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Characterization of Indigenous Duck Production Systems in the Madarounfa Department, Niger

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Abstract

The local duck is a type of poultry whose farming remains rudimentary in Niger. This study aims to characterize the local duck production system in the Madarounfa Department, located in the Maradi Region of Niger. A survey was conducted among 100 farmers across five municipalities in the Madarounfa Department. The results show that 81% of producers practice mixed farming with temporary free-ranging. About 42% of respondents have 2 to 5 years of experience, and 61% prefer ducks with black-and-white plumage. The majority of farmers (83%) keep ten ducks or fewer. Farming infrastructure includes night shelters (89%), waterers (95%), feeders (97%), and ponds (55%). The main causes of duck mortality are diseases (27%), domestic accidents (17%), lack of feed (17%), and road traffic (16%). Regarding reproduction, the age at first laying is approximately 360–365 days. A hen lays between 16 and 20 eggs per cycle, with two laying cycles per year. Natural incubation lasts between 35 and 40 days, with a hatching rate of up to 90%. However, only 50% of ducklings survive. The rainy season is the most favorable for hatching. To improve productivity, interventions are needed in housing conditions, feed management, and disease prevention.

Keywords: Duck farming; Local duck; Niger; Mortality; Reproduction

1. Introduction

In Niger, livestock farming contributes 15% to household income and 25% to food requirements [1]. To strengthen food security, the government implemented a strategy in 2012 to promote short-cycle production systems, particularly poultry and fish farming [2]. Traditional poultry farming accounts for 98% of the national poultry stock, compared to only 2% for modern poultry systems [3]. The national poultry population increased from 16,978,445 in 2010 to 19,502,605 in 2017.

Despite the importance of poultry farming, most studies have focused on local chickens and guinea fowls, analyzing their feeding practices, zootechnical performance, and the introduction of exotic breeds ([4]; [5]; [6]). No specific study has been conducted on local duck farming, even though it represents 4% of the poultry population [3] and is known for its superior growth performance and higher resistance to avian diseases compared to other poultry species [7].

This study aims to characterize the local duck production system in the Madarounfa department through a field survey, in order to contribute to the development and promotion of this type of farming.

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2. Methodology

2.1. Study Area Description

The Madarounfa Department, located in the Maradi Region of Niger, covers an area of 3,500 km², representing 9% of the region's total surface. It is bordered by the departments of Guidan Roumdji and Aguié, and shares a 100 km border with Nigeria. Administratively, it consists of six municipalities: one urban (Madarounfa) and five rural (Dan Issa, Djiratawa, Sarkin Yama, Gabi, and Safo) (Figure 1). The population is estimated at over 597,000 inhabitants [8], with a high population density of 170 inhabitants per square kilometer. This rapid demographic growth is attributed to socio-cultural and economic factors.

The Sudanian-Sahelian climate is characterized by a rainy season from June to October, with annual precipitation ranging between 400 and 800 mm, and a long dry season from November to May. The department is crossed by temporary watercourses and includes permanent water bodies such as Lake Madarounfa and the Kourfi Koura pond.

The local economy is mainly based on agriculture (millet, sorghum, cowpea, groundnut) and livestock farming (cattle, sheep, goats, poultry). Fishing, although traditional, plays an important role in the local livelihood. In addition, the cultivation of *Moringa oleifera* is expanding and has become a significant source of income for many residents.

