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Poultry farming in Bukavu city, South Kivu, Democratic Republic of Congo (DRC): Constraints and Opportunities

Bishamamba Casinga[1] & Dieumerci R. Masumbuko[2]
Department of Environment and Sustainable Development, Institut Supérieur de Développement Rural de Kaziba (ISDR/Kaziba)[1], South-Kivu, DR. Congo.
Department of Environment and Sustainable Development, Institut Supérieur de Développement Rural de Bukavu (ISDR/Bukavu), P.O. Box 2849, Bukavu, South-Kivu, DR. Congo.

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ABSTRACT
Objective: This study aimed to characterize chicken farming systems, and to inventory opportunities and constraints to this sector in Bukavu city, east of DR Congo.
Methodology and results: A cross-sectional survey was conducted with 60 poultry farmers in three municipalities (Kadutu, Ibanda and Bagira) using semi-structured interviews and closed- and open-ended questionnaires. The main findings show that most of chicken farmers in Bukavu are male (81.7%), single (53.3%), have an average level of education equivalent to a state diploma (50%), and most have trade as their main occupation (79.1%), with poultry farming being secondary (78.5%). They have an average of 3.5 ± 4.4 years' experience in poultry farming. Semi-intensive farming (70%) is the most common method. The two main motivations are increased income and job creation (85%), followed by self-consumption (8.3%). The most common improvement is improved breeds (73.3%). In addition to chickens, quails, ducks, guinea fowl and pigeons are also raised, albeit in small numbers. The main constraints faced by poultry farmers are the resurgence of diseases (100%), a lack of feed (91.7%), a lack of access to credit (25%), insufficient support from government services (10%), and problems selling poultry products (3.3%).
Conclusion and application of results: This study has certainly highlighted progress in the poultry sector, particularly regarding improvements in farming conditions, such as feed, watering and healthcare. However, certain constraints are associated with this type of farming. These include unsustainable buildings, non-compliance with stocking densities, heating and lighting system problems, feed importation from neighbouring countries, a shortage of qualified technicians, uncontrolled poultry house movement and a lack of expertise among some farmers. Despite the constraints faced by poultry farmers and the fact that chicken farming in the city of Bukavu is a secondary activity, it remains essential for farmers' diets and their socio-economic lives, particularly for young people. The poultry sector deserves special attention with a view to improvement. This would involve encouraging sustainable practices, such as providing poultry farmers with training and capacity building, giving them access to credit or subsidies, offering them support from state and non-state services, promoting local feed production and encouraging the widespread use of phytotherapy. These measures would increase poultry production in the city of Bukavu. The aim is to develop locally adapted solutions to overcome the many obstacles commonly encountered in poultry farming.
Keywords: Livestock farming, chickens, Bukavu City, South Kivu, Constraints, Opportunities.

INTRODUCTION

Like most African countries, the Democratic Republic of Congo (DRC) suffers from significant food insecurity. Developing the livestock sector is an important part of the strategy to combat this, as it provides poor populations with high-quality protein, creates wealth and diversifies the agricultural sector. Poultry sector offers a particularly quick and affordable solution in this regard thanks to its short production cycle (N Moula *et al.,*2012). Its importance is further accentuated by the ever-increasing demands of consumers and the urgent need to address protein deficiency in Congolese diet (N Moula *et al.,* 2012). Promoting poultry farming and gradually improving poultry breeding performance can stimulate economic development while safeguarding biodiversity (FAO, 1998). It should be noted that chicken farming is in decline in the Democratic Republic of Congo (DRC), with low rates in most provinces, including South Kivu and Bukavu city (INS, 2015). This low rate is thought to be linked to farming systems and various epidemics caused by a lack of adequate health monitoring (Sarkar et Bell, 2006). Consequently, hens are unable to fulfil their genetic potential. These production difficulties are all complex and vary according to farming systems, due to different biological, social and economic factors that influence production methods (Sonaiya et Swan, 2004). And yet chickens play a very important role in Congolese society. They contribute to human nutrition in form of meat or eggs. They play a part in social exchanges and are sacrificed during celebrations and religious rituals or sold to earn money and contribute to household income. They also produce excellent manure. Compared to cattle and small ruminants, chickens are animals that households can easily sell or slaughter to pay for their children's school fees, medical care, or other small family expenses (Katunga *et al.,* 2020). Method of raising chickens in Bukavu is almost identical to that used throughout the Democratic Republic of Congo (DRC). To better understand this situation, it is helpful to review poultry farming in Bukavu, given that a change in chicken farming system could improve production and consequently increase farmers' income. According to a study by Bisimwa *et al.* (2019) on the characterization of the production and reproduction systems of local chickens in three agroecological zones of South Kivu; poultry farming is a secondary activity involving traditional, low-performance production techniques. In addition, results of three surveys on chicken farming conducted in DRC, including a baseline survey and two surveys on characteristics of local chicken production in provinces of South Kivu and Ituri, show that the predominant system is still traditional. Has this trend changed over the years? It is therefore important to clarify this issue in the poultry sector in Bukavu city. The general aim of this work is to contribute to food security by promoting chicken farming. More specifically, it seeks to: (1) characterize poultry farmers and poultry farms, (2) determine the prophylactic techniques and sanitary measures used, and (3) inventory the main opportunities and constraints in this sector.

