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Mohammad Reza Khalilnezhad,
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Temin Payum,
Jawaharlal Nehru College (Pasighat), India

*CORRESPONDENCE

Rifu Xu

✉ poultryxu@jlau.edu.cn

Ning Qin

✉ ningqin@jlau.edu.cn

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Assessment of backyard broiler production in Zambia: a potential for household food and economic security

Simushi Liswaniso^{1,2,3}, Kolawole Odubote³, Thobela Louis Tyasi⁴, Shengxiao Cao^{1,2}, Sheng Wang^{1,2}, Yu Ou^{1,2}, Dikai Zhang^{1,2}, Xue Sun^{1,2}, Rifu Xu^{1,2*} and Ning Qin^{1,2*}

¹Laboratory of International Agricultural Cooperation, Ministry of Education, Changchun, China,

²College of Animal Science and Technology, Jilin Agricultural University, Changchun, China,

³Department of Animal Science, University of Zambia, Lusaka, Zambia, ⁴Department of Agricultural Economics and Animal Production, University of Limpopo, Sovenga, Limpopo, South Africa

Introduction: Poultry production remains an important aspect of food systems because it provides supplementary income and a cheap source of protein. Backyard production has been growing lately due to many factors like urbanization, population increase, and increases in income levels at household levels. However, there is a paucity of information on the characteristics of backyard broiler production in Zambia.

Methods: This study using a structured online questionnaire was administered to 444 respondents in all 10 provinces of Zambia to provide information on the management practices and production performances.

Results: The study revealed that most producers were located in urban and peri-urban areas (74.52%) and that most producers were males (61.49%) with 72.07% having attained tertiary education. Provinces showed no significant variation ($p > 0.05$) in the average batch size (292.40) and the number of batches per year (6.32). The most commonly raised breeds were Cobb 500 (50%) and Ross 308 (44.14%), which were mainly sourced from agents. These were mostly fed commercial feed (97.97%). All farmers provided housing mainly made of concrete floors (87.16%) and clay brick walls (50.90%) with iron sheets (92.79%) for roofing. All farmers used the deep litter system, and wood shavings were the most (64.86%) used as bedding material. The mean mortality rate per batch of 7.59% varied significantly ($p < 0.05$) among provinces. Most farmers that experienced disease outbreaks (77.03%), had their chickens treated (97.30%), and vaccinated (97.75%) while 60.36% of the respondents never used ethnoveterinary medicines. The common marketing channel was selling to people within the residences (40.32%) and selling directly at the market (40.32%) at 6 weeks of age. With a national mean profit of ZMW 5,932 that varied significantly ($p < 0.05$) between the provinces, most farmers earned between ZMW 2,000 and ZMW 5,000 from their backyard broiler production.

Discussion: The findings of this study provide insights that could inform policy and influence the sector's possible growth, thereby enhancing household food and economic security.

KEYWORDS

backyard production, biosecurity, broiler production, chicken marketing, smallscale farmers, Zambian farmers

1 Introduction

Livestock production is an important sector mainly because it generates supplementary incomes and provides protein and employment. Within the livestock sector, the poultry subsector is the fastest-growing sector globally (Mbuza et al., 2017). The primary factors contributing to this expansion include increased population growth, escalated demand for protein, and increased purchasing power within most populations. Poultry, like other small livestock, are widely incorporated into multi-functional urban agriculture and food systems globally (Zimmerer et al., 2021). Despite the noted global growth within the poultry sector, its growth rate in African countries is low compared to other parts of the world (Nkukwana, 2018).

Backyard poultry production is becoming very popular mainly due to its ability to contribute to society's nutritional and socio-economic well-being by providing alternative affordable protein sources, employment, and incomes (Elkhoraibi et al., 2014; Correia-Gomes and Sparks, 2020; Kumar et al., 2021). Other authors attribute the growth of backyard poultry production to several reasons such as the increased demand for fresh and nutritious foods (Alders et al., 2018; Nicholson et al., 2020) and the need for extra income (Elkhoraibi et al., 2014). However, despite the growth and interest in keeping poultry within residences, in some cases, it is a public health hazard as it has been linked to some disease outbreaks that may be zoonotic (Pedersen et al., 2004). Additionally, overuse and misuse of antibiotics have led to increased cases of resistance thereby posing a challenge to humans (Diarra et al., 2007; Forgetta et al., 2012). For this reason, backyard poultry production has recently become a center of research in several countries (Badubi et al., 2004; Ali and Hossain, 2010; Eltholth et al., 2016; Gororo and Kashangura, 2016; Alemayehu et al., 2019; Alemayehu et al., 2019; El-Menawey et al., 2019; Gibril and Habib, 2019; Gharib et al., 2023).

The informal sector and backyard poultry producers are essential aspects of food systems in Zambia as they account for over 75% of the poultry market in Zambia (Hichaambwa, 2012; Harrison et al., 2024). In Zambia, the poultry industry contributes 4.8% to the agricultural GDP and represents 48% of the livestock value addition, making it the largest sub-sector in the livestock industry (Agriprofocus, 2015). Close to 50,000 and 30,000 permanent and seasonal jobs, respectively, are created by the poultry subsector in Zambia both in the layers and broilers (Mwansa, 2013). Over 86% of broilers in Zambia are produced under small-scale production, mainly in backyards (Zamstats, 2022). The backyard broiler producers habitually produce broilers from within their backyards, mainly within the living compounds. These are not usually registered nor regulated by any regulatory body (Liswaniso et al., 2024).

Despite its value and potential as a significant contributor to food security, backyard broiler production faces many challenges, such as disease outbreaks and poor market linkages (Singh et al., 2022). Most backyard broiler producers lack basic knowledge of management, biosecurity, and health management, posing a more significant risk for zoonoses that could compromise food safety and pose health risks for humans. Hence, this study aimed to assess the production system, housing, management practices, biosecurity, and health management of broiler chickens in Zambia and compare the estimated gross profits across the provinces to inform policy for possible interventions.

2 Materials and methods

2.1 Study location

This study was conducted in Zambia. Zambia's climate is tropical, with three distinct seasons. From December to April, it is warm, humid, and rainy, especially in the north, which gets above 1,200 mm of rain yearly. May to August is dry and chilly, while September to November is dry and hot. Temps range from 25 to 35°C in the warm season, dropping to 6–24°C during cooler months.

For this study, respondents who were backyard producers were sampled from 82 districts out of the 115 districts across all 10 provinces of Zambia. Figure 1 shows the map of Zambia highlighting the sampled districts. The complete list of the names of districts and the number of respondents per province is presented in Supplementary Table 1.

2.2 Sample size and sampling

Owing to the lack of registers of backyard farmers, it was difficult to have a clear sampling frame. For this reason, random and snowball sampling techniques were used to sample the respondents. Using the district government department of livestock development, questionnaires were circulated to the identified backyard broiler producers in the respective districts. The sample size was determined by using the formula as used by Singh et al. (2022):

$$n = Z^2 P (1 - P) / d^2,$$

where N = is the sample size, Z is the statistic corresponding to the level of confidence, P is the anticipated prevalence, and d is precision.