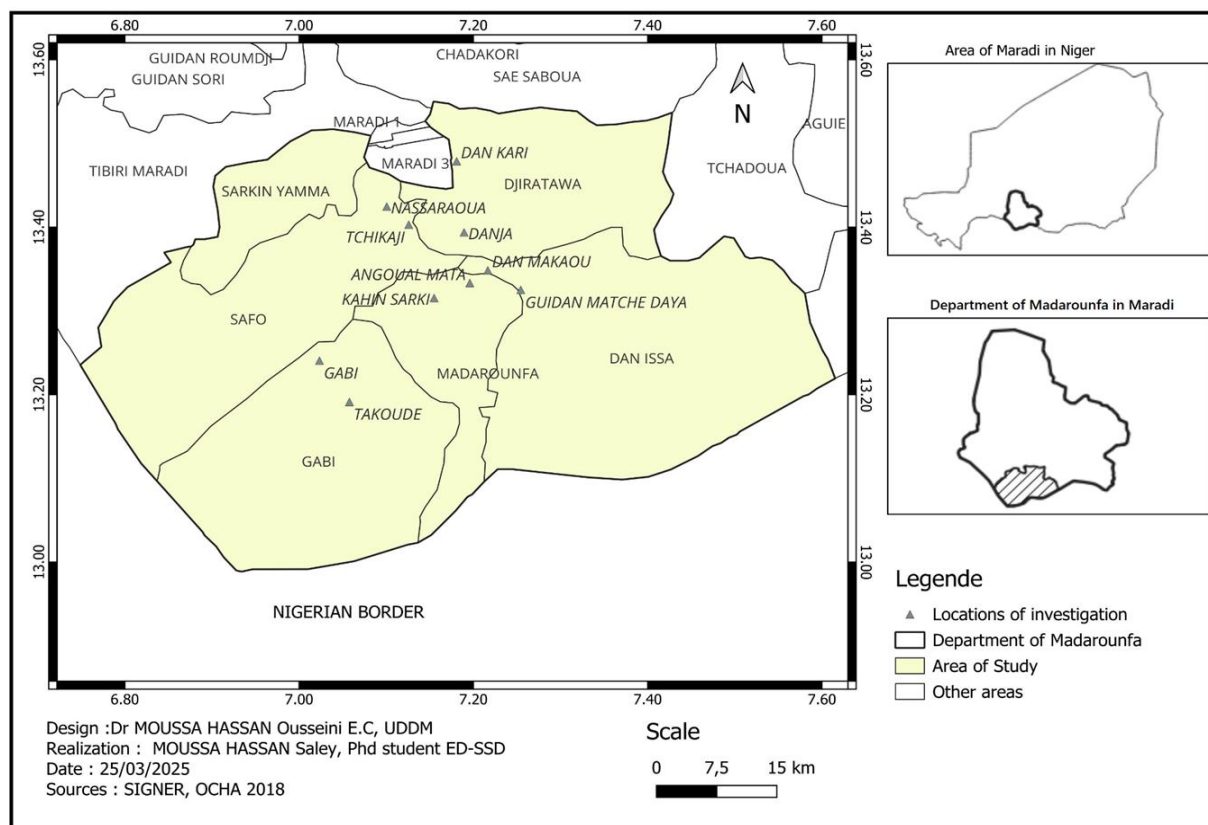


Figure 1 Study area map showing the location of the Madarounfa Department

2.2. Survey

A field survey was conducted to collect data on local duck farming, including poultry production systems, infrastructure, disease occurrence, health management, and production performance (number of eggs per female per cycle, number of laying cycles per year, hatching rate, and duckling survival rate). Data were gathered using a structured questionnaire.

2.2.1. Selection of Villages

The survey was carried out in five municipalities of the Madarounfa Department: one urban municipality (Madarounfa) and four rural municipalities (Dan Issa, Djiratawa, Gabi, and Safo) (Table 1, Figure 1). In collaboration with the

Departmental Directorate of Livestock, two villages were selected from each municipality. The selection criteria included a significant concentration of duck farmers and a minimum distance of 15 km between villages.

2.2.2. Selection of Farmers

In each selected village, 10 farmers were interviewed, totaling 100 duck breeders (Table 1). The selection of respondents was facilitated by village chiefs, who had in-depth knowledge of the local farming population.

