



Characterization and typology of guinea pig breeding in the Department of Menoua-Western Region, Cameroon

Gina France Tobou Djoumessi^{1,2} · Fernand Tendonkeng³ · Laurette Blandine Mezajouck Kenfack² · Emile Miégoué³ · David Wauffo Fokom^{3,4} · Hervé Mubé Kuitche³ · Ulrich Darlin Tsafack Fondjeu³ · Nassim Moula¹ · Jean-Luc Hornick¹

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Abstract

A survey was carried out on 356 breeders in the Department of the Menoua Region of West Cameroon to characterize guinea pig breeding systems, using descriptive analysis, factorial analysis of multiple correspondences (AFCM), and upward hierarchical classification (CAH). Three types of guinea pig breeders have been identified, discriminated according to the size of the herd and the professional character of the breeding. Most of the housing systems were of the traditional type, free-ranging on the ground. Feed generally was based on fodders and food residues, and hygiene conditions were considered as good. The main difficulties faced by the farmers were mortalities resulting from diseases and predation. Guinea pig breeding was considered a source of income for households. Sales were year-round, at age-related prices. Development of guinea pig breeding in Cameroon would require better-addressing breeding techniques and the creation of economic interest groups to strengthen food security allowed by this activity.

Keywords Cameroon · Guinea pig breeders · Breeding · Typology

Introduction

In Cameroon, malnutrition is rampant in low-income families, causing stunting among children mainly due to a low intake of protein-rich foods in general in household diets, amounting to less than 10% of the contents of the

plate (WFP, 2016). According to the standards recommended by the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO), the amount of animal protein required for each individual is 42 kg/capita/year. In Cameroon, the meat sector contributes only 34 kg/per capita/per year, including

✉ Gina France Tobou Djoumessi
ginafdjoumessi@gmail.com

✉ Jean-Luc Hornick
jlhornick@uliege.be

Fernand Tendonkeng
ftendonkeng@gmail.com

Laurette Blandine Mezajouck Kenfack
mezajouglurette@yahoo.fr

Emile Miégoué
migoumile@yahoo.fr

David Wauffo Fokom
fokomwauffod@yahoo.fr

Hervé Mubé Kuitche
mubehervemkh@yahoo.com

Ulrich Darlin Tsafack Fondjeu
fondjeutud@yahoo.com

Nassim Moula
nassim.moula@uliege.be

¹ Faculty of Veterinary Medicine, Department of Veterinary Management of Animal Resources, Animal Nutrition in Tropical Environments, University of Liege-Belgium, Quartier Vallée 2 Avenue de Cureghem 10, 4000 Liege1, Belgium

² National School of Agro-Industrial Sciences, Department of Food Science and Nutrition, University of Ngaoundéré-Cameroon, P.O. BOX, 751, Ngaoundéré, Cameroon

³ Faculty of Agronomy and Agricultural Sciences, Department of Zootechnics, University of Dschang-Cameroon, P.O. BOX, 96, Dschang, Cameroon

⁴ Multipurpose Research Station, Institute of Agricultural Research for Development, Bangangté, Cameroon

game consumption; poultry contributes 2.4 kg/per capita/per year (FAO, 2005). Mini-breeding is likely to provide a partial answer to this problem, both as a source of protein and income for poor populations (Bislava et al., 2022; Imoru and Babadipe 2019). Of the small-livestock practices, guinea pig breeding is one of the most susceptible to improve the food security of vulnerable populations, especially in rural areas because of the ease with which it can be practiced (Imoru and Babadipe 2019; Koubaa et al. 2019; Djoumessi et al. 2020; Fokom et al., 2020; Faihun et al., 2017).

The guinea pig is a rodent belonging to the Caviidae family, native to Latin America. It is widely farmed in Cameroon, particularly in the western highlands and in the sub-humid forest zone of the Center and South (Ngou Ngoupayou et al., 1995; Chauca, 1995). Its breeding requires little space and low production costs. Moreover, the labor requirements to practice it are low. Children may be involved, for example, in the collection of fresh food from the fields and cleaning of dwellings (Yiva et al. 2014). Guinea pig breeding provides essential sources of protein for populations whose income does not allow easy access to meat from conventional livestock (Ogunniyi et al., 2015). It can help improve the livelihoods of families through job creation and economic growth, and food security through reducing the deficit in animal protein.

Despite these advantages, Niba et al. reported that in 2012 the majority of Cameroonian guinea pig breeders remained of the very traditional type, offering a deficient diet in both quality and quantity. Bislava et al. (2022) confirmed these observations and reported inadequate breeding housing, uncontrolled reproduction leading to high inbreeding rates, mortality from various causes and little identifiable by guinea pig breeders, and a poorly structured marketing chain. Imoru and Babadipe (2019) observed that these breeders have very low productivity, which tends to discourage breeders. Yet the breeding of guinea pigs occupies an undisputed place in the fight against food insecurity. The improvement of nutrition and economics for households

deserves further study to identify practices that could promote sustainable livestock as desired by the breeder.

It is, therefore, necessary to study the information currently available on guinea pig breeding, to put in relation the sociological parameters of the breeders with the techniques of management of breeding, and the objectives pursued by the breeding, to achieve a current typology in the Region.

