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Typology and Characterization of Traditional Poultry Farming Systems in Togo

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ABSTRACT

The current cross-sectional survey was conducted in the Kara and Savannah Regions of Togo from February to April 2020, to explore the typology of traditional poultry farms and controlling measures of Newcastle disease in these two regions. The survey covered 378 households using the ClustOfVar method of principal component analysis to address the issue of farm typology. The results indicated three distinct classes of livestock, each with its specific characteristics and satisfactory projection quality of individuals in the plan. The findings indicated that 3.17%, 82.8%, and 14.02% of the surveyed poultry farmers accounted for classes 1, 2, and 3, respectively. Households in the first two classes were headed by men and almost all households in the third class were headed by women. In addition, in all classes, the animals belonged to the heads of household in the majority of cases. In terms of animal health and prevention of Newcastle disease, the study revealed that the Newcastle disease vaccine was the only vaccine administered in rural areas to chickens from four weeks of age and was used once in 56.9% of households. Vaccination was carried out mainly by Village Livestock Auxiliaries with the expense of 0.045-0.13 USD per chicken. It is worth mentioning that the use of medicinal herbs to treat the diseases and strengthen the immune system of poultry is widespread in Togo, and on average, the laying hens lay 11.66 eggs per clutch and brood 3.08 times per year. This production performance of chickens in northern Togo is comparable to that of traditional chickens in other African countries, with slight differences.

Keywords: Health management, Togo, Traditional poultry farming, Typology

INTRODUCTION

During the year 2020, the Togolese government has taken measures to limit imports of frozen poultry products and has strictly prohibited non-domestic poultry products from countries infected by avian influenza, while emphasizing the development of local production. In Togo, modern poultry farming coexists with traditional poultry farming. The latter is more dominant and is practiced by more than 80% of households in rural areas (MAEP, 2013). As in most developing countries, traditional poultry farming in Togo plays important nutritional, social, economic, and cultural roles. It is a means of improving food security (Orounladji et al., 2021), alleviating poverty (Nahimana et al., 2019), and supplying an important source of animal protein (Emuron et al., 2010; Issa et al., 2012), which contributes substantially to the income of rural families, enabling them to meet their immediate needs (Cost of medicines, children's schooling, and small equipment, Aklilu et al., 2007; Issa et al., 2012).

Despite its importance, such a measure has been confronted with numerous genetic, nutritional, management, and biosecurity obstacles. In addition, the formulation of recommendations and the development of strategies to promote the growth of the traditional poultry sector is difficult. Moreover, the evaluation of the sector is also difficult because statistics are scarce and insufficient. Therefore, there is a need to conduct studies based on recent data to affect the development of the sector. Moreover, the availability of recent data on traditional poultry farming is very important and should be a prerequisite for decision-making processes and operational mechanisms used for the development of the poultry

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sector. In recent years, studies have documented traditional poultry farming in Togo. For example, Dao et al. (2015) conducted phenotypic characterization of local chicken (*Gallus Gallus domesticus*) populations in Togo; and Talaki et al. (2020) established the current status of traditional poultry farming. However, none of these studies addressed the classification of traditional poultry farming in Togo. The interest of classification lies in the fact that it neither allows the simplification of the reality while respecting the main characteristics nor compares groups of farms to evaluate their functionality, identify possible solutions to the problems encountered, and provide adapted recommendations (Perrot and Landais, 1993; Djenontin et al., 2004). The present study is meant to improve the documentation of traditional poultry farming in Togo and make the necessary information available for decision-making to orient developmental actions. Specifically, the current study aimed to establish a classification of traditional poultry farming systems in Togo by highlighting the different types of traditional poultry farms, their characteristics, their management methods, and the main factors limiting the growth and development of these farms. This study can therefore provide information that will help decision making for the emergence of local poultry farming.