Table 1 Distribution of surveyed duck farms across selected localities in the Madarounfa Department

Municipality	Villages	Number of producers surveyed
Gabi	Takoudé	10
	Gabi	10
Djirataoua	Danja	10
	Dan karé	10
Dan Issa	Dan makaou	10
	Guétso	10
Safo	Nassarawa	10
	Tchikaji	10
Madarounfa	Ougouwa mata	10
	kayi	10
Total	10	100

2.3. Data Analysis

The data were entered into Excel 2013 and then processed using SPSS version 26 for descriptive analysis.

3. Results

3.1. Socioeconomic Characteristics of Duck Producers

Table 2 presents the socioeconomic characteristics of duck producers in the Madarounfa department. The study revealed that local duck farming is predominantly a male activity, representing 70% of the cases. Regarding the producers' roles within their families, the majority are heads of households (58%), followed by spouses (31%).

The age distribution analysis shows that 43% of respondents are between 30 and 50 years old. In terms of marital status, more than half of the local duck farmers are married (87%).

The study also indicated that the primary occupation of 82% of local duck producers is agriculture. The main objectives of engaging in duck farming are self-consumption (53%) and income generation (38%).

In terms of educational level, 44% of the producers are literate in Arabic. Furthermore, 39% of the respondents have followed a formal education path, with 21% at the primary level, 14% at the secondary level, and 4% at the high school level. A significant proportion—17%—of respondents are illiterate.

These results highlight the socioeconomic profile of duck producers in the region, underlining the importance of duck farming in their livelihood strategies and the challenges related to education and training.

Table 2 Characteristics of Duck Producers in the Madarounfa Department

Parameters and Variables	Number	Frequency (%)
Gender of respondents		
Women	30	30%
Men	70	70%
Total	100	100%
Family role of the duck producers		
Wife	31	
Children	11	
Head of household	58	
Total	100	100%
Marital status of the duck producers		
Single	9	9%
Divorced	2	2%
Widow(er)	2	2%
Married	87	87%
Total	100	100%
Age of the duck producers		
< 30 years	17	17%
30-50 years	43	43%
51-70 years	34	34%
> 70 years	6	6%
Total	100	100%
Main activities of the duck producers		
Agriculture	82	82%
Trade	14	14%
Livestock farming	2	2%
Total	100	100%
Objectives of duck farming		
Sel-consumption	53	53%
Sale	38	38%
Gift	8	8%
Distraction	1	1%
Total	100	100%
Education level of the duck producers		
Islamic school	44	44%
Primary school	21	21%

Secondary school	14	14%
High school	4	4%
Illiterate	17	17%
Total	100	100%

3.2. Management of Duck Farming

3.2.1. Systems and Management of Local Duck Breed Farming

Table 3 presents the farming systems as well as the persons responsible for managing the ducks in the Madarounfa department. The majority of ducks (81%) are raised under a semi-scavenging system, meaning they roam freely during the day (Figure 2) but are provided with an enclosure at night along with supplementary feeding in the evening. The flock management is mainly handled by the mother of the household (56%) and the children (34%).

Table 3 Farming System and Persons Responsible for Duck Management

Parameters/Variables	Number	Frequency (%)
Farming system		
Captivity	6	6
Scavenging	13	13
Semi-scavenging	81	81
Total	100	100
Responsible for flock management		
Father	10	10
Mother	56	56
Children	34	34
Total	100	100



Figure 2 Ducks scavenging in wastewater

3.2.2. Duration of Practice and Plumage Color Preference in Local Ducks

Table 4 presents the preferred plumage colors of ducks according to the producers, along with the reasons behind these preferences. The majority of producers (61%) prefer a black-and-white bicolor plumage, while 29% favor white plumage (Figure 3). This study revealed that plumage preferences are based on four main motivations. The dominant reason is personal preference (81%), followed by market-related criteria (12%), tradition (2%), and religion (2%), as shown in Table 4.

Table 4 Plumage Color Preferences and Reasons for Preference

Parameters and variables	Number	Frequency (%)
Plumage color preference		
White	29	29
Black-White	61	61
No preference	10	10
Total	100	100
Reason for the color preference		
Tradition	2	2
Personal preference	81	81
Sale	12	12
Religion	2	2
No preference	3	3
Total	100	100



Figure 3 Plumage Colors Observed

Figure 4 illustrates the experience of duck farmers in the Madarounfa department. It shows that 42% of the farmers have between 2 and 5 years of experience in this activity.

