Atlantic	11.11	27.75	66.67		
	Borgou	33.33	0	0		
	Littoral	0	5.55	0	30.64	0.000
	Mono	44.44	0	0		
	Ouémé	11.11	66.70	33.33		
Location of the quail farmer	Urban area	44.44	94.45	33.33	9.82	0.007
	Peri-urban area	55.56	5.55	66.67		
Sex of quail farmers	Male	100	94.45	66.67	2.15	0.340
	Female	0	5.55	33.33		
Socio-cultural group	Adja	22.22	0	0		
	Bariba	11.11	0	0		
	Djeman	0	0	66.67		
	Gun	11.11	22.20	33.33		
	Fon	0	44.49	0		
	Kota Fon	11.11	0	0		
	Mina	0	16.65	0	34.83	0.009
	Popo	11.11	0	00.00		
	Sahoue	11.11	11.10	0		
	Xla	11.11	0	0		
	Yoruba	11.11	5.55	00.00		
Level of education	Educated	100	11.10	66.67	20.73	0.000
	Non educated	0	88.90	33.33		
Main activity	Agriculture	55.56	0	33.33		
	Quail production	33.33	66.67	00.00		
	Crafts	0	5.55	0	18.74	0.006
	Trade	0	5.55	66.67		
	Public service	11.11	22.20	00.00		
Training in quail production	Trained	88.89	16.65	66.67	14.34	0.000
	Not Trained	11.11	83.35	33.33		
Membership in a farmers' association	Membership	11.11	5.55	33.33	4.038	0.132
	No membership	88.89	94.45	66.67		
Motivation for quail production	Virtues of eggs	66.67	16.65	33.33		
	Prestige	11.11	66.70	0	32.62	0.000
	Rentability	0	5.55	66.67		
	Easy quail production	22.22	11.10	0		
Type of building	Hard closed	33.33	11.10	0		
	Semi-closed hard	55.56	72.25	100	22.10	0.000
	Traditional closed	11.11	16.65	0		
Mode of quail production	Caged	88.89	100	100	6.028	0.152
	On ground (litter)	11.11	0	0		
Source of food	Purchase	22.22	100	66.67	18.69	0.000
	Factory	77.78	0	33.33		
Vaccination	No vaccination	100	94.44	33.33	23.96	0.000
	Vaccination	0	5.55	66.67		
Diseases covered	None	11.11	22.22	0		
	Avitaminose (Avit)	0	22.22	33.33	6.064	0.008
	Avit+coccidiose	88.89	55.56	66.67		

p<0.05: Significant, p<0.01: Highly significant, p<0.001: Very highly significant

average of all categories combined and an average laying rate of 66.60±3.25%. They did not vaccinate their birds but used medicinal plants such as *Moringa oleifera, oxymum*, *vernonia*, etc. They often had the highest mortality (1.84±0.20%)

- The type III consisted of quail farmers from the Atlantic region (66.67%) (Table 3) whose flocks were located in peri-urban areas (66.67%). Most of them belonged to the Djeman socio-cultural group (66.67%) who had trade (66.67%) as their main activity. These farmers chose quail production for the profits realized from the sales of eggs and meat and reared the birds in hard semi-enclosed (100%) and cage (100%) buildings. These farmers vaccinated (66.67%) their birds against Newcastle disease and infectious bronchitis by orally administering them with HB1 and H120 vaccines, respectively. They also prevented and treated coccidiosis (66.67%). Despite these health provisions, they lost birds at an average rate of 1.13±0.18% (Table 4). They were the least experienced (3±1 year) but had the largest flock size of 4,600-30,500 quails on average of all categories combined with an average laying rate of 71.18±5.09%