MATERIALS AND METHODS

The study was carried out in the north of Togo, in the 14 prefectures of the Savannah and Kara regions. Of these 14 prefectures, 8 were covered by the dry Savannah agro-ecological zone and 6 by the Atakora agro-ecological zone. The Savannah agro-ecological zone covers all the Savannah regions (Cinkasse, Tone, Tandjouare, Kpendjal, Kpendjal-ouest, Oti, and Oti-sud) and one prefecture of the Kara region (Keran). This agro-ecological zone is a lowland area with a Sudanese climate. Precipitation, concentrated between May and October, oscillates between 1000 and 1100 mm per year with an average of 82 days of rain (Soara et al., 2020). The temperature typically varies from 22 to 35°C, with an annual mean relative humidity of 56% (Amey et al., 2015; Soara et al., 2020).

The Atakora agro-ecological zone covers the other six prefectures of the Kara region (Assoli, Bassar, Binah, Dankpen, Doufelgou, and Kozah). This agro-ecological zone is a space of mountains with a Sudano-guinean environment. The precipitation annually changes from 1100 to 1400 mm with a normal of 113 days of a downpour (Soara et al., 2020). The temperature varies from 21°C to 34°C, and the normal relative humidity is annually 63% (Amey et al., 2015; Soara et al., 2020).

Administratively, Togo is subdivided into regions, regions into prefectures, prefectures into cantons, cantons into communes, and communes into localities (neighborhoods, villages, farms, hamlets). Figure 1 clearly illustrates the study area.

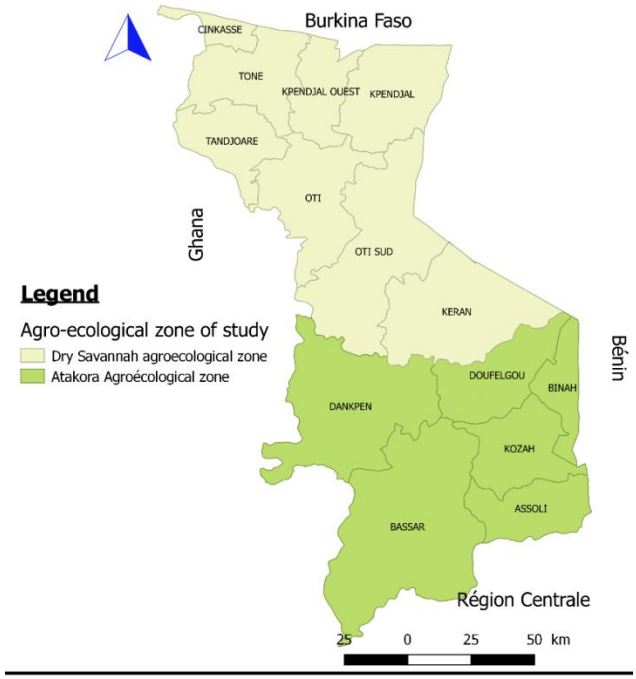

Figure 1. Study area (north of Togo)

Sampling

The three-stage stratified sampling method was used to define the study sample. In the first stage, all prefectures in both regions were selected. In the second stage, three cantons in each prefecture were selected on the basis of remoteness, and one commune was selected from each canton. In the next step, a locality was randomly selected from one of the selected communes. Finally, in each locality, farmers were selected on the basis of remoteness, accessibility, and availability to provide information. Nine households were surveyed in each locality. In total, 378 households were surveyed in the two agro-ecological zones.

Data collection

Data was collected using a questionnaire from February to April 2020 including semi-open and closed questions. The questionnaire included geographical location, identification of the farmer, flock (animal species, number, and origin of poultry), and rearing practices (rearing method, health monitoring, and feeding).

Information on the plants used to treat the chickens was obtained from the farmers in the language they know. Then the scientific names were subsequently searched.