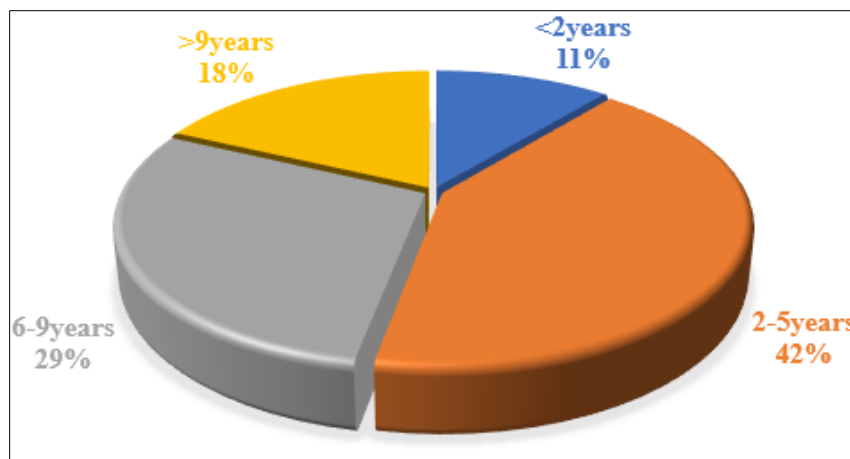


Figure 4 Experience in Duck Farming

3.2.3. Duck Flock Size

Figure 5 presents the experience of duck farmers in the Madarounfa department. It shows that 42% of the farmers have between 2 and 5 years of experience in this activity.

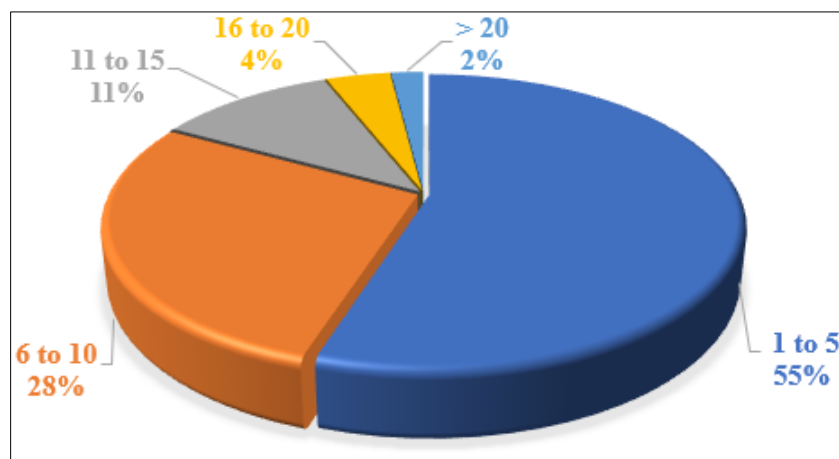


Figure 5 Number of Ducks per Producer in the Madarounfa Department

3.2.4. Housing and Equipment for Raising Local Duck Breeds

Table 5 presents the types of housing and management systems used by duck farmers in the Madarounfa department. It shows that 89% of producers provide night shelters for their ducks, while 11% do not. These shelters are constructed from various materials such as clay, wire mesh, and other locally available resources. The majority of shelters are made of banco (mud brick), small in size, and some feature multi-level structures (Figures 6 and 7).

Furthermore, 95% of producers provide drinking troughs and 97% provide feeders for feeding the ducks (Figures 8 and 9). The drinking troughs are generally made from cut barrels or clay containers, while the feeders are often made of plastic or metal trays (Figures 10 and 11).

Since ducks are aquatic birds, access to water is essential for their reproduction and development. Thus, 55% of local duck farmers provide bathtubs crafted either from clay (Figure 10) or cement (Figure 11).