Materials and methods

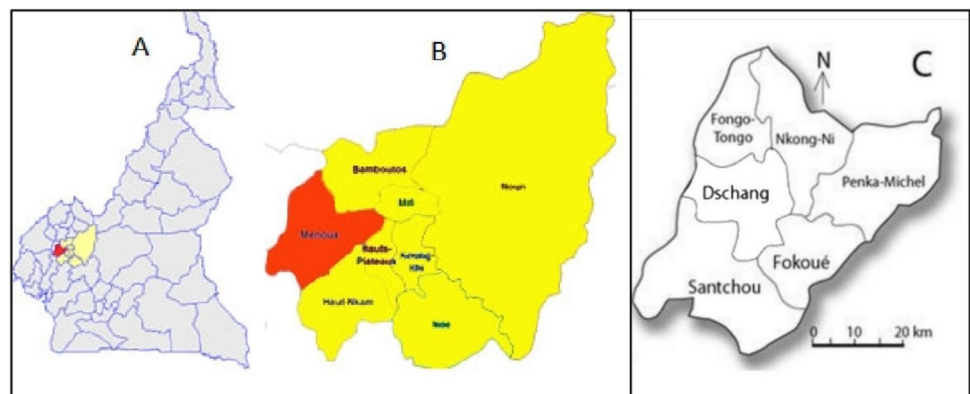
Comprehensive approach

The proposed method consisted of analyzing the social characteristics of guinea pig breeders, the interrelationships between practices, and the objectives of producers. Then, thanks to a multivariate analysis, the typology of the breeders was identified to characterize the link between the types of systems in the different localities.

Study environment

The survey was conducted from March 30, 2021, to May 25, 2021. A sample of 346 breeders was carried out in the Department of Menoua, located in the West Cameroon Region, with six districts (Dschang, Fongo-Tongo Nkong-Ni, Penka-Michel, Santchou) (Fig. 1). This Department is located between 5° 11' and 5° 40' North latitude and between 9° 49' and 10° 21' East longitude. Its area is 1384 km² (National Institute of Statistics, 2013) with a hilly terrain mainly made up of large areas: plateaus (between 1200 and 1600 m of altitude), plains (between 715 and 1000 m of altitude), and areas of altitude (between 1600 and 2200 m altitude). These areas are characterized by a long rainy season from mid-March to mid-November and a short dry season from mid-November to mid-March. The study population is estimated to be over 500,000 with a large urban population concentrated in the city of Dschang and the boroughs' headlands. The predominant economic activities are agriculture

Fig. 1 Geographic location of the study area. **A** Map of Cameroon (Yellow Region of the West, red Department of Menoua), **B** West Region (red Menoua), **C** Borough of Menoua. Source: author



and livestock. The Regional climate is commonly known as cool, dry tropical. The Menoua has landscapes of humid savannas and high-altitude dry forests. According to the Köppen-Geiger map, the climate is classified as Aw, that is, having an average annual temperature above 18 degrees and with precipitation above annual evaporation. The average temperature is 20.4 °C and the dry season lasts 5 months from mid-November to mid-March. The average rainfall is 1936 mm, with the wettest months of August and September and the driest months of January and December (Climate-Data.org. 2016).

Material

The questionnaire addressed to the breeders had a majority of multiple-choice questions and included several groups of statements (social data, livestock techniques, zootechnical information, housing, food, prophylaxis, and profitability). The proposed answers were chosen during a preliminary investigation and discussions with the breeders.

Sampling

Once the boroughs targeted, the sub-prefects, the Departmental delegate, and the district delegates were met, to present the project and obtain their consent to conduct this survey in their work area. With their agreement, the meetings were planned with the breeders who practice guinea pig breeding. The owners of guinea pigs were solicited through the zootechnical centers to obtain their support for the project. A total of 346 guinea pig breeders were investigated.

Data collection methods

Questionnaire

The questionnaire presented most multiple-choice questions and included several groups of statements. The proposed responses were chosen during the preliminary survey, during discussions with farmers.

Social data: This section collected information on the socio-professional characteristics of wine growers.

Breeding techniques: We evaluated the size of the herd, the different species raised, the type and importance of the workforce employed, and the monitoring of the breeding.

Zootechnical information: This section covered aspects relating to the production and reproduction of guinea pigs.

Housing: This part of the survey aimed to collect information on the types of housing used, the constituent materials, and the energy sources used.

Feed: Questions were asked about the nature of the food, the availability of water, and the rate of rationing.

Prophylaxis: Information was obtained on the prevention of diseases and the assistance or not of veterinarians or substitutes.

Rentability: Some economic aspects such as the prices and the criterion of sale of the animals and the type of customer were collected.

Investigation

A preliminary survey was carried out on 10 breeders. It helped refine the questionnaires, better identify the questions asked validate the approach to be taken during the interviews, and finally ensure that most of the producers' difficulties could be identified.

The actual survey phase consisted of visiting each farm and talking to the farmers to collect information based on the questionnaire. Breeders were identified using the non-probability method snowball (Johnston and Sabin 2010). The first breeders surveyed informed the investigators about the existence of other breeders who in turn became additional informants. All persons declared to own at least one pair (male and female) and an average of ten animals were considered as breeders. To make us understand the breeders, the questionnaire written in French was translated orally into the local language if necessary. The identification of breeding areas was carried out with the help of block leaders. In addition to interviews, direct observations were focused on kept animals (Tables 1, 2, 3, 4, 5, 6, 7 and 8).