Nationwide, the sample size was calculated as 370 respondents based on a 50% prevalence (assuming almost 50% of the populace depends on backyard broiler production and related sectors) and 95% confidence intervals; however, to ensure ample representation from all provinces, the sample size was increased to 444.

2.3 Data collection

Four hundred and forty-four backyard broiler farmers successfully participated in this study by responding to a structured questionnaire administered by the enumerators. The questionnaire collected information on demographics, production systems, marketing, biosecurity and health management, housing, and consumption. Before proceeding with the questionnaire, the purpose of the study was explained to the respondents, and consent was obtained.

2.4 Data analysis

Data was received and cleaned in Excel. MINITAB V21 was used for the statistical analysis. Qualitative responses were reported as percentages of a particular response out of the total number of participants. Cross-tabulation analysis was used with Chi-square analysis to compare between provinces. For quantitative responses, an analysis of variance was conducted to compare means between

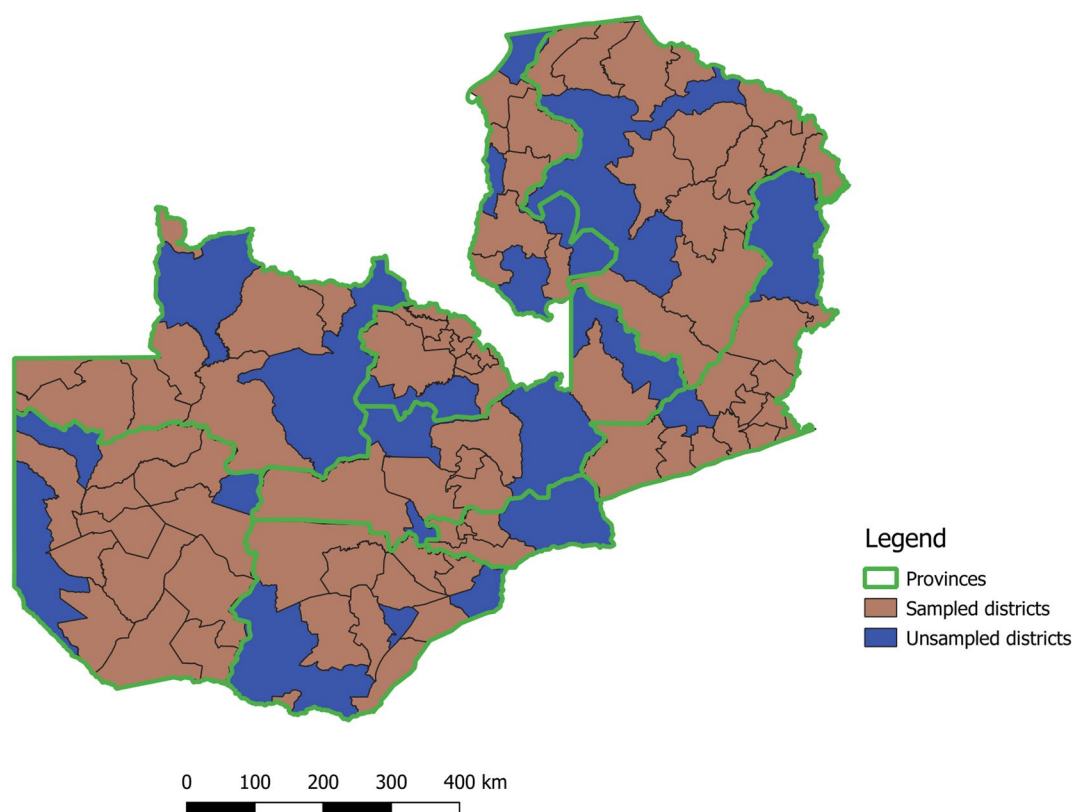


FIGURE 1
Map of Zambia showing the sampled areas.

provinces, and Tukey's test was employed to separate means at 95% confidence.

3 Results

3.1 Socioeconomic characteristics of backyard broiler producers in Zambia

Table 1 shows the sociodemographic characteristics of the respondents who were backyard poultry owners. This study revealed that backyard broiler production in Zambia was male-dominated in all provinces except Luapula, where females dominated.

Backyard broiler production in Zambia is dominated by the age group between 30 and 50 years across all the provinces in Zambia. This finding suggests that backyard broiler production is a key livelihood source for this economically active group, contributing to household income, food security, and community development. However, it may also highlight a gap in youth engagement in agriculture. This study further revealed that only about 21.62% of the producers were below the age of 30 years. Most households had a household size of between 5 and 10 persons per household. Moreover, there was no significant difference ($p = 0.318$) in household sizes of backyard broiler producer households between provinces, with a national average of 5.77 ± 0.11 persons per broiler-keeping household (Table 1). This study also revealed that in Zambia, backyard broiler production is dominated by those with above-secondary education.

Almost all the backyard broiler producers in this study had attained some formal education.

Most farmers had an average income of between ZMW 5,000 and ZMW 10,000 (1USD = 24 ZMW). This pattern was common in the Copperbelt, Central, Eastern, Luapula, Lusaka and Muchinga provinces. However, most farmers in Northern, Northwestern, Southern, and Western provinces had an average monthly income of less than ZMW 5000. Farming was the most common occupation in Central, Eastern, and Copperbelt provinces. The majority of backyard broiler producers in Southern and Western provinces were self-employed. Formal employment was the most common occupation in Luapula, Lusaka, Muchinga, Northern, and Northwestern provinces. However, overall, most backyard broiler producers in Zambia were in formal employment, indicating that broiler production was an enterprise in addition to their primary jobs.

This study revealed that most backyard broiler producers in Zambia use customary land for their broiler production, which is the most common land ownership type in Central, Copperbelt, Eastern, and Northwestern provinces. However, most farmers in Luapula, Lusaka, Muchinga, Northern, Northwestern, and Southern provinces rented the premises they used for production. Ownership with title deeds only dominated in the Western province. Urban and peri-urban agriculture characterized the settings of nearly three-quarters of the backyard broiler producers in Zambia that were sampled in this study.

Most respondents had less than 5 years of experience in broiler production. This may suggest that broiler production is a fast-growing enterprise, with many joining the backyard broiler industry in the last

TABLE 1 Socio demographics of the backyard broiler producers in Zambia.