Statistical analysis

The data collected were analyzed using R software version 4.0.4. The principal component approach for mixed data, ClustOfVar (classification of variables) was used to create synthetic indices reducing the dimension of 10 initial variables chosen for the classification. This classification of variables could highlight the links between the different variables and summarize the information through the construction of new numerical synthetic variables. Then, the hierarchical ascending classification was applied to the synthetic indices to carry out the classification of the individuals. The 10 initial variables were considered as active elements, meaning that determining elements for the formation of the factorial axes. These include the agro-ecological zone of the farm, the main activity and sex of the head of the household, the holder or owner of the poultry in the household, the poultry species and the other animal species raised, the total number of poultry, the mode of acquisition of the poultry, the mode of rearing, and the source of the feed. Descriptive statistics (means, standard deviation, relative frequencies, and absolute frequencies) were used to describe the other variables that were not used in the classification. The results of the ClustOfVar were interpreted as described by Kuentz-Simonet et al. (2013) and Saracco et al. (2019).

RESULTS

Classification of variables

Following the application of the ClusOfVar method on the 10 initial variables, 4 clusters of variables were retained, which were called synthetic variables on the basis of the maximization of the cohesion rate at 54.46%. The stability criterion was used to determine the number of clusters to consider. These synthetic variables include variables that are strongly related to each other, i.e. that provide the same type of information. Table 1 shows the links that exist between the initial variables of each class and the synthetic variable summarizing the class. The squared loading provides the representation qualities of each of the variables on the factorial axes. The closer the squared loading is to 1, the better the variable is represented in that class. This is the case for the initial variables poultry owners and sex of the head of household, which are very well represented in the synthetic variable 2. In addition, synthetic variable 1 reflects the type of farming applied in relation to the agro-ecological zone. Synthetic variable 2 is the quantitative variable that represents the family member owning the animals regarding the sex of the head of the household. Synthetic variable 3 groups together information on the origin of the feed given to the poultry concerning the main activity of the head of the household. Finally, the fourth synthetic variable 4 is a grouping of variables relating to the composition and constitution of the flock.

Table 1. Relationship between the variables in each cluster of traditional poultry farms and the associated synthetic variables

Cluster	Initials variables	Squared loading	Eta²
Synthetic Variables 1	Agro-ecological zone	0.76	0.963
	management methods	0.76	
Synthetic Variables 2	Owner of poultry	0.96	0.853
	Gender of the head of the household	0.96	
Synthetic Variables 3	Main activity of the head of household	0.76	0.053
	Origin of food	0.76	
Synthetic Variables 4	Poultry species raised	0.51	0.017
	Number of owned birds	0.48	
	Other species kept	0.28	
	Mode of acquisition	0.27	

Classification of farming systems

In order to better identify the specificities of the farming systems, the hierarchical ascending classification was applied to these four synthetic variables (principal components) leading to the classification of the farms into three classes with an explained inertia rate of 60.6%. Figure 2 shows the projection of the individuals colored according to their classes in this first factorial plane. The figure indicates that the classes are relatively homogeneous and separated from each other with a satisfactory quality of projection of individuals. The problem of the classification of traditional poultry farms can be understood through the description of the classes by

the variables that characterize the individuals in each of the three classes.

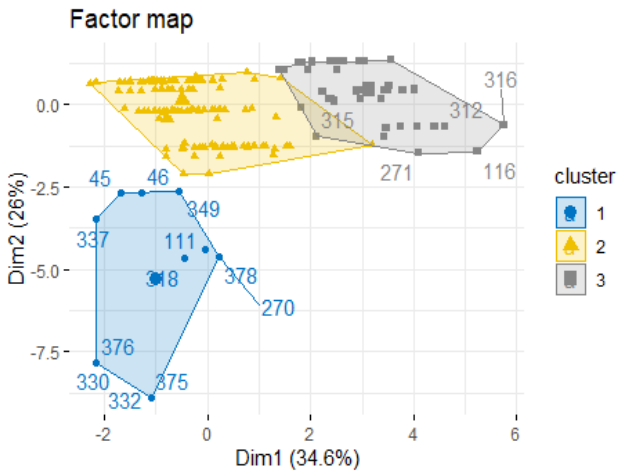

Figure 2. Graphic representation of traditional poultry farms clusters on axis 1 and 2