MATERIALS AND METHODS

Study area : Geographical location: Bukavu city lies in east of the country, 2,286.1km from the capital, Kinshasa. It lies between 1°36' and 5°23' south latitude, and between 26°47' and 29°20' east longitude. It is bordered to the west and south by Kabare territory, to the north by Lake Kivu and to the east by the Ruzizi Valley, which forms a natural border with Rwanda and Burundi (Sadiki *et al.,* 2010).

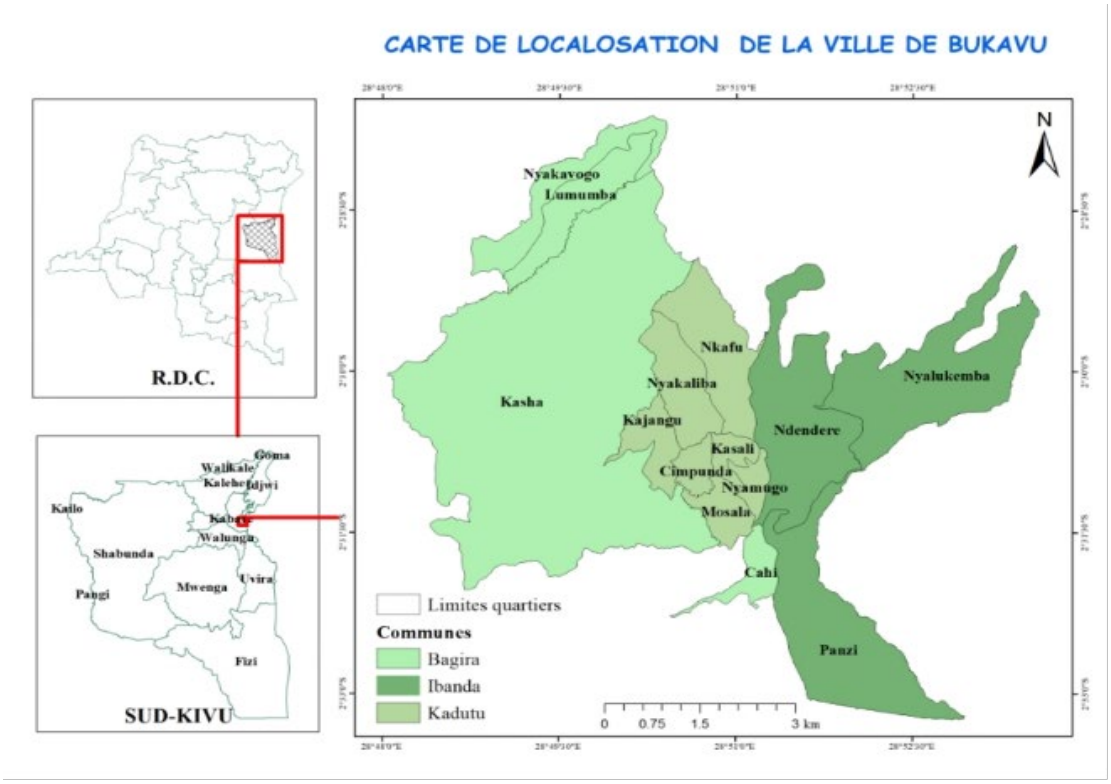

Figure 1*:* Map of Bukavu city

Climatic factors in Bukavu city: Temperature is a limiting factor of paramount importance in agriculture. In Bukavu, temperatures generally range from 14°C to 26°C, rarely falling below 12°C (Ramade, 2015). Precipitation varies from region to region and is an important ecological factor influencing the functioning and distribution of terrestrial ecosystems (Fautrier *et al.,* 1980). Precipitation in Bukavu varies greatly throughout the year. The rainy season lasts eight months, from 22 September to 20 May, with a daily rainfall probability of over 36%. November is the month with the highest number of rainy days in Bukavu, with an average of 19 days with at least 1 millimetre of rainfall. The driest season lasts four months, from 20 May to 22 September. July is the month with the fewest days of precipitation, with an average of 2.8 days with at least 1 millimetre of precipitation (Cirimwami *et al.,* 2019).