Category	Characteristics	Households per province (%)										Overall	X	p-value
		CB	CP	EP	LP	LUS	MP	NP	NWP	SP	WP			
Gender	Female	30.77	33.33	22.03	56.00	38.03	45.00	48.00	46.30	41.67	38.98	38.51	14.60	0.103
	Male	69.23	66.67	77.97	44.00	61.97	55.00	52.00	53.70	58.33	61.02	61.49		
Age	Less than 30 years	10.26	30.56	22.03	20.00	21.13	7.50	20.00	20.37	16.67	38.98	21.62	24.80	0.131
	30–50 years	76.92	66.67	69.49	68.00	67.61	80.00	68.00	66.67	75.00	57.63	68.92		
	Above 50 years	12.82	2.78	8.47	12.00	11.27	12.50	12.00	12.96	8.33	3.39	9.46		
HH size	Less than 5 years	20.51	33.33	37.29	32.00	18.31	20.00	32.00	29.63	27.78	38.98	28.83	17.00	
	Between 5 and 10	71.79	66.67	59.32	68.00	77.46	75.00	64.00	64.81	66.67	59.32	67.34		
	Above 10	7.69	0.00	3.39	0.00	4.23	5.00	4.00	5.56	5.56	1.69	3.83		
Education Experience	Primary	0.00	0.00	5.08	4.00	8.45	12.50	16.00	5.56	8.33	3.39	6.08	52.74	0.000
	Secondary	5.13	11.11	11.86	20.00	18.31	25.00	28.00	37.04	36.11	18.64	20.72		
	College or university	94.87	88.89	81.36	76.00	70.42	62.50	56.00	53.70	55.56	77.97	72.07		
	No formal education	0.00	0.00	1.69	0.00	2.82	0.00	0.00	3.70	0.00	0.00	1.13		
Occupation	Farmer	71.79	44.44	54.24	8.00	0.00	0.00	0.00	0.00	5.56	11.86	19.59	482.84	0.000
	formal Employment	2.56	5.56	5.08	84.00	98.59	100.00	100.00	100.00	13.89	11.86	51.35		
	Self Employed	23.08	30.56	30.51	4.00	1.41	0.00	0.00	0.00	47.22	62.71	21.17		
	Unemployed	2.56	19.44	10.17	4.00	0.00	0.00	0.00	0.00	33.33	13.56	7.88		
Land ownership type	Ownership by title	30.77	36.11	35.59	28.00	14.08	22.50	12.00	27.78	33.33	35.59	27.70	31.47	0.025
	Renting	15.38	25.00	23.73	48.00	45.07	40.00	56.00	33.33	36.11	32.20	34.46		
	Traditional land ownership	53.85	38.89	40.68	24.00	40.85	37.50	32.00	38.89	30.56	32.20	37.84		
Monthly income	Less than ZMW 5000	23.08	33.33	37.29	56.00	52.11	40.00	64.00	55.56	61.11	59.32	47.97	46.01	0.000
	ZMW 5000- ZMW10 000	48.72	44.44	47.46	40.00	43.66	57.50	32.00	35.19	30.56	32.20	41.44		
	Above ZMW 10000	28.21	22.22	15.25	4.00	4.23	2.50	4.00	9.26	8.33	8.47	10.59		
Location	Peri-urban	35.90	25.00	23.73	20.00	38.03	7.50	12.00	44.44	22.22	25.42	27.48	52.53	0.000
	Rural	30.77	22.22	35.59	52.00	30.99	70.00	40.00	29.63	50.00	25.42	36.71		
	Urban	33.33	52.78	40.68	28.00	30.99	22.50	48.00	25.93	27.78	49.15	35.81		
Experience	Less than 5 years	69.23	83.33	67.80	68.00	69.01	80.00	64.00	70.37	80.56	72.88	72.30	13.52	0.760
	Between 5 and 10 years	17.95	8.33	16.95	24.00	21.13	15.00	32.00	16.67	11.11	18.64	17.79		
	More than 10 years	12.82	8.33	15.25	8.00	9.86	5.00	4.00	12.96	8.33	8.47	9.91		

CB, Copperbelt Province; CP, Central province; EP, Eastern Province; LP, Luapula Province; LUS, Lusaka Province; MP, Muchinga province; NP, Northern Province; NWP, Northwestern Province; SP, Southern Province; WP, Western Province; SEM, standard error of the mean; ZMW, Zambia kwacha (currency 1USD = 24 ZMW).

5 years. However, the smaller number of farmers that have been keeping broilers for more than 5 years may suggest how temporal the venture is among backyard farmers with many exiting the industry within 5 years.

3.2 Broiler breeds, source of day-old chicks, management, and feeding practices

Table 2 shows the results of the commonly produced broiler breeds, source of day-old chicks (DOC), management, and feeding practices. Agents were the most common source of day-old chicks (DOC) across all the provinces in Zambia, with almost two-thirds of

the backyard broiler producers relying on them. A third of the farmers across all the provinces had direct access to commercial breeders for sourcing DOCs.

In all the 10 provinces across Zambia, most farmers sourced their DOC from within their districts. A third sourced their DOC from within the province but outside their districts. Very few sourced their DOCs from outside their provinces, which was only common in Muchinga province.

The common practice in Zambia is for farmers to pre-order the DOC for collection at a later date. This is due to the limited DOC supply nationwide and fewer commercial hatcheries. In all the provinces of Zambia, most farmers collected their DOCs within two (2) weeks after paying (Table 2). About a quarter of the respondents

TABLE 2 Day-old chick preference management and nutrition among backyard broiler producers in Zambia.

Category	Characteristic	Households per province (%)										Overall	χ^2	p-value
		CB	CP	EP	LP	LUS	MP	NP	NWP	SP	WP			
Source of DOC	Commercial breeders	30.77	36.11	30.51	36.00	21.13	22.50	24.00	31.48	38.89	44.07	31.30	35.03	
	From small-scale breeder	2.56	11.11	5.08	4.00	0.00	0.00	0.00	1.85	2.78	3.38	2.93		
	From Agents	66.67	52.78	64.41	60.00	78.87	77.50	76.00	66.67	58.33	52.55	65.77		
Distance to the source of chicks	Outside the province	10.26	13.89	11.86	12.00	23.94	35.00	4.00	12.96	5.56	20.34	16.22	29.90	0.038
	Within the province	35.90	41.67	32.20	40.00	26.76	30.00	40.00	37.04	44.44	20.34	33.11		
	within the same district	53.85	44.44	55.93	48.00	49.30	35.00	56.00	50.00	50.00	59.32	50.68		
Waiting Period for DOC	within 2 weeks	69.23	63.89	59.33	88.00	70.43	47.50	84.00	62.96	61.12	83.06	68.01	56.50	
	Between 2–4 week	25.64	30.56	28.81	12.00	19.72	40.00	16.00	27.78	33.33	11.86	24.55		
	After 4 weeks	5.13	5.55	11.86	0.00	9.85	12.50	0.00	9.26	5.55	5.08	7.44		
Price of DOC (ZMW)*	<15	33.33	13.89	40.68	36.00	18.31	42.50	32.00	53.70	66.67	50.85	38.74	68.39	
	15–20	64.10	77.78	59.32	64.00	81.69	57.50	68.00	46.30	33.33	49.15	60.36		
	>20	2.56	8.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.90		
DOC transport type	Public transport	30.77	27.78	35.59	32.00	29.58	50.00	36.00	37.04	30.56	20.34	32.43	44.95	0.016
	Private transport	48.72	47.22	38.98	40.00	26.76	10.00	36.00	33.33	27.78	27.12	32.66		
	Hired van or taxi	17.95	19.44	18.64	20.00	26.76	22.50	20.00	27.78	33.33	38.98	25.45		
	We walk with them	2.56	5.56	6.78	8.00	16.90	17.50	8.00	1.85	8.33	13.56	9.46		
Breed Preference	Cobb 500	100	97.22	100	100	90.14	0.00	0.00	0.00	0.00	0.00	50.00	594.52	0.000
	ROSS 308	0.00	2.78	0.00	0.00	2.82	47.50	100	100	100	100	44.14		
	Other	0.00	0.00	0.00	0.00	7.04	52.50	0.00	0.00	0.00	0.00	5.86		
Batch size (%)	<200	25.64	41.67	33.90	44.00	46.48	62.50	40.00	37.04	55.56	44.07	42.79		
	200–500	61.54	47.22	55.93	44.00	49.30	35.00	48.00	57.41	38.89	49.15	49.55		
	>500	12.82	11.11	10.16	12.00	4.23	2.50	12.00	5.55	5.56	6.78	7.66		
No. of Batches	<5	35.90	25.00	30.51	32.00	32.39	25.00	36.00	51.85	44.44	33.90	34.91	20.78	0.291
	5–10	56.41	63.89	54.24	56.00	63.38	67.50	56.00	46.30	50.00	54.24	56.76		
	>10	7.69	11.11	15.25	12.00	4.23	7.50	8.00	1.85	5.56	11.86	8.33		
Mortality	<5	41.03	33.33	44.07	20.00	32.39	20.00	20.00	37.04	22.22	40.68	33.11	46.28	0.012
	5–10	48.72	50.00	47.46	52.00	50.71	52.50	56.00	50.00	63.89	32.20	49.10		
	11–15	2.56	5.56	8.47	8.00	5.63	15.00	20.00	9.26	11.11	6.78	8.56		
	>15	7.69	11.11	0.00	20.00	11.27	12.50	4.00	3.70	2.78	20.34	9.23		
Feed type	Commercial feed	97.44	91.67	100	100	100	97.50	100	98.15	97.22	96.61	97.97	11.70	
	Own made feed	2.56	8.33	0.00	0.00	0.00	2.50	0.00	1.85	2.78	3.39	2.03		