Class 1 accounted for 3.17% of the surveyed population. Sixty-seven percent of the farms in this class were located in the Atakora agro-ecological zone. The same proportion (67%) of farms in this class practiced semi-open-air farming and 33% practiced open-air farming. In the open-air system, the birds were not confined and could move around over a wide area. The use of shelters, if any, was optional. In contrast, in semi-free-range systems, birds were housed at night and were allowed to roam all day. Space sometimes was set aside for the poultry to roam and provided direct access to the shelter or henhouse. All households in this class were male-headed; the animals were owned mainly by the men (58%) and secondarily by the whole family (42%). The majority of heads of households (83%) had livestock as their main activity, and almost the same proportion of the feed distributed to poultry in households came from household purchases (50%) and agricultural work (42%). Regarding the composition of the flock, 33% of farmers had only hens as poultry species and 67% combined hens with guinea fowl and/or ducks and turkeys. Of the farmers, 33% had only poultry as backyard animals while 67% combined sheep and/or goats and cattle with poultry. Forty-two percent of the farms possessed a flock size of more than 90, and 33% of the farms owned less than 30 poultry. The majority of farms in this class were established by purchase (92%) and a minority by purchase and donation (8%).

Class 2 had the largest number of poultry farmers (82.8%) of the survey population. The majority of flocks in this class were purchased (88%) and gifts, trusts, and inheritances represented 1%, 2%, and 4%, respectively. In 62% of the flocks, at least two poultry species co-exist, and 81% of households owned at least one animal species other than poultry. About half of the poultry flocks on these farms were less than 30 (51%). More than half (60%) of the farms in this class were in the dry savannah agro-ecological zone. The free-range mode dominated the semi-free-range mode. All households were headed by men, the majority of whom were farmers (90%), and craftsmen, traders, and civil servants were in the minority. The animals were mostly owned by men (82%) and in a minority by the family. The feed distributed to the poultry came mainly from the household's agricultural work. Finally, class 3 was made up of 14.02% of the surveyed population. Nearly most of the people in this class were found in the agro-ecological zone of the dry savannah and Atakora (45% in the dry savannah and 55% in the Atakora). Almost all of these poultry households were headed by women. The majority of these women (89%) had agriculture as their main activity, and a minority (11%) were involved in the trade. Ninety-two percent of poultry was owned by women, and 8% by the family. At least two different species of poultry were kept in 45% of households. Fifty-five percent (55%) owned only chickens. In 55% of households, poultry coexisted with other animal species (cattle, sheep, goats). Poultry was fed on the products of the household's agricultural work.

Overall characteristics of the farms and households surveyed

Management method

Two farming methods, including open-air and semi-open-air modes, were distinguished in the current study. In the open-air system, the birds are not confined and can roam over a wide area. The use of shelters, if any, is optional. In contrast, in the semi-outdoor system, the birds are housed at night and left to roam all day. In this type of farming, the chicks are not left to roam like the adult chickens. They are kept in a secure area with permanent access to water and feed. Termite supplements are usually provided. This care is provided until the chicks reach an age when their chances of survival in a hostile environment are high (average age 8 weeks). The space set aside for the birds to roam sometimes gives direct access to the shelter or coop.

Livestock housing

The poultry house in traditional poultry farming is used to house birds at night and protect them from the weather and predators. The current study has indicated that 9% of households do not have a coop to house their birds. In these households, birds find shelter in trees, on walls, and in the corners of houses. Within the 91% of households that have a chicken coop, four types of poultry shelter were identified. Regarding their importance, they included traditionally improved chicken coops (76.5%), unfinished uninhabited rooms (8%), basic chicken coops (6%), and modern chicken coops (1%).

Animal monitoring

Animal care was provided by men in 48.94% of households. the family, wife, and children were respectively responsible for animal monitoring of 30.95%, 11.37%, and 8.73% of households. In 6% of households, more than one hour was spent on poultry per day, while in 94% of households it took less than one hour to look after the animals. Twenty-two percent of farmers washed water troughs daily to serve water to the poultry, while in 78% of households, water troughs were washed one to five times a week.