Methods: We conducted an in-depth survey, collecting data through semi-structured interviews and questionnaires containing both closed and open questions, from a small number of chicken farmers in the city of Bukavu. The main data collected from farmers concerned their farms and their farming techniques, such as housing, feeding, health protection and various breeding methods used. We also asked about constraints and

opportunities of poultry farming in Bukavu, and strategies to boost production in our study area. Additionally, we took illustrative pictures of the different poultry farming systems encountered in Bukavu using a camera, and we recorded all the data using a pen and notebook. This in-depth survey phase was implemented using a random sampling method, as precise data on the number of chicken farmers in Bukavu is unavailable. This phase was conducted using a snowball sampling system, whereby populations with common characteristics are selected to obtain a representative sample.

Sampling techniques: It was used to select a subset of units from a target population to gather information. This information is then used to draw conclusions about the population. Primary data collection was carried out in two stages: an exploratory phase and an in-depth phase. Exploratory survey aimed to establish contact with livestock farmers and identify different neighbourhoods of Bukavu, to determine number of farmers to include in the study. This stage involved identifying potential issues that could arise during the survey or in-depth phase. Interviews were conducted with neighbourhood leaders to identify various livestock farmers present in the study area. For our study, we selected 60 poultry farmers based on the size of their flock (±100 birds), their experience (at least five years), their age (18 years or older) and their responsibility in household (head of household or farm manager). These farmers were selected from our three different study areas (Kadutu, Ibanda and Bagira), with 20 farmers per commune.

Data analysis: Questionnaire was set up in Kobbo collect to facilitate data collection. After collection, data was exported into Excel 365 to form database. Pearson Chi-square (χ^2) test was used to determine whether two categorical variables were independent of each other. R studio 4.4.1 software was used for these statistical analyses.

RESULTS

Socio-economic characterization of poultry farmers in Bukavu city

Table 1: Socioeconomic characteristics of respondents

Variables	Modalities	Commune			Ov.Mean (%)	χ^2	P-V	
		Bagira (%)	Ibanda (%)	Kadutu (%)				
Sex	Female	4(20)	4(20)	3(15)	3.7(18.3)	61.23	0.00	
	Male	16(80)	16(80)	17(85)	16.3(81.7)			
Age (years)	Mean±SD	32.3±7.2	31.1±10	31.5±8,6	31.6±8.6	-	-	
Marital status	Single	8(40)	13(65)	11(55)	10.7(53.3)	63.59	0.00	
	Married	12(60)	7(35)	9(45)	9.3(46.7)			
Level of study	Primary	0(0.0)	3(15)	1(5)	1.3(6.7)	68.90	0.00	
	Secondary	13(65)	7(35)	10(50)	10(50.7)			
	Undergraduate	2(10)	5(25)	2(10)	3(15)			
	Postgraduate	5(25)	5(25)	7(35)	5.7(28.3)			
Profession	Driver	0(0)	0(0)	1(5)	0.3(1.7)	102.2	0.00	
	Unemployed	0(0)	2(10)	0(0)	0.7(3.3)			
	Commerce	12(60)	4(20)	2(10)	6(30)			
	Electrician	0(0)	0(0)	2(10)	0.7(3.3)			
	Breeder	0(0)	5(25)	1(5)	2(10)			
	Teacher	4(20)	0(0)	6(60)	3.3(26.7)			
	Student	2(10)	6(30)	3(15)	3.7(18.3)			
	Public official	2(10)	3(15)	2(10)	2.3(11.7)			

	Nurse	0(0)	0(0)	2(10)	0.7(3.3)			
	Doctor	0(0)	0(0)	1(5)	0.3(1.7)			
Household size	Mean±SD	5.9±1.5	7.0±2.7	5.8±2.0	6.2±2.0			
Main activity	Commerce	0(0)	6(30)	1(5)	2.3(11.5)			
	Breeder	20(100	14(70)	19(95)	17.7(88.5)			
Length of service	Mean±SD	4.4±1.5	3.1±1.6	3±1.3	3.5±4.4	-	-	

Legend: Ov. Mean= Overall mean, χ^2= Khi-scare, P-V= probability value and SD= Standard deviation

Table 1 shows that chicken farmers in Bukavu city are predominantly male (81.7%), more likely to be single (53.3%), particularly in Ibanda commune (65%), and have an average level of education (50% have a state diploma), although this varies significantly depending on the commune (PV < 0.05). Most farmers are primarily engaged in trade (30%), followed by teaching (26%), while 18.3% are students. On average, 6.2±2.0 working members of household are involved in the farm. The secondary activity is livestock farming (88.5%), with an average experience of poultry farming of 3.5±4.4 years.