Table 5 Housing and Equipment for Duck Management

Parameters and variables	Number	Frequency (%)
Night shelter		
Present	89	89%
Absent	11	11%
Total	100	100%
Drinker		
Present	95	95%
Absent	5	5%
Total	100	100%
Feeder		
Present	97	97%
Absent	3	3%
Total	100	100%
Bathtub		
Present	55	55%
Absent	45	45%
Total	100	100%

**Figure 6** Multi-level night shelter made of clay



Figure 7 Night shelter made of thatch and wire mesh



Figure 8 Clay duck drinker



Figure 9 Plastic feeder



Figure 10 Clay duck bathtub



Figure 11 Cement duck bathtub

3.2.5. Feeding of Local Duck Breeds

In the free-ranging family system, ducks find most of their food in the natural environment by moving freely throughout the day. In contrast, in mixed family systems and captivity, farmers provide supplementary feeding to the ducks (Figure 12). Thus, 46% of producers distribute cereal bran, 24% provide kitchen scraps, 23% give seeds (mainly corn, sorghum, or millet), and a minority of farmers (7%) supplement the diet with lettuce leaves. No farmer uses commercial feed.

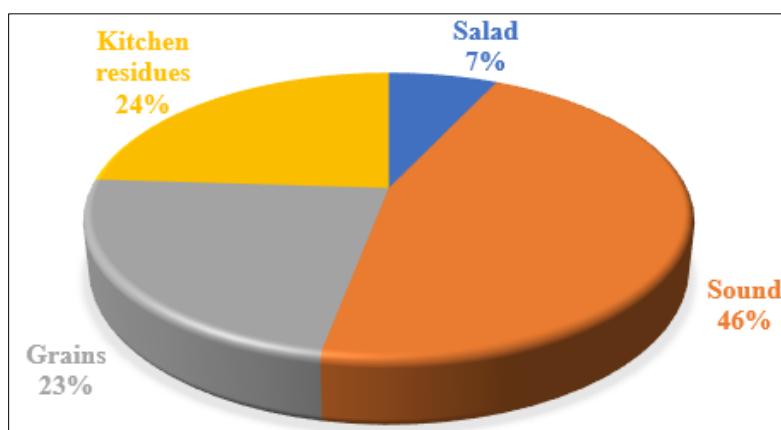


Figure 12 Foods Provided to Ducks

3.2.6. Health Monitoring of Ducks

The surveyed producers do not have any structured medical prophylaxis program. Hygiene measures are mainly limited to sweeping the shelters. For treating certain diseases, producers rely on traditional remedies. This study shows that only 32% of farmers use veterinary products to treat their ducks (Table 6).

Table 6 Use of Veterinary Medicines by Duck Producers

Parameters	Number	Frequency (%)
Present	32	32%
Absent	68	68%
Total	100	100%

3.2.7. Causes of Duck Flock Losses in the Madarounfa Department

Regardless of the age and sex of the ducks, this study highlighted the main mortality factors in the Madarounfa department (Figure 13). Diseases are the leading cause of mortality (27%), followed by domestic accidents (17%), lack of food (17%), collisions with vehicles (16%), theft (13%), and predation (6%).