Table 2. Characteristics of the different classes of traditional poultry farms in the north of Togo in 2020

Variables	**Modalities**	**Classes**		
		1 (%)	2 (%)	3 (%)
Agro-ecological zone	Atakora	66.66	39.93%	54.71
	Dry savannah	33.33	60.06	45.28
Mode of acquisition	Purchase	91.66	87.54	88.67
	Purchase, Donations	8.33	1.59	0
	Purchase, Inheritance	0	3.51	0
	Entrusting	0	1.91	3.77
	Gift	0	1.27	3.77
	Gift, Entrusting	0	0.31	0
	Inheritance	0	3.83	3.77
Management methods	Open-air	66.66	82.1	73.58
	Semi open-air	33.33	17.89	26.41
Poultry species raised	Chickens	33.33	38.02	54.71
	Chickens + other poultry	66.66	61.98	45.28
Other species kept	No	33.33	19.17	45.28
	Yes	66.66	80.83	54.71
Number of poultry	Less than 30	33.33	50.8	69.81
	Between 30 and 60	25	26.51	22.64
	Between 60 and 90	0	13.41	7.54
	More than 90	41.66	9.26	0
Owner of the animals	Couple	0	1.91	0
	Infants	0	0.95	0
	Family	41.66	15.33	75.47
	Female	0	0	92.45
	Male	58.33	81.78	0
Gender of the head of household	Female	0	0.31	96.22
	Male	100	99.68	3.77
Main activity of the head of household	Agriculture	8.33	90.41	88.68
	Breeding	83.33	0	0
	Others	8.33	9.58	11.32
Source of food	Purchase	50	0	0
	Purchase, agriculture	8.33	1.59	3.77
	Purchase, others	0	0.63	1.88
	Agriculture	41.66	94.25	90.56
	Agriculture, others	0	3.19	3.77

Technical support and poultry health management

Traditional poultry farmers who received technical advice or support represented 9% of the surveyed population. Of these farmers who receive technical support, 87.5% were adults (over 36 years old). Of these farmers, 31.25% had more than 90 heads of poultry, but generally, 78.12% of farmers possessed more than 30 birds. In these rural areas, this support and advice were provided mainly by Village Livestock Assistants and to a less extent by veterinarians and livestock technicians. These Village Livestock Assistants intervene much more during vaccination and mass deworming campaigns for poultry and small ruminants. The Village Livestock Assistant is a village farmer chosen by his peers and trained to carry out basic health care for poultry, in particular vaccination. He acts in cooperation with a private veterinarian from whom he obtains vaccines and veterinary products. The veterinarian also ensures follow-up, ongoing training, and technical exchanges between the Village Livestock Assistants in his sector. This is the result of several animal farming development projects put in place over the past several years by the government and its development partners. On the farms, the measures taken by the farms to prevent the introduction of diseases were based on simple sweeping of the farm premises, washing of farm equipment with detergent or soap.

Medicinal plants were used both to prevent and treat poultry against diseases. The majority of farmers (82.8%) used plants or plant organs to treat and cure animals. These plants were given as infusions or simply soaked in water given to the birds. Table 3 lists all the plants identified in this study.

The use of veterinary products remained low, only 6% of farmers frequently used veterinary products to treat their poultry. The anti-parasitic were the most popular products. Antibiotics, on the other hand, were not widely used and were mostly limited to the use of tetracycline purchased by farmers from street vendors in rural areas when animals indicated symptoms of the disease. Farmers were aware of the practice of vaccination to prevent devastating poultry diseases. Just over half of the farmers (57%) had their birds vaccinated at least once. This vaccination usually takes place during mass vaccination campaigns organized by the government. Vaccination is carried out mainly by Village Livestock Auxiliaries and the Newcastle disease vaccine is the only vaccine administered to chickens in rural areas. Its cost varies from 0.045-0.13 USD per chicken.