Statistical analysis

The collected data were stored in a database designed in Excel. Statistical analyses were performed using SAS 9.4 and R (version 3.0.1). The descriptive statistical analyses and the independence test were carried out using the SAS software; the Multiple Correspondence Analysis (ACM) was carried out with R, to establish the typology guinea pigs breeders of (package FactorMineR, functions MCA, and hierarchical clustering on principle components) (Rennes, France). The variables used for the MFA are presented in Table 9.

The typological analysis was performed to group individuals into segments based on similarities.

Results

Descriptive statistical analysis

Draw-up uni- or bi-variate profiles of guinea pig breeders were obtained from surveys carried out among the 346

Table 1 Social characteristics of guinea pig breeders ($n=346$) in the Menoua Department, West Cameroon Region

Variables	Modalities	Percentages	$P > \chi^2$
Localities	Fongo-Tongo	13.0	0.002
	Nkong-Ni	17.9	
	Dschang	25.4	
	Santchou	14.6	
	Penka-Michel	16.9	
	Fokoué	12.2	
Sex	Male	45.7	0.002
	Female	54.3	
Age	15–24	29.8	0.001
	25–34	29.5	
	35–44	18.5	
	45+	22.2	
Marital status	Single	55.8	0.001
	Married	34.7	
	Widowed	9.5	
Level of study	None	19.9	0.002
	Primary	27.7	
	Secondary	29.6	
	Superior	22.8	
Year of experience	None	12.7	0.001
	1–5	46.8	
	6–10	37.6	
	More than 10 years	2.9	
Main activity	No activity	6.9	0.001
	Farmer	35.3	
	Shopkeeper	11.3	
	Breeder	4.6	
	Public employee	9.8	
	Student	32.1	

breeders of the Department of Menoua, West Cameroon Region.

Social characteristics of breeders

The main social characteristics of livestock producers are presented in Table 1. The localities surveyed contributed fairly and consistently to the collection of data. However, a higher proportion—one-quarter—of breeders from the community of Dschang contributed to the study ($P < 0.002$). With just over 54% of respondents, women were more represented ($P = 0.002$). The age groups were represented in a balanced way by 10-year intervals between 15 and 45 years and for persons over 45 years of age. The investigation revealed that single breeders were met more frequently ($P < 0.001$). In addition, more than 80% of the respondents reported an experience in the breeding of guinea pigs between 1 and 10 years. Although all levels of education were represented, those who completed undergraduate and graduate studies were the majority ($P < 0.002$). Finally, two-thirds of breeders shared a balanced status of farmer or student ($P < 0.001$).

General characteristics of breeders

The answers given by the respondents concerning the characteristics of guinea pig breeding are presented in Table 2. Only about 4% of farmers had paid labor. One-third of farmers operated alone ($P < 0.002$). For about half of the farmers, guinea pig breeding was carried out for mixed purposes of manuring, consumption, and marketing. Just over a quarter of that was just marketing. Nearly 50 breeders have reported breeding to supply university research laboratories.

The achievement of the objectives of the farm faced several constraints but the financial difficulties to ensure certain stages (production, veterinary care) were cited as a priority for almost every other consideration, although differences were observed between boroughs ($P < 0.007$) (Fig. 2).

Table 2 General characteristics of guinea pig breeders ($n=346$) in the Menoua Department, West Cameroon Region

Variables	Modalities	Percentages	$P > \chi^2$
Objective of livestock breeding	Own consumption	6.6	0.001
	Sale	26.3	
	Own consumption + sale + manure	53.2	
	Scientific research	13.9	
Labor force	Not remunerated (family)	61.3	0.002
	Remunerated	3.5	
	Single breeder	35.2	
First main constraint mentioned	Sanitary ¹	21.1	0.001
	Robberies	19.4	
	Predation	14.5	
	Financial	45.0	

¹Some related to health conditions

Table 3 Guinea pig breeding systems ($n=346$) of the Menoua Department, West Cameroon Region

Modalities	Percentages	$P < \chi^2$
Ground freedom	49.7	0.002
Moving floor cage	4.1	
Cage	46.2	

Table 4 Feed rationing practice by guinea pig farmers ($n=346$) in the Menoua Department, West Cameroon Region

Modalities	Percentages	$P > \chi^2$
Complete concentrate	2.9	<0.001
Forage	3.8	
Forage + concentrate	17.3	
Forage + food residues	60.7	
Forage + concentrate + food residues	15.3	

Table 5 Main suspected causes of mortality of guinea pig breeders ($n=346$) in the Menoua Department, West Cameroon Region

Modalities	Percentages	$P > \chi^2$
Disease	26.0	<0.001
Dietary deficiency	23.4	
Animal predation	9.2	
Stress	20.6	
Unknown	20.8	

Table 6 Main suspected diseases encountered by breeders of guinea pigs ($n=346$) in the Department of Menoua, West Cameroon Region

Modalities	Percentages	$P > \chi^2$
Dermatoses	25.7	<0.001
Coccidiosis	19.4	
Verminous	13.6	
Don't know	41.3	

Table 7 Regularity of cleaning of the breeders by the breeders of guinea pigs ($n=346$) of the Department of Menoua, West Cameroon Region

Modalities	Percentages	$P > \chi^2$
3 times per week	12.1	<0.001
2 times a week	16.8	
1 time per week	24.6	
1 time in 2 week	26.0	
No cleaning ¹	20.5	

¹No litter**Table 8** Types of guinea pig clientele ($n=346$) in the Menoua Department, West Cameroon Region

Modalities	Percentages	$P > \chi^2$
Breeders	22.3	<0.001
Shopkeeper	27.4	
Restaurants	30.6	
Private person	19.7	

Size classes of livestock on breeders

The approximately reported flock size classes ranged from 10 to 160 animals (Fig. 3). Two-thirds of respondents ($P < 0.001$) reported having a herd of between 10 and 60 animals, purchased from animals on their own and in the markets.