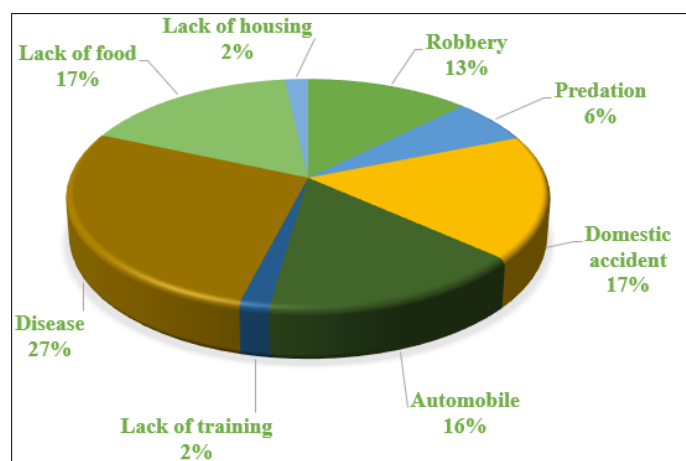


Figure 13 Causes of Mortality in Ducks

3.2.8. Mortality by Sex and Age in Ducks

Table 7 presents duck mortality according to age and sex. The analysis of the relationship between age and mortality indicates that losses are higher among ducklings than among juveniles and adults. The mortality rates recorded at each physiological stage are 80% for ducklings, 15% for juveniles, and 3% for adults. Additionally, 2% of farmers report mortality cases affecting all age groups.

Regarding mortality by sex, survey data reveal that it is higher in females (25%) than in males (19%). Furthermore, 21% of producers believe that both sexes are equally exposed to mortality.

Table 7 Duck Mortality by Age and Sex

Parameters and variables	Number	Frequency (%)
Duck Mortality by Age		
Ducklings	80	80%
Juveniles	15	15%
Adults	3	3%
All	2	2%

Total	100	100%
Duck Mortality by sex		
Males	19	19%
Female	25	25%
Both	21	21%
Unknown	35	35%
Total	100	100%

3.3. Support Needs Expressed by Producers

Table 8 presents the types of support requested by duck farmers to improve their production. Thus, 33% of the farmers express a need for assistance with vaccination, while 23% request funding.

Table 8 Support Needs Expressed by Duck Producers

Parameters	Number	Frequency (%)
Training	9	9%
Vaccination	33	33%
Technical support	15	15%
Funding	23	23%
Commercial feed	10	10%
Farming equipment	10	10%
Total	100	100%

3.4. Production and Reproduction Performance of Ducks in the Madarounfa Department

3.4.1. Age at First Laying

This study conducted in the Madarounfa department determined the age at first laying for local breed ducks raised in traditional farming systems (Figure 14). Thus, 84% of farmers report that the first laying occurs at 12 months of age.

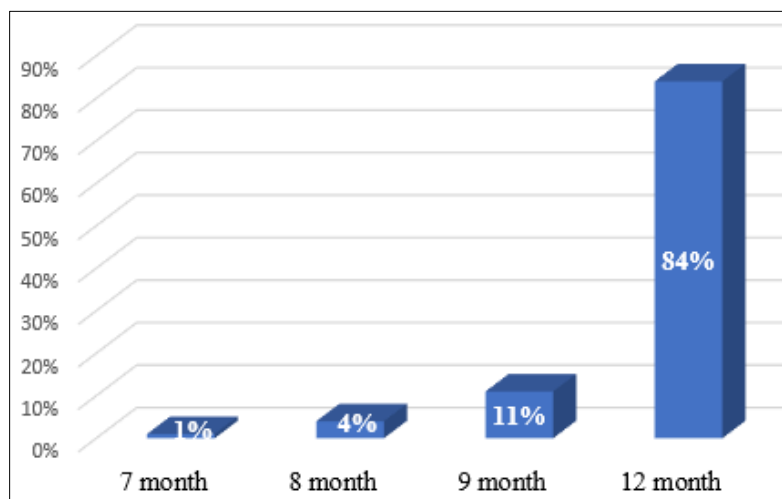


Figure 14 Age at First Laying in Ducks from Madarounfa

3.4.2. Number of Eggs Laid and Cycle Duration in Ducks

Table 9 presents the number of eggs laid per cycle as well as the duration of the reproductive cycle for local ducks raised in the Madarounfa department. According to 52% of farmers, the duck lays between 16 and 20 eggs per cycle.

The cycle duration corresponds to the period from the start of laying to the next laying, including incubation, hatching, and weaning of the ducklings. Survey data indicate that for 67% of farmers, this duration is 2 months.