Table 3. Plants used to prevent and treat chickens against parasitic, bacterial, and viral diseases in the north of Togo*

Scientific names of plants	The used plant organs	Diseases
Azadirachta Indica	Leaves, bark	Diarrhea, anorexia
Manguifera Indica	Bark	Bacterial infections, depression
Khaya Anthotheca	Root	Drowsiness, bacterial infections
Anarcadium Occidentale	Bark	Diarrhea, bacterial infections
Khaya Sénégalenses	Bark	Plague, swelling of the head
Vitellaria Paradoxa	Bark	Parasitosis, coccidiosis
Milicia Exclesia	Bark	Plague, swelling of the head
Cassia occidentalis	Bark	Coccidiosis and diarrhea
Andasonia Digitata	Bark	Diarrhea
Capsicum sp	Fruits	Depression, parasitosis
Citrus Limon	Fruits, Leaves	Depression
Elaeis guineensis	Flours	Diarrhea, bacterial infections
Parkia biglobosa	Bark, root	Plague, diarrhea, bacterial infections
Vitellaria Paradoxa	Bark	Plaque, basterial infections and parasitosis
khaya Anthotheca	Bark	Plague, diarrhea, swelling of the head, and bacterial infections

*References of these findings are the farmers in the north of Togo that used these plants to treat the infected chickens

Table 4. Zootechnical parameters of local chickens in the north of Togo

Production parameters	Agro-ecological zone		Mean
	Atakora	Dry savannah	
Age at which hens start laying (months)	7.32 ± 1.31[a]	6.10 ± 0.97[b]	6.76 ± 1.31
Number of broods per year	3.09 ± 0.36	3.08 ± 0.58	3.08 ± 0.47
Number of eggs laid per clutch	11.36 ± 1.83	11.84 ± 1.75	11.66 ± 1.79
Number of chicks hatched per clutch	9.40 ± 2.22[a]	9.25 ± 1.79[b]	9.30 ± 1.96
Number of chicks reaching maturity (2 months)	7.28 ± 2.62[a]	6.65 ± 1.92[b]	6.88 ± 2.23

Production performance

Table 4 summarizes the reproductive performance of hens by agro-ecological zone, as collected from farmers No significant differences were observed between the hatchability and the eggs laying in the two agro-ecological zones. On average, the hens lay 11.66 eggs per clutch and brood 3.08 times per year. In contrast to the two parameters mentioned above, significant statistical differences ($p \leq 0.05$) were observed in the two agro-ecological zones for the age at which the hens started laying, hatchability, and survival rate of chicks after two months. The maturity here referred to non-sexual maturity but the stage at which the chicken's vulnerability to predators, disease, and the weather was greatly reduced, compared to the chick stage.

DISCUSSION

The classification method of variables followed by hierarchical ascending classification paved the way to meet the objective of this study, which was to highlight the main characteristics and establish a classification of traditional poultry farms in the agro-ecological zones of the dry Savannah and Atakora in Togo. These data, together with other results, have revealed similarities and differences related to the socio-economic contexts and conditions of production. Traditional poultry farming was practiced in all households regardless of the age, sex, or the nature of the main activity of the head of the household. However, there was a high representation of male-headed households which can be explained by several reasons. The first reason as can be explained by the results of the current study referred to the strong correlation between the sex of the head of the household and the owner of the animals (synthetic variable 1), added to the fact that the animals belonged in the majority of cases to the head of the household, who in most cases is a man. Secondly, the responsibility of the household head is traditionally with the man. Traditional poultry farming is an activity initiated or authorized by the head of the household. The woman only takes the authority of the household in the case of the man's disability or death. This male dominance has been reported previously in Togo by Talaki et al. (2020) and Dao et al. (2015). This male dominance is consistent with that found by Pinde et al. (2020), Loukou (2013), and Moula et al. (2012) in Burkina Faso, Chad, and India, respectively. The authors supported the hypothesis of patriarchal family management in some African countries. However, contrary results according to which traditional poultry farming is an activity dominated by women and young people have been revealed by Fotsa et al. (2007). This low representation of women could be an obstacle to the success of actions aimed at reducing female poverty (Pinde et al., 2020) and achieving rural women's empowerment. Mechanisms to increase women's prerogatives to help reduce the representation gap between women and men in traditional poultry farming and promote gender equity. This proposal is in line with that of Pinde et al. (2020), which recommends that gender issues be taken into consideration in development actions and that the position of women in rural society is strengthened in order to reduce female poverty. The activity is mostly practiced by farming households as also mentioned by Talaki et al. (2020) and MAEP (2013).