Characterization of poultry farms in Bukavu city

Table 2: Chicken farming system in Bukavu city

Variables	**Modalities**	**Commune**			**Ov. Mean (%)**	**χ^2**	**P-V**
		Bagira (%)	**Ibanda (%)**	**Kadutu (%)**			
Training in poultry farming	No	18(90)	14(70)	17(85)	16.3(81.7)	63.9	0.00
	Yes	2(10)	6(30)	3(15)	3.7(18.3)		
Organization	Sukash	0(0)	0(0)	1(5)	0.3(1.7)	71.7	0.00
	ASOP	0(0)	1(5)	0(0)	0.3(1.7)		
	None	18(90)	14(70)	17(85)	16.3(81.7)		
	Fondapro	1(5)	0(0)	1(5)	0.7(3.33)		
	IITA	1(5)	4(20)	1(5)	2(10)		
	Uzimach	0(0)	1(5)	0(0)	0.3(1.7)		
Main occupation of the head of the family	Driver	0(0)	1(5)	1(5)	0.7(3.3)	79.1	0.00
	Commerce	12(60)	11(55)	8(40)	10.3(51)		
	Electrician	0(0)	0(0)	1(5)	0.3(1.7)		
	Breeder	1(5)	4(20)	1(5)	3(10)		
	Teacher	4(20)	0(50)	3(15)	2.3(28.3)		
	Public official	3(15)	3(15)	2(10)	2.7(13.3)		
	Nurse	0(0)	0(0)	2(10)	0.7(3.3)		
	Mason	0(0)	1(5)	1(5)	0.7(3.3)		
	Doctor	0(0)	0(0)	1(5)	0.3(1.7)		
Farming method	Extensive	0(0)	2(10)	0(0)	0.7(3.3)	71.6	0.00
	Intensive	9(45)	5(25)	2(10)	5.3(26.7)		
	Semi-int.	11(55)	13(65)	18(90)	14(70)		
Reasons for choosing livestock farming	Self-cons.	2(10)	0(0)	3(15)	1.7(8.3)	68.2	0.00
	Revenue	18(90)	19(95)	14(70)	17(85)		
	Subsidy	0(0)	1(5)	3(15)	1.3(6.7)		
Number of	Hens	199±15.1	150±10.8	238.9±31	196±18.9	-	-

heads in the poultry house	Cockles	94.5±10.1	49.7±7.8	70.8±7.2	71.7±8.3	-	-
	Chicks	49.7±6.1	13.9±2.8	32.4±7.1	32±5.3	-	-
Race types	Improved	14(70)	14(70)	16(80)	14.7(73.3)	75.13	0.0
	Impro.&non-improved	4(20)	3(15)	3(15)	3.3(16.7)		
	Local	2(10)	0(0)	0(0)	0.7(3.3)		
	Hybrids	0(0)	3(15)	1(5)	1.3(6.7)		
Other poultry raised	Ducks	6.3±0.7	2.4±1.2	2.3±0.4	3.7±0.8		
	Guineafowls	4.1±0.48	2.2±0.7	5.2±1.6	3.8±0.9		
	Pigeons	2.8±0.19	3.2±0.1	2.3±0.4	2.8±0.23		
	Quails	6.2±1.1	9.1±1.8	10.7±1.4	8.7±1.43		
Building materials	Durable	4(20)	6(30)	7(35)	5.7(28.3)	62.17	0.01
	Non-durable	16(80)	14(70)	13(65)	14.3(71.7)		
Use of disinfectants	No	0(0.0)	2(10)	1(5)	1(5)	67.2	0.06
	Yes	20(100)	18(90)	19(95)	19(95)		
Types of disinfectants	Ash	3(15)	6(30)	4(20)	4.3(21)	61.5	0.00
	Lime	8(40)	4(20)	7(35)	6.3(31.7)		
	Chlorine	9(45)	10(50)	9(45)	9.3(46.7)		
Monthly frequency	1-2 times	18(90)	14(70)	17(85)	16.3(81.7)	63.9	0.00
	More than 2	2(10)	6(30)	3(15)	3.7(18.3)		
Existence pavement	Yes	8(40)	8(40)	8(40)	8(40)	61	0.00
	No	12(60)	12(60)	12(60)	12(60)		
Footbath available	No	10(50)	8(40)	11(55)	9.7(36.3)	64.13	0.00
	Yes	10(50)	12(60)	9(45)	10.3(51.7)		

Legend: Ov.Mean= Overall mean, χ^2= Khi-scare, P-V= probability value, ASOP="Association de Soutien à l'autopromotion", IITA= International Institute of Tropical Agriculture, Semi-int.= Semi-intensive and Self-cons.=Self-consumption

As shown in Table 2, most livestock farmers in Bukavu (81.7%) have never received training in poultry farming. On average, 1.7% of respondents received training from ASB Sukash, 1.7% from ASOP, 10% from IITA, 1.7% from Uzima Chicken, and 3.3% from Fondapro. The most common activity among heads of households is trade (51%). Semi-intensive farming (70%) is widely practiced by farmers in Bukavu, while 26.7% practice intensive farming and 3.3% practice extensive farming. The main motivation for farming is to increase income (85%), followed by self-consumption (8.3%). The average number of hens per poultry farmer was found to be 196.03 ± 18.9, the average number of roosters was found to be 71.7 ± 83, and the average number of chicks was found to be 32 ± 5.3 in the various poultry houses visited during our survey. Chicken farming in Bukavu is dominated by improved breeds (73.3%). However, chickens are not the only animals raised: four other species were also found among the surveyed poultry farmers, including quails (with an average of 8.7±1.43 per farmer), followed by ducks (3.7±0.8), guinea fowl (3.5±0.9) and pigeons (2.8±0.23). The materials used for chicken housing are generally non-durable (71%) and often include flooring or sub-flooring (60%). It has been observed that farmers frequently use several products to disinfect their poultry houses, with 81.7% doing so every month. The most used product is chlorine (46.7%), followed by lime (31%) and ash (21%). Footbaths were observed in front of the poultry house door in 51.7% of cases, compared to 36.3% where there was no footbath.