Table 9 Number of Eggs Laid per Cycle and Cycle Duration

Parameters and variables	Number	Frequency (%)
Number of Eggs Laid per Cycle		
10-15 eggs	39	39%
16-20 eggs	52	52%
21-25 eggs	9	9%
Total	100	100%
Cycle Duration		
1 month	12	12%
2 months	67	67%
3 months	12	12%
12 months	9	9%
Total	100	100%

3.4.3. Incubation Duration and Number of Laying Cycles per Year

Table 10 presents the incubation duration as well as the number of annual reproductive cycles of ducks in the Madarounfa department. According to 71% of farmers, the incubation period ranges between 35 and 40 days. Furthermore, more than half of the producers (57%) report that the duck undergoes two incubation cycles per year.

Table 10 Incubation Duration and Number of Cycles per Year in Ducks in the Madarounfa Department

Parameters and variables	Number	Frequency (%)
Incubation Duration		
24-26 days	2	2%
27-30 days	9	9%
31-34 days	18	18%
35-40 days	71	71%
Total	100	100%
Number of cycles per year		
Once	9	9%
Twice	57	57%
Three times	34	34%
Total	100	100%

3.4.4. Hatch Rate of Ducks in the Madarounfa Department

The hatch rate is defined as the ratio of the number of eggs hatched to the total number of eggs laid, multiplied by 100. Table 11 presents the hatch rate of ducks raised in the Madarounfa department. Thus, according to 44% of producers, local breed ducks raised in traditional settings in this department have a hatch rate of 90%.

Table 11 Hatch Rate of Ducks Raised in the Madarounfa Department

Parameters	Number	Frequency (%)
50% of the eggs laid	6	6%
75% of the eggs laid	3	3%
80% of the eggs laid	25	25%
90% of the eggs laid	44	44%
100% of the eggs laid	22	22%
Total	100	100%

3.4.5. Viability Rate of Ducklings

The viability rate corresponds to the ratio of the number of ducklings that survive to adulthood to the total number of ducklings after hatching, multiplied by 100. Table 12 presents the viability rate of ducklings in the Madarounfa department. Thus, according to 50% of producers, this viability rate is 50%, meaning that out of 100% of hatched ducklings, only 50% reach adulthood. Figure 15 illustrates a duck with her ducklings after hatching.

Table 12 Viability Rate of Ducklings in the Madarounfa Department

Parameters	Number	Frequency (%)
25% of the ducklings at hatching	5	5%
50% of the ducklings at hatching	50	50%
75% of the ducklings at hatching	22	22%
80% of the ducklings at hatching	25	25%
100% of the ducklings at hatching	6	6%
Total	100	100%



Figure 15 A Duck with Her Ducklings After Hatching

3.4.6. Period with the Highest Hatch Rate

Table 13 presents the time of year associated with the highest hatch rate. According to 98% of farmers, the rainy season is the period during which the hatch rate is the highest.

Table 13 Period with the Highest Hatch Rate

Parameters	Number	Frequency (%)
Rainy season	98	98%
Dry season	2	2%
Total	100	100%

4. Discussion

4.1. Socioeconomic Characteristics of Producers

This study shows that duck farming in Madarounfa is mainly done by men (70%), with women representing 30%. Most farmers are aged between 30 and 50 years (43%), similar to findings for Barbary duck farmers in Southern Benin [9] and local chicken farmers in Niger and Nigeria [10], [11]. However, in some regions like Senegal, women dominate family poultry farming [12]. A large majority of producers (87%) are married, comparable to data from Burkina Faso and Southern Niger [13], [2], though all Southern Benin duck farmers were married [9]. Only 39% of farmers had formal schooling, with 17% illiterate, consistent with studies from Southern Niger and Nigeria [2]. These figures differ from Southern Benin, where secondary education levels were higher and illiteracy greater [9], [13]. Agriculture is the primary livelihood for 82% of farmers, and duck farming serves as both a source of income and food, echoing findings by Logtene and Ndzingu [14] and Nahimana et al. [12]. This demographic and socio-economic profile helps contextualize traditional duck farming systems in West Africa.