The majority of farmers provided shelters for their poultry due to the many projects in the livestock sector initiated by the government and private development partners. This is also the case in Burkina Faso, where micro-projects and subsidies to farmers have increased the availability of poultry farming equipment and infrastructure in rural areas (Pinde et al., 2020). However, in most cases, poultry houses were built with non-durable materials that were not weather resistant and did not facilitate the elimination of external parasites (lice, ticks) and other pathogens, as disinfection and maintenance operations are rare or non-existent. This has been noted in other African countries, such as Ethiopia (Dassie and Ogle, 2001), Nigeria (El-Yuguda et al., 2007), and Senegal

(Ayssiwede et al., 2013). Moreover, this would represent a risk factor for infectious and parasitic diseases, which could be considered as the main causes of poultry losses in traditional poultry farming according to several studies (Maminiaina et al., 2007; Talaki et al., 2020; Dzogbema et al., 2021). The development of this sector also requires the improvement of poultry houses, which would encourage regular maintenance although maintenance is limited to a simple sweeping of the houses and their surroundings.

Poultry farming is the perfect practice to be combined with other aspects of agriculture. It represents a symbiotic or beneficial association for the household. It is easy to feed the poultry since almost all the feed given to the birds comes from farm products. Moreover, the kitchen wastes were distributed to the chickens instead of being thrown away. Hence kitchen wastes were well valorized in the feeding of the poultry. On the other hand, poultry produces manure to fertilize the soil, thus improving agricultural yields. This would explain the predominance of farmers in this practice, representing a huge potential for the country where agriculture is practiced by at least 80% of the population (MAEP, 2013). To go further, traditional poultry farming contributes to the income of rural families, covering food needs and providing social functions (Brou et al., 2020; Emuron et al., 2010; Issa et al., 2012) enabling them to meet immediate family needs such as the cost of medicines, children's schooling, and purchase of small equipment (Aklilu et al., 2007), and all this from a relatively small investment (Issa et al., 2012). Poultry can also be considered a bank for farmer economies. For rural populations whose banking is still very low, livestock is used as a means of saving and capitalizing on profits from agricultural and non-agricultural activities. As a common currency, poultry farming constitutes a source of income that can be quickly mobilized to meet the expenses of rural households.

The low investment in financial and human resources could justify the widespread use of the free-range system. The advantage of this system is that the food intake is low. The advantage of this system is that the food intake is low. Animals in total scavenge on food debris from nature such as broken grain found around grain threshing areas, termites, earthworms, locusts (Ayssiwede et al., 2013) However, pecking resources become scarce in the dry season which affects the productivity of the animals. On the other hand, in the semi-open-air or semi-extensive system, feed loads are high (Ayssiwede et al., 2013) but have the advantage of reducing losses due to predation, accidents, theft, and disease. A transition to a semi-outdoor system with a controlled roaming area would increase livestock numbers and improve household income and socioeconomic status. Furthermore, the age at which females start laying eggs is earlier in the dry savannah agro-ecological zone than in the Atakora agro-ecological zone.