CB, Copperbelt Province; CP, Central province; EP, Eastern Province; LP, Luapula Province; Lus, Lusaka Province; MP, Muchinga province; NP, Northern Province; WP, Northwestern Province; SP, Southern Province; WP, Western Province; DOC, Day old chick; ZMW, Zambia kwacha (currency 1USD = 24 ZMW).

had to wait for more than 2 weeks but less than 4 weeks to collect their DOCs. It was rare to collect chicks on the same day of purchase.

The average cost of chicks statistically differed ($p = 0.000$) across the provinces, with the central province having the most expensive at ZMW 16.22/chick. The southern province had the lowest price per chick (ZMW 13.79/DOC). Despite the national average price of ZMW 14.92/DOC, the price range of 15–20 ZMW was very common in all the provinces.

This study also revealed that different forms of transportation were used to transport the day-old chicks from the suppliers to the production site (Table 2). The most common ways chicks were transported included public transport, private transport, hired taxis, or vans. Just under 10% of the respondents never used mechanical means of transporting the DOC to their production site, but they carried the DOC to the production site.

According to this study's findings, Zambia has two main breeds of broilers. These are Cobb 500 which dominated in Central,

TABLE 3 Backyard broiler housing and bedding materials among backyard broiler producers in Zambia.

Category	Characteristic	Households per province (%)										Overall	χ^2
		CB	CP	EP	LP	LUS	MP	NP	NWP	SP	WP		
Floor type	Compacted Clay	10.26	2.78	8.47	12.00	9.86	15.00	8.00	16.67	16.67	6.78	10.59	28.37
	Concrete	89.74	94.44	89.83	80.00	87.32	80.00	92.00	83.33	80.56	91.53	87.16	
	Nothing on the floor	0.00	2.78	1.69	8.00	2.82	5.00	0.00	0.00	0.00	0.00	1.80	
	Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.78	1.69	0.45	
Bedding	Boxes	0.00	0.00	1.69	0.00	2.82	2.50	0.00	0.00	5.56	0.00	1.35	92.21
	Grass	10.26	11.11	15.25	0.00	4.23	25.00	8.00	9.26	19.44	6.78	10.81	
	Groundnuts or Wheat hulls	10.26	30.56	5.08	8.00	21.13	27.50	12.00	24.07	11.11	23.73	18.02	
	Maize bran	0.00	0.00	8.47	4.00	2.82	7.50	4.00	1.85	0.00	1.69	3.15	
	Sacks	0.00	0.00	0.00	8.00	0.00	0.00	0.00	0.00	0.00	1.69	0.68	
	Sand	2.56	0.00	1.69	0.00	0.00	2.50	0.00	1.85	0.00	1.69	1.13	
	Wood shavings	76.92	58.33	67.80	80.00	69.01	35.00	76.00	62.96	63.89	64.41	64.86	
Wall type	Clay bricks	43.59	38.89	45.76	40.00	59.15	60.00	44.00	70.37	69.44	30.51	50.90	56.54
	Concrete blocks	48.72	58.33	47.46	52.00	26.76	32.50	52.00	24.07	27.78	54.24	40.77	
	Other	2.56	0.00	5.08	4.00	7.04	5.00	4.00	1.85	2.78	8.47	4.50	
	Plastics	2.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	
	Woody materials	2.56	2.78	1.69	4.00	7.04	2.50	0.00	3.70	0.00	6.78	3.60	
Roofing materials	Grass thatched	5.13	5.56	0.00	0.00	5.63	17.50	0.00	12.96	2.78	1.69	5.41	43.57
	Iron sheets	94.87	88.89	100.00	100.00	91.55	82.50	96.00	85.19	97.22	94.92	92.79	
	Other	0.00	5.56	0.00	0.00	2.82	0.00	4.00	0.00	0.00	3.39	1.58	
	Plastics	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.85	0.00	0.00	0.23	

CB, Copperbelt Province; CP, Central province; EP, Eastern Province; LP, Luapula Province; LUS, Lusaka Province; MP, Muchinga province; NP, Northern Province; NWP, Northwestern Province; SP, Southern Province; WP, Western Province.

Copperbelt, Luapula, and Lusaka provinces, and Ross 308 which dominated in Northern, Northwestern, Southern, and Western provinces. However, overall, the Cobb 500 was the most common nationally.

The finding of this study revealed that it was common for most farmers in all the provinces to have a batch size of 200–500 chickens per cycle except in Muchinga province, where the smaller batch size of less than 200 chickens/batch was common. However, the number of batches per year insignificantly ($p = 0.102$) varied across provinces with a national mean of 6.22 batches per year. Nonetheless, in all the provinces, most farmers produced 5–10 batches annually, except in Northwestern province, where most farmers produced fewer batches.

The mortality per batch was significantly different ($p = 0.010$) between provinces, with a national average of 7.59%. However, most farmers in all the provinces recorded a mortality rate per batch of 5–10%, except for the western province, where the majority had a lower mortality rate per batch. The current study revealed that almost all backyard broiler farmers used commercial feeds in Zambia.