Breeding system

Three types of breeding systems have been identified, which are extensive in total ground freedom (Fig. 4), semi-intensive in mobile cages (Fig. 5), and intensive in cages (Fig. 6) (Table 3). The cages were made of wire mesh and the moving cages with local materials such as clay, planks, bamboo, and plywood.

Figure 7 shows the distribution of the main constraints of breeding guinea pigs by the breeding system. In a cage and free on the ground, financial constraints were the first one, predation being the first cited for the mobile cage (Fischer's exact test; $P < 0.05$). In this category, however, it should be remembered that the number concerned is small ($n = 14$).

Guinea pig feed

Guinea pigs were fed varied diets that included complete concentrates, fresh or preserved forage forages, and kitchen residues (Table 4). Multi-ingredient diets were largely the majority (> 90% of cases) ($P < 0.001$). Of these, the mixture of fodder and food residues accounted for two-thirds of cases.

Food distribution averaged two to three times a day. Feed was placed on the floors or hung in the cage. Forage was harvested daily in fields, roadsides, and swampy areas during the drought because very few farmers (21.4%) had forage fields ($P < 0.001$). *Pennisetum purpureum* remained the forage species mainly used by breeders because of its availability. Almost 30% of farmers did not provide drinking water to animals ($P < 0.001$).

Table 9 List of variables used for the MFA

Variables	Modalities
Localities	Fongo-Tongo
	Nkong-Ni
	Dschang
	Santchou
	Penka-Michel
Sex	Fokoue
	Male
Age	Female
	15–24
	25–34
	35–44
Education	45+
	None
	Primary
	Secondary
Breeding experience	Superior
	None
	1–5
	6–10
Main activities	More than 10 years
	None
	Farmer
	Shopkeeper
	Breeder
Breeding objectives	Public employee
	Students
	Own consumption
	Sale
Labor	Own consumption + sale + manure
	Scientific research
	Not remunerated (family)
Main breeding constraint	Remunerated
	Breeder
	Sanitary
	Robberies
Cleaning frequency	Predation
	Financial
	3 times per week
	2 times a week
	1 time per week
Veterinary assistance	1time in 2 week
	No cleaning ¹
Flock size	Yes
	No
	10–60
Breeding system	61–110
	111–160
	Cage
	Ground freedom
	Moving floor cage

Table 9 (continued)

Variables	Modalities
Presence of mortality	Yes
	No
Deworming breeding	Yes
	No
Type of feeding	Concentrate
	Forage
	Concentrate + forage
	Forage + food residues
	Concentrate + forage + Food residues

Distributed green forages were generally assumed to be a sufficient source of water for the animals.

Suspected causes of mortality and their frequency in livestock

Mortalities presumed to be related to diseases and dietary deficiencies accounted for half of the reports. In five cases, livestock producers could not identify causes of mortality ($P < 0.001$) (Table 5).

Main reported diseases suspected by the breeders

The results reveal that several diseases were suspected by the breeders ($P < 0.001$) (Table 6). The main disease, as defined by the breeder, was cutaneous (dermatoses), then digestive (coccidiosis), or verminous (digestive worms). A third of the breeders practiced self-medication, and the others administered no care to the sick guinea pigs.

Livestock hygiene

The monitoring of livestock hygiene was not regular (Table 7). The majority of farmers cleaned the breeders regardless of the district. The frequency of cleaning varies from one farm to another. Breeders engaged in cleaning three times a week had a relatively small proportion (12.1%). The less frequent cleaning was bimonthly and no cleaning was observed in one-fifth of the cases but due to lack of litter.

Nature of customers

Table 8 reveals that market demand came from the various links in the value chain of guinea pig breeding, with customers being breeders, traders, restaurants, or individuals.

Fig. 2 Frequency of the main constraints reported by breeders ($n=346$), according to the Departments of Menoua, West Cameroon Region

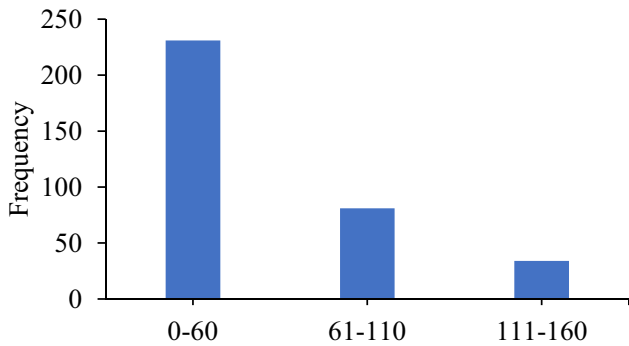
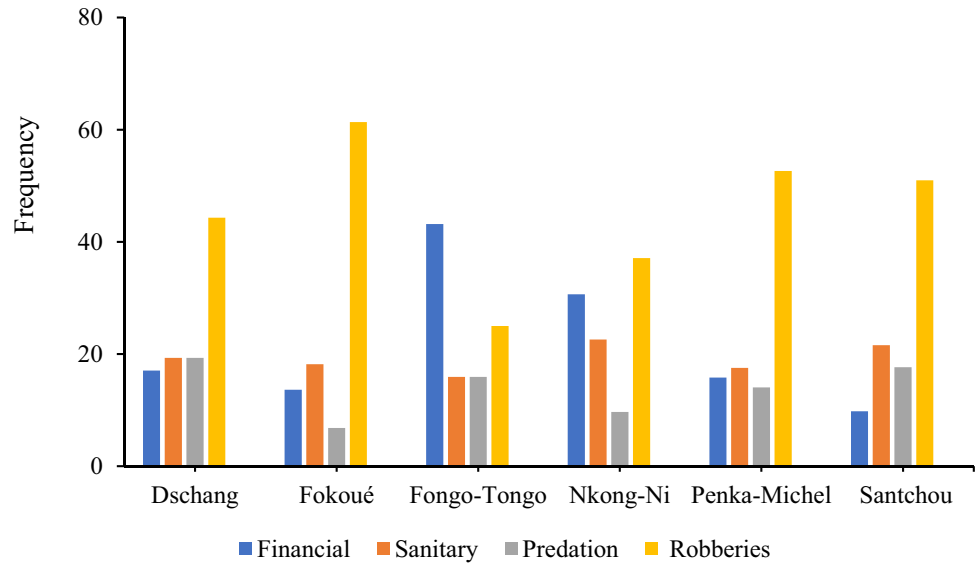