The number of eggs laid per hen per brood is almost identical in the two agro-ecological zones. Statistically, the number of chicks hatched per brood is also almost identical in the two agro-ecological zones although there is a statistical difference at the 5% level. The results revealed that in the Atakora agro-ecological zone, chicks have a statically higher chance of survival compared to chicks in the dry savannah agro-ecological zone. Compared with other results, the number of eggs laid per hen is close to those reported by Ayssiwede et al. (2013) in Senegal and Mwalusanya et al. (2002) in Tanzania which are 12 and 11.8 respectively. However, this value is lower than that revealed by Fotsa (2008) in Cameroon and (Dassie and Ogle, 2001) in Ethiopia. Fotsa (2008) reported a number of eggs per clutch ranging from 12.74 to 14 and Dassie and Ogle (2001) reported a number of 13. The obtained results were nevertheless close to the values or ranges reported by other authors (Halima, 2007). Concerning the number of clutches per year per hen, the current results are similar to those reported by other authors (Dassie and Ogle, 2001; Missohou et al., 2002; Yameogo, 2004; Fotsa, 2008). In general, the number of broods per year per hen for traditional chickens varies from 3 to 4 (Dassie and Ogle, 2001; Missohou et al., 2002; Yameogo, 2004; Fotsa, 2008). In rare cases, it is between 4 and 5 (Mammo et al., 2008). The hatching rate values are also comparable to those reported by the same authors (Fotsa et al., 2007; Halima, 2007; Mammo et al., 2008).

Health care in rural areas is much more about the use of plants with medicinal properties. The use of plants to treat poultry is a widespread endogenous practice that is passed down from generation to generation. Eighty percent of the world's population uses medicinal plants to treat illness. It is based on indigenous knowledge, experience, and cultural beliefs (Ashraf et al., 2018). Several authors have provided scientific evidence to support the use of these plants for medicinal purposes in poultry. Several compounds have antihelmintic, antiprotozoal, antioxidant, antifungal, antimicrobial, insecticidal, and sperm promoting effects (Bonsu et al., 2012; Ashraf et al., 2018). Mohamed et al. (2010) revealed that methanolic extracts of some plants have strong antiviral activity against poultry viruses. These extracts particularly inhibit the replication of the Newcastle Disease Virus (Ashraf et al., 2018). In addition,

methanolic extracts of *Andasonia digitata*, a plant widely used in northern Togo, consumed by the population and used for medicinal purposes is also reported to have antiviral properties against Newcastle disease at doses between 200 and 250 mg/ml (Sulaiman et al., 2011; Ashraf et al., 2018). Moreover, the use of *Aloe scundiflora* reduces mortalities in Newcastle disease-affected flocks. The use of *caspicum spp* to treat diseases in poultry is a very common practice. It is used in combination with other plants and works by improving the resistance of poultry against viral diseases (Lans et al., 2007; Ashraf et al., 2018). In terms of immunization, Newcastle Disease vaccination is practiced and just over half have their poultry vaccinated. This percentage is still relatively low because about half of the farms remain under the threat of Newcastle disease, which is the disease against which animals are vaccinated. The focus on Newcastle disease is justified by the fact that it has been reported to be the most devastating disease in poultry flocks, especially in traditional poultry farming.

CONCLUSION

The method of variable classification followed by the ascending hierarchical classification accomplishes the point of this investigation which is to set up the classification of traditional poultry farms in Togo. Three distinct classes emerged, each with its own specificities and with a satisfactory quality of projection of individuals. Overall, some aspects need to be improved in order to optimize the productivity of the poultry. These aspects concern the structure of the farm buildings, which to some extent affects the health situation of the farms. Moreover, it concerns the management of the poultry in terms of care of the chicks and the food supplements provided in addition to the resources picked up by the animals in the wild. Furthermore, the health aspect, more specifically Newcastle disease, is the main bottleneck and considerably limits the development of the flocks. It would therefore be interesting to further investigate Newcastle disease in Togo and its impact on the development of the traditional poultry sector in Togo.

DECLARATION

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

This work was carried out by the contribution of all authors. Koffi François-Xavier Dzogbema designed the protocol, collected and analyzed data, and draft the manuscript. Essodina Talaki validated the protocol, supervised the data collection and revised the manuscript. Abdul Waadjidou Tchabozire and Lamboni Lare collected data and revised the manuscript. Komlan B. Batawui and Balabadi B. Dao revised the manuscript. All authors read and approved the final version of the manuscript.

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Ethical considerations

Ethical issues (including plagiarism, consent to publish, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancy) have been checked by the authors.

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