Table 3. Feed supply system for poultry farms in Bukavu city

Variables	Modalities	Commune			Ov.Mean (%)	χ^2	P-V
		Bagira (%)	Ibanda (%)	Kadutu (%)			
Existence of a feeding trough	Yes	20(100)	20(100)	20(100)	20(100)	61	0.00
Type of feeding trough	Steel	5(25)	5(25)	5(25)	5(25)	71.51	0.00
	Wood	14(70)	9(45)	11(65)	11.3(60)		
	Plastic	1(5)	6(30)	4(20)	3.7(18)		
Presence of drinking troughs	Yes	20(100)	20(100)	20(100)	20(100)	61	0.00
Type of drinking troughs	Basin	0(0)	1(5)	2(10)	1(5)	69.7	0.00
	Masonry tank	0(0)	1(5)	0(0)	0.3(1.7)		
	Piece of can	2(10)	7(35)	4(20)	4.3(21)		
	Siphoids	18(90)	11(65)	14(70)	14.3(75)		
Water source	Régideso	20(100)	20(100)	20(100)	20(100)	61	0.00
Water storage facility	Can	20(100)	20(100)	20(100)	20(100)	61	0.00
Ration category	Concentrate	19(95)	16(80)	19(95)	18(90)	111.1	0.00
	Cereals	1(5)	4(20)	1(5)	2(10)		
Origin of concentrate	Local market	20(100)	18(90)	20(100)	19.3(96)	62.18	0.00
	Imported	0(0)	2(10)	0(0)	0.7(3.3)		
Cereal-based food	No	12(60)	8(40)	16(80)	12(60)	67.78	0.00
	Yes	8(40)	12(60)	4(20)	8(40)		
Types cereal-based food	None	12(60)	8(40)	16(80)	12(60)	82.01	0.00
	Maize, soya	8(40)	6(30)	4(20)	6(30)		
	Maize, soya, wheat	0(0)	6(30)	0(0)	2(10)		
Green fodder	No	17(85)	16(80)	18(90)	17(85)	60.34	0.00
	Yes	3(15)	4(20)	2(10)	3(15)		
Type of green fodder	Cabbage	2(10)	0(0)	0(0)	0.7(3.3)	24	0.15
	Bean leaf	1(5)	0(0)	2(10)	1(5)		
Number of rations/days	Mean±SD	2.95±0.2	2.1±0.44	2.05±0.2	2.36±0.29	-	-
Ingredient processing	Crushed	8(40)	10(50)	4(20)	7.3(36)	27.27	0.00
	Granules	0(0)	2(10)	0(0)	0.7(3.3)		
Origine of food	Imported	8(40)	20(100)	5(25)	11(55)	34	0.00
Additional use	No	11(55)	12(60)	17(85)	13.3(66)	64.19	0.00
	Yes	9(45)	8(40)	3(15)	6.7(33.3)		
Type of additional use	Calcium	5(25)	5(25)	0(0)	3.3(16.7)	31.50	0.00
	Moringa	0(0)	0(0)	1(5)	0.3(1.7)		
	Fry	0(0)	1(5)	0(0)	0. 3(1.7)		
	Kitchen leftovers	4(20)	2(10)	2(10)	2.3(13.3)		

Legend: Ov. Mean= Overall mean, χ^2= Khi-scare, P-V= probability value and SD= Standard deviation.

With regard to feeding, results in Table 3 show that wooden feeders are the most common (60%), followed by siphon drinkers (75%). Additionally, farmers use water from REGIDESO, which they store in jerry cans. Chicken feed mainly consists of imported concentrates or fodder (90%), as well as cereals (10%). Farmers buy concentrates from the market (96%). Forty per cent (40%) of cereal-based feed is produced by farmers themselves, with maize and soya being the most used raw materials in the city of Bukavu (30%). Green fodder (15%), cabbage (3.3%) and bean leaves (5%) are also given to chickens, but proportions vary significantly depending on the municipality studied (P-V<0.05). Most farmers distribute feed to animals 2.36 ± 0.29 times a day, taking into account the hen's stage of development. Cereals are often crushed before being distributed to the animals. Most of poultry feed used is imported (55%), and results also show that some farmers use supplements (33.3%) in their poultry feed.