3.3 Backyard broiler housing in Zambia

Table 3 shows the housing and bedding types used by broiler farmers in Zambia. All the farmers sampled in this study used a deep litter system and credited this to its less demand for capital.

The most common type of floor was concrete floors across all the provinces. Compacted clays were also mentioned as a type of floor by 10.59% of the respondents. This study established that in Zambia, wood shavings were the most common bedding provided to broilers across all the provinces.

Overall, this study established that the most common wall types of poultry houses across the provinces were those made of clay bricks. Clay brick walls dominated Lusaka, Muchinga, Northwestern province, and Southern provinces. With a national average of 40.77%, walls made of concrete dominated in Copperbelt, Central, Eastern, Luapula, Northern and Western provinces.

Iron sheets were the most popular roofing material on broiler houses across all the provinces, with 92.79% of respondents nationwide using them. Very few respondents used grass, Plastics, and woody materials.

3.4 Biosecurity practices in Zambia

On average, as a biosecurity measure, over half of the farmers in all the provinces restricted visitors' access to their broiler houses (Table 4). The isolation of sick birds and the wearing of specific protective clothing in poultry houses were mentioned but had a low

TABLE 4 Biosecurity measures and source of information by backyard broiler producers in Zambia.

Category	Characteristic	Households per province (%)											χ^2	p-value
		CB	CP	EP	LP	LUS	MP	NP	NWP	SP	WP	Overall		
Biosecurity measures	Isolate birds with suspected di	20.51	19.44	15.25	12.00	8.45	27.50	16.00	24.07	13.89	30.51	18.92	41.20	
	Quarantine new birds	2.56	2.78	6.78	0.00	1.41	7.50	0.00	3.70	2.78	5.08	3.60		
	Restrict visitors access to poultry	53.85	52.78	52.54	64.00	54.93	45.00	48.00	46.30	58.33	42.37	51.13		
	Wearing of specific protective	20.51	22.22	22.03	16.00	23.94	15.00	36.00	22.22	25.00	22.03	22.30		
	None of the above	2.56	2.78	3.39	8.00	11.27	5.00	0.00	3.70	0.00	0.00	4.05		
Presence of Footbath	No	43.59	47.22	40.68	52.00	54.93	65.00	72.00	57.41	55.56	32.20	50.45	21.04	0.012
	Yes	56.41	52.78	59.32	48.00	45.07	35.00	28.00	42.59	44.44	67.80	49.55		
Cleaning frequency	Daily	2.56	8.33	10.17	8.00	5.63	2.50	8.00	7.41	8.33	15.25	7.88	33.23	
	Weekly	46.15	50.00	40.68	32.00	46.48	50.00	28.00	40.74	44.44	33.90	41.89		
	Monthly	2.56	11.11	1.69	4.00	7.04	5.00	8.00	5.56	8.33	3.39	5.41		
	Whenever need arises	30.77	19.44	23.73	36.00	23.94	20.00	40.00	27.78	25.00	28.81	26.58		
	Never clean at all	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.85	0.00	0.00	0.23		
	At end of production cycle	17.95	11.11	23.73	20.00	16.90	22.50	16.00	16.67	13.89	18.64	18.02		
Rodent/wild bird access	No	64.10	80.56	74.58	64.00	70.42	70.00	68.00	61.11	61.11	74.58	69.37	17.58	0.483
	No idea	10.26	2.78	1.69	0.00	2.82	0.00	4.00	9.26	8.33	5.08	4.50		
	Yes	25.64	16.67	23.73	36.00	26.76	30.00	28.00	29.63	30.56	20.34	26.13		
Mortality management	Burning	33.33	25.00	28.81	12.00	8.45	10.00	4.00	20.37	13.89	22.03	18.47	57.66	0.001
	Burying	58.97	50.00	45.76	60.00	57.75	67.50	56.00	62.96	50.00	52.54	55.86		
	Consume if they are of age	2.56	13.89	8.47	4.00	23.94	5.00	8.00	9.26	25.00	8.47	11.71		
	Trashing	5.13	11.11	16.95	24.00	9.86	17.50	32.00	7.41	11.11	16.95	13.96		
Source of information	Agricultural agencies and organ	0.00	8.33	3.39	0.00	1.41	5.00	8.00	1.85	0.00	6.78	3.38	98.14	
	Agro dealers	12.82	19.44	15.25	0.00	5.63	5.00	24.00	1.85	13.89	20.34	11.49		
	Books and magazines	7.69	16.67	8.47	4.00	11.27	12.50	16.00	9.26	8.33	6.78	9.91		
	Friends	28.21	13.89	8.47	12.00	14.08	22.50	8.00	7.41	11.11	11.86	13.51		
	Internet	28.21	16.67	16.95	12.00	5.63	5.00	4.00	3.70	16.67	22.03	13.06		
	Veterinarians and/or Livestock experts	23.08	25.00	47.46	72.00	61.97	50.00	40.00	75.93	50.00	32.20	48.65		

CB, Copperbelt Province; CP, Central province; EP, Eastern Province; LP, Luapula Province; LUS, Lusaka Province; MP, Muchinga province; NP, Northern Province; NWP, Northwestern Province; SP, Southern Province; WP, Western Province.

prevalence. The high presence of footbaths dominated the Copperbelt, Central, Eastern, and Western provinces. A low presence of footbaths characterized the rest of the provinces.

Farmers admitted to cleaning their poultry housing in all the provinces. Weekly cleaning regimes were the most common in all the provinces except in Luapula and Northern provinces, where cleaning whenever needed was the most common. Cleaning at the end of the production cycle was the third most common cleaning routine

practiced in Zambia. Very few had a daily or monthly cleaning routine for their poultry houses.

The study revealed that almost 70% of the respondents reported that rodents or wild predators do not gain entry to broiler poultry houses, while the remainder either confirmed access or had yet to learn.

In terms of mortality management, the most common way of mortality disposal across all the provinces was burying. Nonetheless, 11.71% consumed their mortalities if they were of age.

3.5 Source of information among backyard broiler farmers in Zambia

Table 4 shows the sources of information among backyard broiler producers in Zambia. Most backyard broiler producers across Zambia got information from veterinarians/Livestock production experts. Friends and the internet, Agricultural agencies and organizations, Agro dealers, and books and magazines were also mentioned.

3.6 Health management practices

Table 5 shows the health practices of the backyard broiler farmers. Most farmers in the study area had access to veterinary services. The study revealed that disease outbreaks were common in all the provinces. This is despite almost all backyard broiler farmers vaccinating their chickens against major known diseases in all the provinces. However, almost all farmers across all provinces treated their sick chickens. The use of ethnoveterinary medicines was less common in all the provinces. Furthermore, the majority of the farmers consult veterinarians on health issues affecting their chickens.