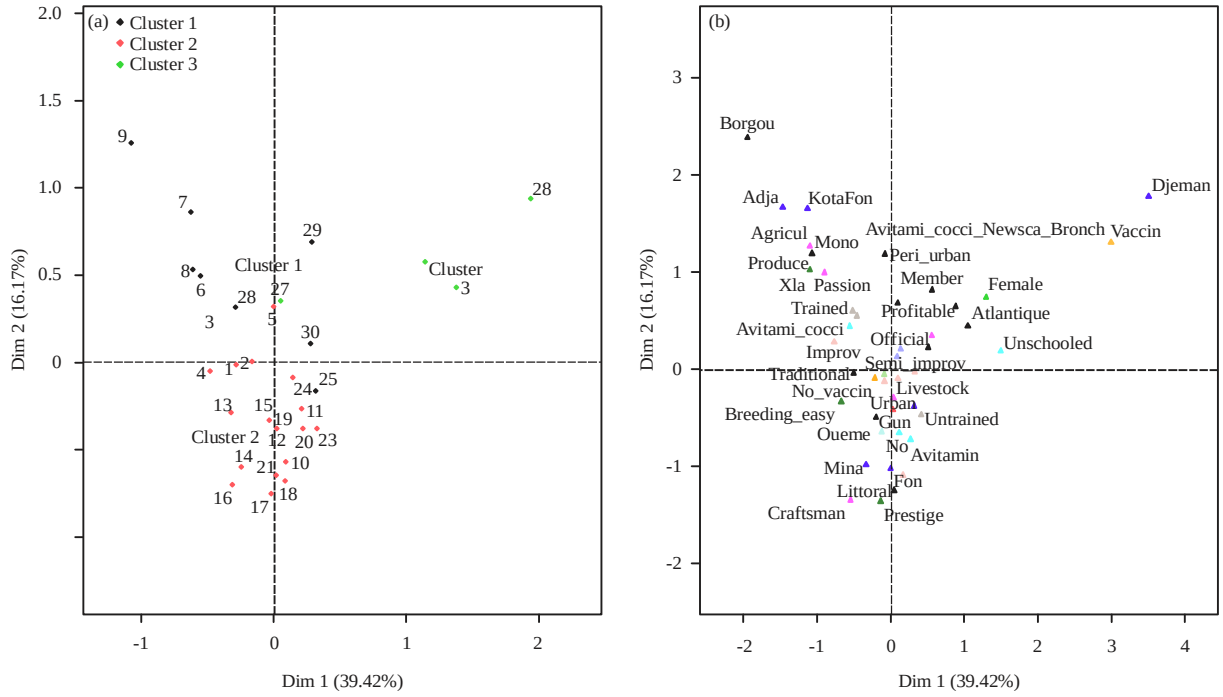

Fig. 2(a-b): Projection of quail farmers surveyed on factorial axis 1 and 2
Cluster 1: Type I, Cluster 2: Type II and Cluster 3: Type III

Table 4: Quantitative values and comparison of different methods describing quail farmers surveyed according to characterization groups

Variables	Type I	Type II	Type III
Quail farmers age	37±5[a]	41±3[a]	35±5[a]
Quail production experience (years)	9±4[a]	8±2[a]	3±1[b]
Household size	4±1[a]	4±1[a]	3±1[a]
Flock size	1288.3±955.02[b]	947.4±537.55[a]	13171±6931.6[c]
Mortality (%)	1.19±0.75[a]	1.84±0.20[b]	1.13±0.18[a]
Laying rate (%)	67.11±4.09[a]	66.60±3.25[a]	71.18±5.09[a]

The values of the same line indicate by different letters are significantly different at the 5% threshold

DISCUSSION

The result of the present study showed that quail production in Benin was predominantly engaged in by men. This observation could be explained by the fact that quail farming technique is not popular in the country. In African societies, men are responsible for the management of animals whereas women support the men in the different activities and have few property rights[10]. A survey of Japanese quail production in selected areas of Bangladesh had shown that 86.5% of quail farmers were men[11]. The average age of quail farmers recorded in this study is similar to that of poultry farmers obtained by Fall *et al.*[12] in Senegal and Issa *et al.*[13] in Chad. Quail farmers were mostly educated with high levels of education. This high rate of education could be attributed to the fact that the new farming system develops more in the centers of professional training. In addition, educated men who visited these centers were often attracted by the medicinal values of eggs and the quality of quail meat. These results are consistent with those obtained by Idrissou *et al.*[14] on modern poultry production in Benin.