Table 4: Poultry reproduction techniques

Variables	Modalities	Commune			Over.Mean (%)	χ^2	P-V
		Bagira (%)	Ibanda (%)	Kadutu (%)			
Use of tracking sheet	No	1(10)	6(30)	1(5)	2.3(11.7)	68.33	0.00
	Yes	19(95)	14(70)	19(95)	173(86.7)		
Origin of breeding males	Markets	4(20)	2(10)	9(45)	5(25)	22	0.01
	Neighbouring farmers	16(80)	16(80)	9(45)	13.7(68.5)		
	Own farm	0(0.0)	1(5)	2(10)	1(5)		
	Donation NGO	0(0.0)	1(5)	0(0.0)	0.3(1.5)		
Reproduction mode	Controlled	20(100)	19(95)	20(100)	19.7(98.3)	63.07	0.00
	Uncontrolled	0(0)	1(5)	0(0)	0.3(1.7)		
Destinations for animals not used for breeding	Sale	5(25)	7(35)	5(25)	5.7(28.3)	61.67	0.00
	Self-consumption	15(75)	13(65)	15(75)	14.3(71.7)		

Legend: Ov. Mean= Overall mean, χ^2= Khi-scare and P-V= probability value

As shown in Table 4, most surveyed farmers (86%) use breeding records, with most breeding males being purchased from other farmers and neighbours (68.5%), and only a small proportion coming from markets (25%). Very few farmers (5%) breed their own males. It was also noted that 1.5% of poultry farmers surveyed had received breeding stock as a donation from an NGO in the area at some point. The most common method of poultry reproduction is controlled reproduction (98.3%), and most animals not used for reproduction are consumed by the farmers themselves (71%) or sold (28.3%). It should be noted that the distribution of animals not used for breeding, breeding method used, and the use of monitoring sheets vary significantly between the different municipalities studied (P-V< 0.01).

Inventory of prophylaxis techniques and health measures used

Table 5. Prophylaxis techniques and health measures

Variables	Modalities	Commune			Ov.Mean (%)	χ^2	P-V
		Bagira (%)	Ibanda (%)	Kadutu (%)			
Prophylactic practice	Vaccination	20(100)	20(100)	20(100)	20(100)	61	0.00
Building cleaning	No	0(0)	0(0)	0(0)	0(0)	61	0.00
	Yes	20(100)	20(100)	20(100)	20(100)		
Monthly frequency	1	0(0)	1(5)	0(0)	0.3(1.3)	14.82	0.13
	2	2(10)	4(20)	0(0)	2(10)		
	3	0(0)	1(5)	0(0)	0.3(1.3)		
	4	18(90)	12(60)	17(85)	15.7(78)		
	8	0(0)	1(5)	3(15)	1.3(6.7)		
	12	0(0)	1(5)	0(0)	0.3(1.3)		
Use of veterinary products	No	0(0)	1(5)	1(5)	0.7(3.3)	62.05	0.00
	Yes	20(100)	19(95)	19(95)	19.3(98.3)		
Type of veterinary products	Antibiotic	0(0)	0(0)	2(10)	0.7(3.3)	76.62	0.00
	Vit, antib, dewormer	20(100)	6(30)	1(5)	9(45)		
	Vitamin	0(0)	6(30)	1(5)	2.3(11.7)		
	None	0(0)	1(5)	1(5)	0.3(3.3)		
Use of phytotherapy	No	20(100)	16(80)	18(90)	18(90)	65.52	0.00
	Yes	0(0)	4(20)	2(10)	2(10)		
Type of phytotherapy	Citrus	0(0)	1(5)	1(5)	0.7(3.3)	7.87	0.00
	Moringa	0(0)	2(10)	1(5)	1(15)		
	Pepper	0(0)	1(5)	0(0)	0.3(1.3)		
Access to building	Yes	20(100)	20(100)	20(100)	20(100)	61	-
Have a vet	No	18(90)	18(90)	20(100)	18(93.3)	64.18	0.00
	Yes	2(10)	2(10)	0(0)	1.3(6.7)		
Category of hens affected by parasitic diseases	Growing	3(15)	2(10)	4(20)	3(15)	61.8	0.00
	Chicks	17(85)	18(90)	16(80)	17(85)		
Favourable season for disease	Rain season	12(60)	13(65)	13(65)	12.7(63.3)	61.15	0.00
	Dry season	8(40)	7(35)	7(35)	7.3(36.7)		
Targeted product	Chicks	0(0)	3(15)	1(5)	1.3(6.7)	93.73	0.00
	Meat	20(100)	7(35)	15(75)	14(50)		
	Meat & eggs	0(0)	1(5)	3(15)	1.3(6.7)		
	Eggs	0(0)	9(40)	1(5)	3.3(15)		

Legend: Ov. Mean= Overall mean, χ^2= Khi-scare, P-V= probability value and Antib.: antibiotic