Fig. 3 Classes of average livestock numbers reported by guinea pig farmers ($n=346$) in the Menoua Department, West Cameroon Region



Fig. 5 Moving floor cage



Fig. 4 Ground freedom

Selling prices of animals

The selling price of the animals varied depending on whether the animal was young or adult (Fig. 8). The results showed that almost 90% of the respondents sold animals between 4 and 7 euros ($P < 0.003$).

Typology of breeders

The MCA was applied to 21 variables (Table 9) composed of 69 modalities contributing to the total inertia of the first 3 axes of 17.96%. Figure 9 reports the statistical significance of the links of the various variables studied with the 3 axes of the ACM. Figure 10 shows the 3 groups of guinea pig breeders in the Department of Menoua-Cameroon.



Fig. 6 Cage

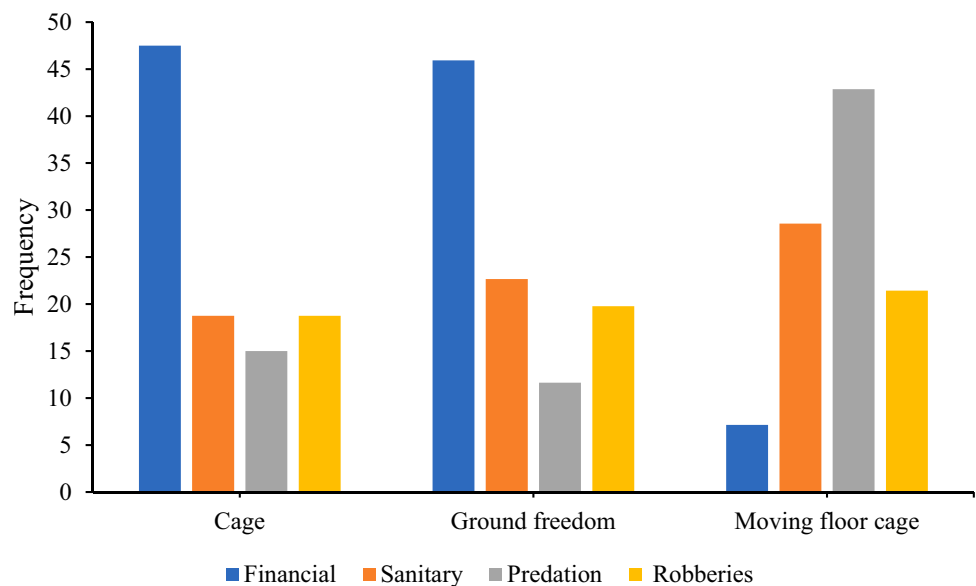
As reported in Fig. 9, axis 1 represents 6.91% of the total inertia. It is more correlated with the type of feeding and breeder experience. Axis 2 reports 6.23% of the total inertia. It describes mainly the livestock size and type of feeding.

The existing correlations between the studied variables and the first two MFA axes are shown in Fig. 9.

Group 1 consisted of 274 breeders. Most of them (89%) declared not having knowledge about guinea pig diseases. Three-quarter used familial labor, used various sources of feeds in small flocks. However, this group did not differ consistently out of the general population.

Group 2 was composed of 62 breeders. They were characterized by offering animal diets made of forages and kitchen wastes. Most of these responders worked by themselves, and

Fig. 7 Citation frequency of the main constraints to breeding guinea pigs, by breeding system, in the Department of Menoua, West Cameroon Region ($n=346$)



declared having knowledge about animal diseases. Half of them possessed large flocks, i.e., a higher proportion than in the general population. Almost all of them raised animals in cages (vs about 50% in the general population).

Group 3 was very characteristic but counted only as 10 breeders. They differed from the general population in that they used concentrate feeds, they had more than 10 years of experience, and they employed paid staff. Livestock production was their primary activity. They were more educated than the general population. All declared having knowledge about animal diseases and the main declared disease was dermatosis. Middle-aged and single, they raised animals free on the ground. Their activity was intended for self-consumption and sales. Finally, when asked if the breeders were members of a professional structure, none of them answered in the affirmative.

Discussion

This study identified several contemporary characteristics and established a typology of guinea pig breeders in a Region of Cameroon known for breeding guinea pigs (Niba et al., 2012).