A study on the characterization of indigenous chicken production systems in Rwanda also showed that 83.6% of respondents had a formal education[15].

The profession of the respondents were of various types but quail production was the main dominant activity for the majority of them. Trade, agriculture, public service and crafts were also carried out by quail farmers. The various activities of quail farmers suggest that they were not making enough money from quail production. However, poultry production is one of the integrated and complementary activities of the agricultural system which contribute to economic welfare[16]. Thus, quail production contributes to the financial diversity of the people of Benin. Similar results were found by Idrissou *et al.*[14] who worked on the diversity of poultry farms in the North of Benin. The non-membership of a professional

association by the majority of quail farmers could be due to the non-regulation and the less revitalisation of the quail sub-sector. Quail farmers had limited financial resources. The lack of support from financial institutions and donors in the sector would explain the financial constraints of quail farmers. Poultry production is a sector considered by financial institutions to be a long-term business and also associated with high risk in the event of epidemic or pandemic outbreak of diseases.

This characterization, obtained in the present study, is similar to those observed in the Senegalese poultry sector of Louga-Dakar[17] and in the Cape Verde region[18]. In Benin, quail production was practiced in urban and peri-urban areas but with predominance in peri-urban areas. These results are in agreement with those of Kouakou *et al.*[19]. Indeed, the marketing of quail products and the size of projected flock determined the location of the farms. This was the factor that determined the locations of the type III farmers in the Atlantic, the most populated department to serve Cotonou, Benin's biggest city. The small space required for quail production would justify the concentration of the majority of type II farmers in the centers of the cities. Thus, type II farmers located at the region of Ouémé served Cotonou with quail products. A similar observation was made by several studies of commercial poultry production[20,21]. According to FAO[1], quail production is highly concentrated in the region of Ouémé, contrary to the results of the present study which indicate that quail production was concentrated in the Atlantic and Ouémé. This discrepancy could be explained by the dynamics of the sector to spread from one region to another. However, almost all the quail farmers of Couffo had relocated to the region of Mono due to the sharp drop in sales of quail eggs. This justified the choice of Mono region after the pre-investigation was carried out. As for the region of Borgo, a good number of quail farmers had abandoned this activity for the same reason of poor sales and spoilage of quail eggs. The significant difference in flock size observed between type III and types I and II could be due to the ability of type III farmers to form partnerships with national and international organizations and to get funding for the training of young people and unemployed graduates and their academic internships. These advantages made it possible for quail farmers to have unpaid labour available unlike those of types I and II who found it difficult to hire labour. Quail production has improved significantly today compared to the results of FAO[1] which estimated the total number of quail in Benin at 1,920 birds. Concerning management practice, the shorter period of the experience of type III quail farmers compared to that of types I and II can be attributed to the fact that the majority of these holdings were newly created and depended only on youth workforce for birds' management. In terms of mortality, types I and III farmers recorded the lowest rates compared to those of type II. These results would be linked to the degree of health care provided by farmers of each type and to the professional training received as well as the level of education.

CONCLUSION

In the present study, three types of quail production in Benin were identified. The management practice of the farmers differed across geographic locations in the Country. The flock size, profession, mode of production, health care and level of education of the quail farmers were different in the three types of quail farming. The survey also found in general that quail farmers were concentrated in the Atlantic where Type III was found with the largest number of quails. Type II was recorded region of Ouémé while Mono and Borgo had smaller numbers of type I quail farmers.

SIGNIFICANCE STATEMENT

This study discovered the general characteristics of quail production in Benin and the three types of quail farmers in Benin were obtained. These findings are important for the improvement of the birds. This will help determine the needed resources to improve the welfare and health of the birds in the Country. This study will help the researcher to uncover the critical areas of the characterization of quail production that many researchers have not been able to explore. Thus, a new theory on quail production in Benin may be arrived at.

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