3.7 Challenges faced by backyard broiler farmers in Zambia

Backyard broiler farmers were interviewed about the challenges they faced in their broiler production, and Table 6 details their responses. The cost of feed was the most common problem faced by farmers in all the provinces. Disease outbreaks were the second most common challenge faced by backyard broiler farmers. Price fluctuations were the third most common challenge faced by farmers. Lack of market, lack of capital, and Shortage of day-old chicks were also mentioned as challenges. Feed shortage was also mentioned and was more common in rural provinces such as Muchinga and Northwestern Province.

3.8 Broiler meat consumption

Table 7 shows the consumption of broiler meat by the respondents in this study. Broiler meat consumption was common across all provinces, with almost all respondents affirming that they consumed it. As for the consumption frequency, most backyard broiler producers consumed broiler meat 1–2 times weekly across the country. About 12.84% consumed broiler chicken meat 3–4 times per week. Only about 4.5% never consume the broiler meat they produce.

3.9 Broiler marketing practices

This study exposed that the demand for broilers in all provinces of Zambia was seasonal peaking during festivals (Table 8). Concerning market competition, fellow backyard broiler producers paused the highest competition for market share with each other. Only a quarter mentioned facing competition from commercial farmers for market share.

Two common market channels of broilers by backyard broiler farmers were common in Zambia (Table 8). The first was where individuals within the compound bought at the farm gate. This was the most common channel in the Central, Eastern, Luapula, Muchinga, and Northern provinces. The second was where the farmers took to the market to sell. This was common in the Copperbelt, Lusaka, Northwestern, Southern and Western provinces. Supplying supermarkets and engaging marketers to resale were uncommon channels identified in this study.

In all the provinces, most farmers sold their broiler chickens at 6 weeks of age. A few sold at 7 weeks. However, selling chickens before 6 weeks or after 7 weeks of age was uncommon. The price of broiler chickens had a national average of ZMW 99.18 per live broiler. This did not vary significantly between provinces ($p = 0.074$). While the northern province had the lowest price per live broiler and Muchinga province the highest, in all the provinces, the most common price range was between 90 and 100 ZMW. It was also a common practice

TABLE 5 Health practices among backyard broiler producers in Zambia.

Category	Characteristic	Households per province (%)										Overall	χ^2	p-value
		CB	CP	EP	LP	LUS	MP	NP	NWP	SP	WP			
Access to Veterinary services	No	48.72	33.33	28.81	20.00	21.13	30.00	40.00	5.56	33.33	37.29	28.60	29.22	0
	Yes	51.28	66.67	71.19	80.00	78.87	70.00	60.00	94.44	66.67	62.71	71.40		
Disease Outbreak	No	28.21	30.56	25.42	20.00	16.90	27.50	16.00	16.67	19.44	28.81	22.97	7.33	0.6
	Yes	71.79	69.44	74.58	80.00	83.10	72.50	84.00	83.33	80.56	71.19	77.03		
Chicken treatment	No	5.13	0.00	3.39	0.00	0.00	7.50	8.00	0.00	2.78	3.39	2.70	12.42	
	Yes	94.87	100.00	96.61	100.00	100.00	92.50	92.00	100.00	97.22	96.61	97.30		
Presence of vaccination	No	2.56	8.33	0.00	0.00	1.41	0.00	4.00	0.00	0.00	6.78	2.25	17.07	
	Yes	97.44	91.67	100.00	100.00	98.59	100.00	96.00	100.00	100.00	93.22	97.75		
Use of ethnoveterinary medicines	No	66.67	61.11	55.93	56.00	71.83	60.00	60.00	51.85	55.56	59.32	60.36	7.26	0.61
	Yes	33.33	38.89	44.07	44.00	28.17	40.00	40.00	48.15	44.44	40.68	39.64		

CB, Copperbelt Province; CP, Central province; EP, Eastern Province; LP, Luapula Province; LUS, Lusaka Province; MP, Muchinga province; NP, Northern Province; NWP, Northwestern Province; SP, Southern Province; WP, Western Province.

TABLE 6 Challenges faced by backyard broiler producers in Zambia.

Challenges	Households per province (%)										Overall
	CB	CP	EP	LP	Lus	MP	NP	NWP	SP	WP	
Costs of feed	87.18	100.00	93.22	96.00	94.37	97.50	96.00	100.00	94.44	86.44	94.14
Diseases	56.41	55.56	61.02	56.00	76.06	52.50	76.00	64.81	63.89	62.71	63.29
Price fluctuation	58.97	50.00	59.32	52.00	59.15	37.50	68.00	46.30	50.00	54.24	53.60
Lack of market	61.54	36.11	27.12	56.00	39.44	30.00	52.00	46.30	52.78	35.59	41.67
Lack of capital	41.03	36.11	40.68	20.00	35.21	45.00	40.00	22.22	44.44	38.98	36.49
Shortage of day-old chicks	35.90	33.33	49.15	28.00	46.48	27.50	20.00	48.15	30.56	23.73	36.49
Feed shortage	17.95	13.89	28.81	20.00	32.39	42.50	16.00	35.19	13.89	11.86	24.55
Lack of housing	7.69	16.67	16.95	4.00	14.08	22.50	12.00	9.26	25.00	13.56	14.41
Lack of information	15.38	8.33	15.25	4.00	12.68	15.00	12.00	5.56	22.22	15.25	12.84
Theft	12.82	16.67	6.78	8.00	5.63	7.50	12.00	5.56	13.89	6.78	8.78
Predators	5.13	13.89	6.78	4.00	2.82	2.50	8.00	5.56	8.33	18.64	7.66

CB, Copperbelt Province; CP, Central province; EP, Eastern Province; LP, Luapula Province; LUS, Lusaka Province; MP, Muchinga province; NP, Northern Province; NWP, Northwestern Province; SP, Southern Province; WP, Western Province.

TABLE 7 Broiler Meat consumption among backyard broiler producers in Zambia.

Category	Characteristic	Households per province (%)										Overall	χ^2	p
		CB	CP	EP	LP	Lus	MP	NP	NWP	SP	WP			
Broiler consumption	No	7.69	0.00	5.08	4.00	4.23	0.00	4.00	7.41	2.78	6.78	4.50	6.61	0.677
	Yes	92.31	100.00	94.92	96.00	95.77	100.00	96.00	92.59	97.22	93.22	95.50		
Consumption Frequency	Every day	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.69	0.23	45.43	
	1–2 times per week	69.23	63.89	88.14	80.00	78.87	95.00	92.00	75.93	77.78	76.27	79.50		
	3–4 times per week	15.38	30.56	6.78	16.00	15.49	5.00	0.00	12.96	13.89	11.86	12.84		
	5–6 times per week	7.69	5.56	0.00	0.00	1.41	0.00	4.00	3.70	5.56	3.39	2.93		
	Do not consume any	7.69	0.00	5.08	4.00	4.23	0.00	4.00	7.41	2.78	6.78	4.50		

CB, Copperbelt Province; CP, Central province; EP, Eastern Province; LP, Luapula Province; LUS, Lusaka Province; MP, Muchinga province; NP, Northern Province; NWP, Northwestern Province; SP, Southern Province; WP, Western Province.

to sell the broilers as live birds in all the provinces. A minority sold their broilers as dressed chickens. Besides, this study revealed that feed costs were the most significant expense of all the costs associated with production in all the provinces.