Socio-economic profile and farm characteristics of the farmers surveyed

It follows from the investigations that guinea pig breeding is conducted more specifically in the Department of Menoua. It is practiced in both urban (Dschang, Santchou) and rural (Nkong-Ni, Fokoué, Fongo-Tongo, Penka-Michel) environments. This observation is similar to that made by Faihun et al. (2017) in Benin and Kouakou et al. (2020) in

Fig. 8 Frequency of selling price per guinea pig in the Menoua Department, West Cameroon Region

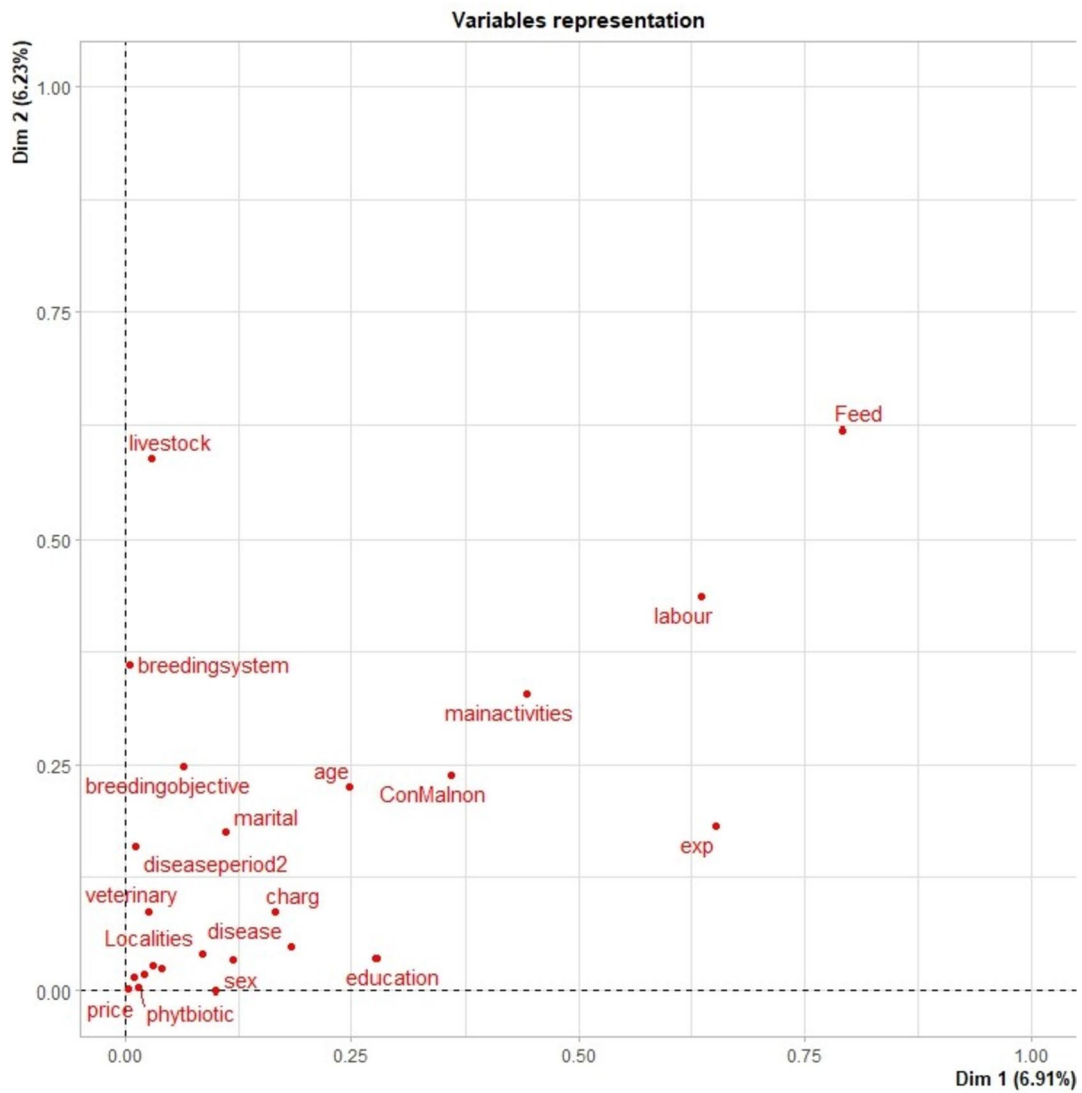
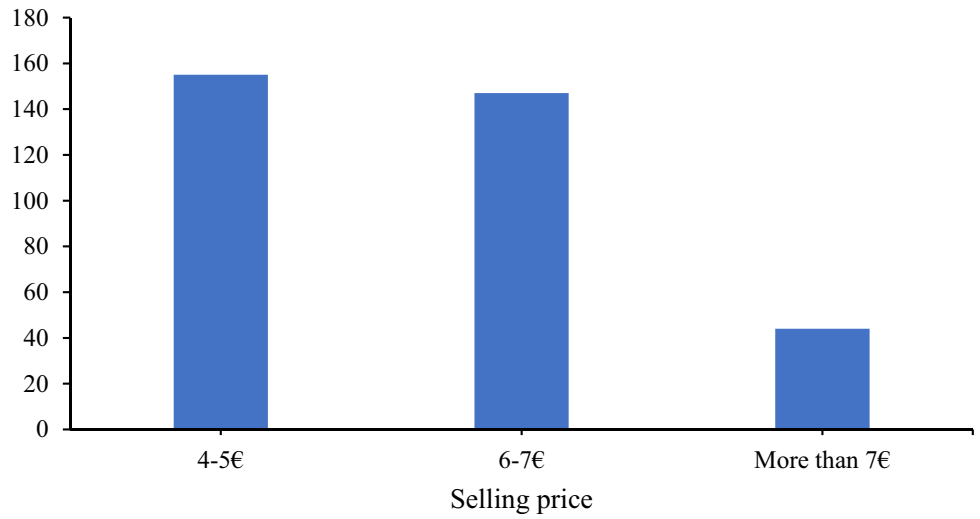