4.2. Rearing Practices

This study highlights key characteristics of traditional duck farming in Madarounfa, Niger, with a focus on gender roles, farming practices, and mortality causes. Duck flock management is mainly done by women (56%), reflecting their domestic responsibilities and the lower investment required compared to large livestock [15]. The majority of farmers (42%) have 2 to 5 years of experience, which is shorter than the 4–20 years reported in Southern Benin [9] and the 1–10 years noted elsewhere [2], indicating regional disparities in the value placed on duck farming.

In terms of plumage preference, 61% of producers favor black-and-white ducks due to their market availability and perceived traits like heat resistance and better hatchability—observations also noted in Côte d'Ivoire [16]. A minority prefer white ducks for their rarity or religious reasons.

Three rearing systems were identified, with 81% of farmers adopting the mixed system. This dominance is attributed to a lack of professionalization, high equipment costs, and limited feed resources. Similar systems were reported in studies from Southern Benin [9], Nigeria [11], Côte d'Ivoire [17] and Burkina Faso [13].

Flock size remains small (≤ 10 ducks for 83% of farmers), a trend influenced by competing local livelihoods like ruminant farming and fishing (DDE/Madarounfa), as also found in Nigeria [18], [11] and Côte d'Ivoire [17]. Unlike larger-scale systems in Philippines [19], local infrastructure is basic but present. Health management is dominated by traditional remedies [2], with disease being the main cause of mortality (27%), especially leg paralysis ("Mari-mari"), also observed in Benin ([9]). Ducklings suffer the highest mortality (80%) due to vulnerability and accidents, consistent with findings from Oguntunji and Ayorinde [11], Donatien et al. [17], and Josée et al. [9].

4.3. Zootechnical Characteristics

This study investigated the reproductive performance of local ducks raised in traditional systems, particularly focusing on the age at first laying. Most farmers (84%) estimate this age to be between 360 and 365 days, though some report earlier ages (270, 240, and 210 days). The age at first laying in local breed ducks in northern Benin is 208 days in the fisheries zone, 209 days in the bar land zone, and 220 days in the lowland zone [9]. Farmers observe that laying is seasonal, mainly during the rainy season, when natural food sources like insects and greens are abundant—similar to

patterns seen in guinea fowl [20]. Consequently, ducklings hatched in the rainy season tend to reach laying age by the next one.

The number of annual broods also affects first laying age. While 57% of farmers report two broods per year, 34% note three—comparable to local chickens [13] and Barbarie ducks in Southern Benin [9]. Ducklings born earlier in the season lay after 360–365 days, mid-season ducklings after 270–240 days, and late-season ducklings after about 210 days [9]. Clutch sizes range from 16–20 eggs (52%) to 10–15 (39%), in line with findings from Nigeria [21].

Incubation lasts 35–40 days (71%), consistent with Naik et al. [22] and Meulen and Dikken [23]. All farmers use natural incubation, with hatchability rates of up to 90% [9], [24]. Some enhance success by limiting eggs or using saline immersion [10]. Although 98% favor the rainy season for hatching, some in Benin prefer the dry season [9]. Duckling viability remains low (50%) due to accidents, prompting preventive practices like tying ducks or using mosquito nets

5. Conclusion

This study on the local duck production system in the Madarounfa department highlighted that duck farming is primarily practiced under a family management system. This system is mainly characterized by semi-free ranging of the animals, although a minority of producers adopt a more confined management style. The flock sizes remain small, mostly ranging between 1 and 10 ducks. The mortality rates, particularly high among ducklings, are attributed to precarious farming conditions and climatic constraints.

The results underline the need to improve farming practices to reduce mortality and optimize productivity. Training producers in modern farming techniques appears essential to enhance zootechnical performance, ensure better meat quality, and promote the profitability of this sector. Finally, further studies could be conducted to deepen the understanding of factors influencing farm productivity and to identify improvement strategies adapted to the local context.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

All authors declare no conflict of interest in this study.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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