As can be seen from Table 5, farmers vaccinate their animals (100%) to protect them against disease. Farmers generally clean their chicken coops four times a month (78%), i.e. once a week. Most farmers (98%) use veterinary products to treat their animals. Overall, the

most used combination is multivitamins, antibiotics and worming treatments (45%). Results also show that herbal medicine is used on average in livestock farming (10%). The most frequently used herbal products are Morinaga (15%), lemon (3.3%) and chilli pepper (1.3%). Visitors and neighbours have easy access to the farm (100%). Most farms in Bukavu city do not have access to a veterinarian (93.3%), with significant variation between municipalities studied (P<0.05). Although some farmers vaccinate their chickens, diseases are still common, particularly among chicks (85%), the category most affected, often during the rainy season (63.3%). The most sought-after product in chicken farming in Bukavu city is meat (50%), followed by eggs (15%), and finally breeding stock (6.5%).

Opportunities and constraints in the poultry sector in Bukavu city

Table 6. Opportunities presented by poultry farming in Bukavu city

Variables	Modalities	Commune			Ov.Mean (%)	χ^2	P-V
		Bagira (%)	Ibanda (%)	Kadutu (%)			
Existence of opportunities	No	0(00)	0(0)	0(0)	0(0)	61	0.00
	Yes	20(100)	20(100)	20(100)	20(100)		
Opportunity 1	Job creation	10(50)	12(60)	8(40)	10(50)	41.49	0.00
	Fertiliser	15(75)	10(50)	12(60)	12.3(61.7)		
Opportunity 2	Chicks	2(10)	1(5)	3(15)	2(10)	64.43	0.00
	Meat	20(100)	17(85)	20(100)	19(95)		
Opportunity 3	Money	0(0)	1(5)	1(5)	0.6(3.3)	58.34	0.00
	Eggs	19(95)	8(40)	16(80)	14.3(71.7)		
0pportunity 4	Money	20(100)	17(85)	20(100)	19(95)	53	0.00

Legend: Ov. Mean= Overall mean, χ^2= Khi-scare and P-V= probability value

As can be seen from Table 6, poultry farming offers many opportunities in Bukavu city, ranging from wealth creation to providing high-quality food. Opportunities most frequently cited and known to poultry farmers surveyed in our study in Bukavu city are obtaining money, highly nutritious food (eggs and meat), fertilizer, job creation and obtaining breeding stock/chicks (95%, 71.7%, 61.7%, 50% and 10% respectively).

Table 7: Constraints of poultry farming in Bukavu city

Variables	Modalities	Commune			Ov.Mean (%)	χ^2	P-V
		Bagira (%)	Ibanda (%)	Kadutu (%)			
Existence of difficulties	Yes	20(100)	20(100)	20(100)	20(100)	61	0.00
Difficulty 1	Epidemies	20(100)	15(75)	20(100)	18.3(91.7)	56	0.00
Difficulty 2	Lack of food	20(100)	20(100)	20(100)	20(100)	61	0.00
Difficulty 3	No access to credit	5(25)	4(20)	6(30)	3(25)	47.6	0.00
	No funding	2(10)	0(0)	0(0)	0.6(3.3)		
	Flow issue	0(0)	6(30)	0(0)	2(10)		

Legend: Ov. Mean= Overall mean, χ^2= Khi-scare and P-V= probability value

Results in Table 7 show that all poultry farmers in Bukavu city face major constraints, including lack of feed, resurgence of disease, lack of access to credit and insufficient resources. Marketing issues are also common, affecting 3.3% of farms. It should be noted that the distribution of these difficulties varies significantly depending on the municipality studied.

DISCUSSION

Characterization of poultry farmers: The study reveals that most farmers are young adults with an average age of around 31. The vast majority (81%) of poultry farmers are male, and half have at least one state-recognised qualification. These figures are slightly lower than those reported by Teno (2010) for farmers in Dakar, Senegal, who had an average age of 47 and were predominantly uneducated. Furthermore, this study's sample shows a significant number of traders practising this profession. Poultry farming is a lucrative activity that generates income, but it requires significant investment. This could explain the high proportion of traders. Additionally, 85% of respondents said they entered the sector for the income generated from selling poultry products (meat, eggs, chicks and manure). Similar observations were made by Sonaiya and Swan (2004), who found that 89.2% of farmers indicated that sales were the sole reason for their involvement in poultry farming, and by Pinde *et al.* (2020), who stated that chicken farming is generally a male-dominated activity undertaken primarily for income generation. In terms of marital status, more than half of the surveyed poultry farmers are single. This proportion is significantly higher than the 11.8% found by Teno (2010).