Fig. 9 Representation of modalities of the MCA on axes 1 and 2

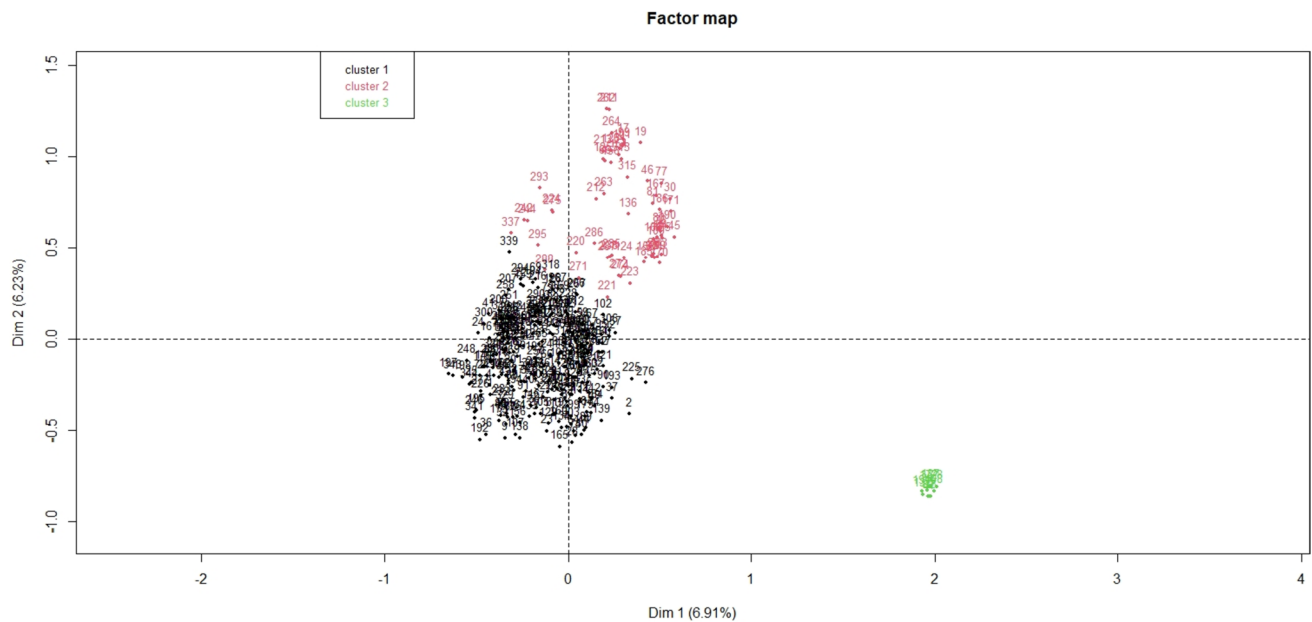


Fig. 10 Graphical representation of groups (after Hierarchical Upward Classification (CAH))

Côte d’Ivoire. The geographical location of the guinea pig breeders reveals a higher proportion coming from the locality of Dschang. This phenomenon is explained by the higher population and density of inhabitants of this locality, which encouraged the meeting of breeders.

Guinea pig breeding was practiced in a balanced way by men and women of all ages, from adolescence to late adulthood (over 45 years), suggesting a non-discriminatory and unbiased activity within the population. Yiva et al. (2014) and Kouakou et al. (2015) reported that in the West Cameroonian highlands, and the Yamoussoukro district, most of guinea pigs were raised by adolescents. On the other hand, contrary to our work, Maass et al., (2012) in the DRC showed that more than 75% of the guinea pig breeders surveyed were male. According to the author, men are responsible for managing livestock, and women with very few property rights usually accompany men in their various activities. On the other hand, in the present study area, the data suggest that women are more involved in this breeding, which seems to be a new element.

More than 80% of the respondents reported having experience in guinea pig breeding only between 1 and 10 years. These statements seem paradoxical given the seniority of the practice, already reported in 1994 by Ngou Ngoupayou et al., (1995). Diffusion of the activity could be at work recently and reflect an attempt to fight against the low GDP growth in the country, compared to the observed global average (<https://ourworldindata.org/economic-growth>). It is unlikely that they will reflect a rapid abandonment of livestock breeding once it is undertaken since the distribution of activity is homogeneous across the age of the breeders.

Respondents had a very varied level of education, ranging from lack of study to university level. This result confirms the representativeness of different social strata, by age and level of study, within the breeders practicing guinea pig breeding in Cameroon. On the other hand, more than a third of the people were engaged in agriculture as their main activity, with another third being represented by the student community. According to the respondents, guinea pig breeding is a multipurpose activity that can be used to generate manure for crops, to ensure material satisfaction of school needs, and incidentally to be carried out in parallel with other activities, especially during retirement. Niba et al. (2012) reported that in Cameroon guinea pig breeding is a secondary family activity practiced by low-income smallholder farmers.