3.10 Estimated gross profits

Table 9 shows the estimates of profits of backyard broilers in Zambia per province. In all the provinces very few backyard farmers had a gross profit of less than ZMW 2,000. However, most farmers broiler farmers made a profit of between ZMW 2,000 and ZMW 5,000. This was also reflected in Copperbelt, Eastern, Lusaka, Southern, and Western provinces. Most farmers in the Central, Luapula, Muchinga, Northern, and Northwestern provinces made a profit of between ZMW 5,000 and ZMW 10,000. It was uncommon in all the provinces to have farmers making more than ZMW 10,000 from their broilers per batch.

However, an analysis of the variance of the average profits per province revealed significant ($p < 0.05$) differences between provinces with a national mean profit of ZMW 5,932. Lusaka province had a

significantly ($p < 0.05$) higher gross profit while the southern province had a significantly ($p < 0.05$) lower gross profit. This study further revealed that feed costs accounted for the largest production cost as mentioned by over 97% of the backyard farmers. The cost of chicks, heating costs, labor, and transportation costs were also mentioned.

4 Discussion

Food insecurity and poverty are two major issues facing sub-Saharan Africa (Cheteni et al., 2020; Xie et al., 2021). With 35% of households in Zambia being food insecure, this reality does not spare them (Mofya, 2021). The anticipated rise in population is expected to hike demand for protein. This necessitates increasing output and productivity and diversifying protein sources (Liswaniso et al., 2023). Small-scale farmers in Zambia, such as those involved in backyard broiler production, play a vital role in reducing food insecurity (Tembo and Kibuka-Sebitosi, 2023). The urban and peri-urban agricultural contexts of broiler production in Zambia and neighboring countries are expanding greatly since Africa is becoming the most rapidly urbanizing region in the world.

TABLE 8 Backyard broiler marketing practices among backyard broiler producers in Zambia.

Category	Characteristic	Households per province (%)										Overall	χ^2	<i>p</i> -value
		CB	CP	EP	LP	Lus	MP	NP	NWP	SP	WP			
Presence of seasonal demand	No	30.77	25.00	27.12	20.00	7.04	12.50	20.00	5.56	5.56	18.64	16.44	26.09	0.002
	Yes	69.23	75.00	72.88	80.00	92.96	87.50	80.00	94.44	94.44	81.36	83.56		
Main competitors	Commercial Poultry farms	30.77	44.44	40.68	20.00	16.90	7.50	24.00	14.81	27.78	28.81	25.45	28.26	0.001
	Fellow backyard farmers	69.23	55.56	59.32	80.00	83.10	92.50	76.00	85.19	72.22	71.19	74.55		
Marketing Type	Individuals from compounds	23.08	47.22	45.76	48.00	40.85	55.00	52.00	35.19	25.00	37.29	40.32	33.20	
	Supply Retailers	15.38	13.89	18.64	20.00	15.49	7.50	24.00	20.37	30.56	16.95	17.79		
	Supply supermarkets	0.00	2.78	1.69	0.00	0.00	0.00	4.00	1.85	5.56	1.69	1.58		
	Take to the market ourselves	61.54	36.11	33.90	32.00	43.66	37.50	20.00	42.59	38.89	44.07	40.32		
Marketing age	5 weeks	12.82	5.56	6.78	4.00	7.04	17.50	12.00	7.41	5.56	6.78	8.33	53.47	
	6 weeks	66.67	75.00	67.80	92.00	70.42	65.00	72.00	40.74	75.00	67.80	67.34		
	7 weeks	20.51	13.89	25.42	4.00	18.31	17.50	16.00	38.89	19.44	18.64	20.72		
	8 or more weeks	0.00	5.56	0.00	0.00	4.23	0.00	0.00	12.96	0.00	6.78	3.60		
Marketing Price (ZMW)*	<90	7.69	16.67	8.47	4.00	19.72	10.00	16.00	5.56	16.67	6.78	11.26	49.51	0.000
	90–100	66.67	63.89	77.97	88.00	66.20	50.00	84.00	64.81	41.67	77.97	67.79		
	>100	25.64	19.44	13.56	8.00	14.08	40.00	0.00	29.63	41.67	15.25	20.95		
Products sold	Chicken pieces/parts	0.00	0.00	1.69	0.00	1.41	0.00	0.00	0.00	0.00	0.00	0.45	35.09	
	Live chickens	87.18	86.11	84.75	84.00	97.18	97.50	100.00	96.30	97.22	94.92	92.79		
	Processed chickens' product	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.85	0.00	0.00	0.23		
	Whole-dressed chickens	12.82	13.89	13.56	16.00	1.41	2.50	0.00	1.85	2.78	5.08	6.53		

CB, Copperbelt Province; CP, Central province; EP, Eastern Province; LP, Luapula Province; Lus, Lusaka Province; MP, Muchinga province; NP, Northern Province; NWP, Northwestern Province; SP, Southern Province; WP, Western Province; *ZMW, Zambia kwacha (currency 1USD = 24 ZMW).

TABLE 9 Backyard broiler profitability among backyard broiler producers in Zambia.

Category	Characteristic	Households per province (%)										Overall	χ^2	<i>p</i> -value
		CB	CP	EP	LP	Lus	MP	NP	NWP	SP	WP			
Gross profit (ZMW)*	<2000	8.33	7.69	15.25	12.00	9.86	25.00	11.11	16.00	13.89	25.42	14.64	48.925	0.006
	2000–4,999	52.78	28.21	50.85	36.00	33.80	22.50	38.89	36.00	52.78	42.37	39.64		
	5,000–10,000	33.33	48.72	28.81	44.00	33.80	45.00	42.59	40.00	33.33	25.42	36.26		
	>10,000	5.56	15.38	5.08	8.00	22.54	7.50	7.41	8.00	0.00	6.78	9.46		
	Mean	7996 ^{ab}	4859 ^{ab}	4631 ^b	6130 ^{ab}	8650 ^a	5100 ^{ab}	5694 ^{ab}	6423 ^{ab}	3996 ^b	4567 ^b	5,932		0.000
Largest Expense	Chicks	2.56	2.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.45	40.61	
	Feed	94.87	97.22	100.00	96.00	98.59	100.00	100.00	96.30	100.00	96.61	97.97		
	Heating	2.56	0.00	0.00	0.00	0.00	0.00	0.00	3.70	0.00	1.69	0.90		
	Labor	0.00	0.00	0.00	0.00	1.41	0.00	0.00	0.00	0.00	1.69	0.45		
	Transportation	0.00	0.00	0.00	4.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23		

CB, Copperbelt Province; CP, Central province; EP, Eastern Province; LP, Luapula Province; Lus, Lusaka Province; MP, Muchinga province; NP, Northern Province; NWP, Northwestern Province; SP, Southern Province; WP, Western Province; *ZMW, Zambia kwacha (currency 1USD = 24 ZMW). Different superscript in same row means significant differences ($p < 0.05$), same superscript in same row means no significant difference ($p > 0.05$).