Characteristics of the poultry farms in Bukavu city: The study found that 70% of respondents use a semi-intensive farming system. More than 80% have limited knowledge of modern farming techniques, use buildings made of unsustainable materials (71.7%), and keep significant numbers of animals (≤200) on small areas of land. Non-compliance with density requirements hinders the proper growth of chickens, despite improved breeds being the most common. Other poultry, such as ducks, pigeons and quails, are raised alongside chickens in the same building or in different housing, regardless of technical standards relating to the distance between buildings. This is consistent with the findings of Idi and Ganda (2005), who recommended a minimum separation distance of 30 meters between chicken coops. The design of livestock buildings and their internal environment are key factors in ensuring good production. Temperature regulation allows for better growth of chicks and hens. In fact, most of the poultry farmers visited in the three communes of Bukavu use coal heating and natural lighting. The same observation was made by Idi and Ganda (2005).

Feeding and Reproduction: Regarding hens in the henhouse, the farmer is required to monitor their nutritional regime. To do so, he must have a thorough understanding of their needs, which vary according to their age, breed, and whether they are broilers or laying hens. This study shows that the diet of hens in Bukavu consists mainly of imported feed (90%) from neighbouring countries such as Rwanda, Uganda and Burundi, which is distributed in wooden feeders on average (60%). Few poultry farmers provide greens for their chickens. To compensate for certain nutrient deficiencies, some farmers add dietary supplements to their poultry feed (33.3%), depending on availability and the season. The availability of essential nutrients such as protein, vitamins and minerals varies according to the season and weather conditions, such as humidity and drought (Lapierre & Pressenda, 2002). Most farmers feed their chickens two to three times a day,

taking their growth stages into account.

Prophylaxis techniques and health measures: During this study, compliance with health-related biosecurity measures was observed. In fact, almost all (98.3%) of the surveyed poultry farmers regularly disinfect their chicken coops. This contradicts the findings of H. Abdou *et al.* (2020). To prevent disease, they all vaccinate their birds. The most used treatment for chickens is a combination of multivitamins, antibiotics and worming treatments (45%). Phytotherapy is also used in poultry farming (10%), with moringa (15%), lemon (3.3%) and chilli pepper (1.3%) being the most frequently used products. Chicks are the most susceptible to disease, which occurs more frequently during the rainy season. Visitors and neighbours have easy access to chicken coops (100%), and most poultry farmers in Bukavu do not have access to a vet (93.3%), which facilitates the spread of disease and frequent losses.

Key constraints and opportunities: In general, well-being of living organisms depends largely on their environment (RésOGM Info, 2008). Constraints on poultry production can be attributed to climatic, health, and management factors (Awa & Tenghe, 2008). All poultry farmers in Bukavu city faces major obstacles. The most frequently encountered issues in poultry sector are food shortages, resurgence of disease, lack of access to credit, insufficient resources and marketing issues (affecting 100%, 91.7%, 25%, 10% and 3.3% of farmers, respectively). These results are consistent with those of H. Abdou *et al.* (2020), who found that all respondents faced numerous difficulties due to a lack of expertise when starting the activity. They are also consistent with findings of Maizama *et al.* (2003), who found that only half of farms benefited from supervision of a poultry technician during the initial weeks of flock establishment and during periods of high mortality. The profitability of a livestock farming system depends on how the farmer conducts their activities. Poultry farming offers many opportunities in the city of Bukavu and its surroundings, including obtaining money, high-nutritional-value food (eggs and meat), fertiliser, job creation and obtaining breeding stock/chicks (95%, 71.7%, 61.7%, 50% and 10% respectively). These results corroborate those of Bashizi and Katunga (2003), who state that poultry farmers can expect to make a profit if they treat their farms as small or medium-sized businesses, employing good management practices and maintaining a minimum number of 150 animals, which can be profitable under Bukavu's farming conditions. However, achieving this will require the adoption of positive elements of intensive systems, particularly the breeding of improved chickens, adequate housing, sufficient and balanced feed, appropriate medical care, and effective management.

CONCLUSION AND APPLICATION OF RESULTS

It should be noted that the purpose of this study is to evaluate the current state of poultry farming in Bukavu. This survey-based study has certainly highlighted progress in the poultry sector, particularly in terms of improvements to certain farming conditions, such as feed quality and watering and feeding equipment, as well as breeding methods. However, numerous shortcomings were identified during this study. In terms of housing, there has been a failure to comply with density requirements and errors have been observed in the heating and lighting systems. Regarding feed, most poultry farmers import complete feed from neighbouring countries. Regarding health, results showed that vaccination and disinfection of buildings are common practices among poultry farmers for protecting their animals. To treat their animals, most farmers use veterinary products and, to a

lesser extent, herbal medicine. The scarcity of qualified technicians (veterinarians), uncontrolled movements in poultry houses, and a lack of expertise in this area among some farmers also result in significant losses for farmers who are already weakened by recurrent epidemics in the region. Considering the socio-economic losses caused by these constraints, this study recommends further research in this area to develop solutions for its successful growth in Bukavu and the surrounding area.

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