The main aim of the guinea pig breeders surveyed was to sell and consume their food to meet their basic needs. Indeed, the socio-economic context of the area and the low purchasing power do not allow the beneficiaries to easily obtain other sources of animal protein. These uses differ from those found in Western countries where guinea pigs are not used as a source of protein but as pets and experimental animals (Maass et al., 2012).

An unexpected finding was that almost 50 farmers reported breeding to supply university research laboratories. This could be explained as a local situation, which may arise when research institutions are present in the study area. This is the case, for example, of the University of Dschang or Yaoundé 1.

A great majority of the breeders had unpaid family labor and one-third worked alone. Mini-breeding in general and

guinea pig breeding in particular require little workspace and are easy to practice individually (Handlos, 2018). The exceptional nature of the remuneration is associated with the few breeders with multiple activities and the civil servants, who therefore have to develop an economic activity around guinea pig breeding.

Guinea pig breeding was practiced mostly in freedom on the ground, a livestock system where farmers do not use livestock infrastructure and where the animals live in housing. Pamo et al. (2005) in Cameroon and Metre et al. (2019), in RD Congo, reported that guinea pigs are generally reared freely, on the ground, in clay boxes as a kitchen and where furniture and utensils serve as hiding places for animals. In addition, half of the breeders were cage breeders, resulting in infrastructure costs and some professionalization.

Guinea pigs were systematically reared without age-sex separation (personal observations) demonstrating no reproductive age. Low productivity, lower animal resistance, and economic losses, all due to high inbreeding rates, are therefore likely. Such a phenomenon was reported by Kouakou et al. (2020) in Côte d'Ivoire. Most breeders (60.7%) fed guinea pigs with kitchen residues associated with fresh fodder (*Pennisetum purpureum*, *Trypsacum laxum*...), and the absence of fodder was exceptionally observed. These results corroborate those of Kouakou et al. (2020) and Umba et al. (2017), which showed that the diet of guinea pigs in rural areas consists mainly of this type of ingredient (80%). Even in an urban environment, as encountered in the capital of the Department, it is likely that the breeders have quite easily forage resources.

Watering was available in most breeders (71.4%). Despite the importance of the water supply of guinea pigs (Fuss, 2002), this aspect was not taken into account in more than a quarter of breeders, while lack of water can lead to pronounced negative effects on animal performance, even if fresh fodder is distributed. Awareness-raising work should be implemented at this level.

Internal disentanglement was little practiced and even absent in 82% of breeders. This is likely justified by the high cost of pesticides and the lack of awareness of the importance of the practice. These results could also help to explain the mortality reported as the first constraint by one-fifth of the breeders. On the other hand, more than half of the respondents (73.41%) were unable to cite diseases encountered in livestock. Among other breeders, the main reported diseases were dermatological. Bislava et al. (2022) and Yiva et al. (2014) reported that the most common pathologies in guinea pig breeding are dermatoses and salmonellosis. Likely, young animals are particularly affected by diseases.

Most of the respondents sold each animal from 4 to 5 euros (12.7% to more than 7 euros). Taking into account an average farm size of 54 animals (weighted average from our results, see Fig. 3), since the majority (90%) of the animals

are intended for sale and their presence in the farm is of the order of 4 months, it can be estimated that the income generated by a farm ($54 \times 90\% \times 12 \text{ months} / 4 \times 5 \text{ €}$) would be around 729 euros per year, an amount that alone would allow exceeding the poverty line.

The typology revealed that a low part of the general variance (13.14%) was explained by the two first axes of the ACM, suggesting a high variability of the practices studied. The first group could be described as practicing mainly guinea pig breeding as a simple familial activity, while the breeders from group 2 could be considered as practicing improved familial breeding in cages, with knowledge about animal diseases, large flocks, and the use of forages. They could be considered as professional breeders.

Group 3 consisted of breeders with high levels of education and more than 10 years of breeding experience, raising animals on the floor with concentrates alone. However, they proved no specific professional activity although they used remunerated people. It is assumed that this minor category of the people surveyed had multidisciplinary professional activities and guinea pig breeding was one of the income sources.

As a whole, the guinea pig breeders in the study area practiced an activity that is not strongly socially integrated, as none of them belonged to a Common Interest Group (CIG).

Conclusion

Guinea pig breeding in the Menoua Department of Cameroon is essentially family-based and extensive, with a low degree of mastery of production techniques. The practice seems to be widespread among the various social strata of the population, given the interest of the species in generating a basic income.

To strengthen the development of guinea pig breeding in Cameroon, breeders should be encouraged to form common interest groups within which training could be provided, including basic technical tools.

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Author contribution G. F. D. T. generated the research idea, designed the study, designed and conducted the data collection and analysis, interpreted the results, and wrote the manuscript. J. L. H. participated in the design of the study, analysis, and reading of the manuscript. F. T. participated in the design of the study and reading of the manuscript. L.

B. M. K., E. M., and H. M. participated in the overall design process. D. W. F. and U. D. T. F. participated in the design of the survey form and in conducting the data collection. N. M. participated in the data analysis and writing of the manuscript. All authors read and approved the final manuscript.

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Data availability The data will be available from the reviewers upon request.

Declarations

Ethics approval Not applicable.

Consent to participate Before the start of the survey, breeders were asked if they would consent to participate.

Consent for publication Not applicable.

Conflict of interest The authors declare no competing interests.

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