Increased productivity from backyard chicken farming with the right interventions can contribute to a sustainable food production system (Singh et al., 2018). The interventions above may include the development of livestock management skills, health prophylaxis measures, on-farm biosecurity implementation, effective market linkages, and improved farm administration. However, for these interventions to be implemented, there is a need to characterize and fully understand the production systems to bring out the picture and conditions under which backyard production is done. This is the first study that shows a national picture of backyard broiler production in Zambia's rural, urban, and peri-urban areas across all provinces. The findings of this study lay a foundation on which interventions and policies aimed at improving backyard food production systems targeted at broiler production can be based. The findings also reveal backyard boiler production's potential to help sustain household food and economic security at the household level.

Just like Ambrose-Oji (2009) reported that individuals involved in agricultural activities have different socioeconomic statuses, this study revealed various social demographic characteristics of farmers involved in backyard broiler production. The male dominance in backyard broiler production reported in this study was also reported by Alemayehu et al. (2019). The gender imbalance tilted toward males in this study may be due to the financially lucrative nature of backyard broilers that tends to attract men (Yekosabeth et al., 2022).

The age group between 30 and 50 years that dominates Zambian backyard broiler production is comparable to that reported by El-Menawey et al. (2019) in Egypt, where a similar age group dominated broiler production. The capital required to venture into broiler production may hinder young ones (less than 30 years) from joining.

Education is an essential aspect of livestock production. Decent education and hands-on experience boost farmers' capability to produce and produce more livestock efficiently (Ali and Hossain, 2010). These high literacy levels among Zambian backyard broiler farmers present good potential for improved production, consequently improving backyard food systems because high literacy makes the adoption of technology easier.

Land tenure is an important aspect of agriculture as it guarantees the longevity of a particular livestock enterprise. In some jurisdictions, land ownership is a prerequisite for urban agricultural production (Kutiwa et al., 2010). Overall, this study revealed that most broiler farmers never owned the premises for backyard broiler production. In Zimbabwe, where a similar study was conducted, most backyard broiler producers owned the land on which they produced their broilers (Gororo and Kashangura, 2016). The differences could be due to differences in sovereign laws around land ownership between the countries.

Broiler production in Zambia is common in urban and rural areas. There was a somewhat equal distribution of representation for the urban, peri-urban, and rural areas. However, the peri-urban area was the least represented. A similar study reported more broiler production in the urban than in the rural areas of Zimbabwe (Gororo and Kashangura, 2016).

Because not all farmers can breed their broilers, purchasing DOC from commercial breeders and through agents is the most common way farmers procure DOC (Eltholth et al., 2016; El-Menawey et al., 2019). This study revealed that most backyard broiler farmers sourced their DOC from agents. In Zambia, the agents are usually closer to the

farmers than the commercial breeders, who are restricted to the big cities. There are few breeders and suppliers of DOC in Zambia, especially in provinces far from the major cities.

Zambia has very few commercial breeder companies where farmers can source DOC. Therefore, this study established how distant the farmers were from their sources of DOC. The study revealed that about half of backyard broiler farmers sourced their DOC within their districts. This distance challenge to the source of DOC is not unique to Zambia. In some countries like Rwanda, it was reported that some of their DOC are imported from neighboring countries (Mbuza et al., 2017). Importation of DOC may ensure quality but may lead to increased production costs.

The choice of transportation type and duration is key to chicks' survival and performance. Poor transportation may lead to poor-quality chicks due to suffocation (Alemayehu, 2019). This study revealed that the most common ways chicks were transported included public transport, private transport, hired taxis, or vans.

Cobb 500 and Ross 308 breeds are the most commonly produced broilers worldwide (Badubi et al., 2004; Gororo and Kashangura, 2016; El-Menawey et al., 2019). Nevertheless, Cobb 500 is preferred for its desired traits of enhanced growth potential, particularly when put on a good feeding plane (Mbuza et al., 2017). The Cobb 500 breed in Zambia was the most-produced broiler breed, just like in Rwanda (Mbuza et al., 2017). However, in most cases, the popularity of these broiler breeds purely depends on the availability of private breeders, who are primarily suppliers of these breeds.

This study revealed that most farmers kept batches of between 200 and 500 chickens per cycle. This finding agrees with what other studies established. For instance Mbuza et al. (2017) and Emaikwuk et al. (2011) reported that most respondents kept between 100 and 500 chickens per batch at 46 and 83%, respectively. With such small flock sizes reported in this study, the profitability of backyard broiler production in Zambia may be doubtful, as Kawsar et al. (2013) established that the profitability of broiler production increases with flock size. The small batch sizes may be attributed to the space limitation within residential premises where most of the production occurs and other resources needed for broiler production.

Commercial breeders add 2% extra chicks in Zambia whenever farmers purchase DOCs. This means average national mortality is assumed to be 2%. However, in this study, the national average mortality rate per batch was 7.59%, with many reporting a 5–10% mortality rate. This is comparable to the 7.40% reported by Gororo and Kashangura (2016) but still higher than the 4.68% reported by Karaman et al. (2023). Other studies reported mortality rates higher than reported in this study. Lamari (2023) and Phiri et al. (2023) reported broiler mortality rates of 10 and 16.86%, respectively. The differences could be attributed to the differences in the management of chickens and their nutrition.

Like in other livestock enterprises, feed and its management are vital in broilers. This is not only because proper feeding leads to enhanced profits, but it also leads to reduced disease incidences. The prominence use of commercial feeds by Zambian backyard broiler producers is comparable to results reported by other researchers in Ethiopia (Alemayehu et al., 2019), Zimbabwe (Gororo and Kashangura, 2016) and Egypt (El-Menawey et al., 2019). Commercial feeds possess known quality nutrients, hence their prominence among small-scale farmers.

Housing is an important aspect of broiler production for protection from predators and makes managing broilers easy. [Khalid et al. \(2021\)](#) reported that the performance of the broilers can be affected by housing type and conditions. [Qaid et al. \(2023\)](#) also reported that housing is vital for comfort, health, well-being, and efficiency of productivity and reproduction in birds. This study found that all the farmers sampled used a deep litter system and credited this to its less demand for capital. This study further established that all respondents provided housing to their broilers.

The findings of this study on housing materials agree with those published elsewhere that concrete is commonly used in broiler housing ([Badubi et al., 2004](#); [Mbuza et al., 2017](#); [El-Menawey et al., 2019](#)). Nonetheless, the materials used entirely depend on various factors such as costs and availability.

This study established that wood shavings were the most common bedding provided to the broilers in Zambia. Grass, boxes, straw, maize bran, sacks, and sand were also mentioned but were rare. Compared to other studies, straw was found to be the most common litter type in Egypt ([El-Menawey et al., 2019](#)), and sawdust was the most common in Rwanda ([Mbuza et al., 2017](#)) and Botswana ([Badubi et al., 2004](#)). The choice of type of bedding usually is influenced by many factors, such as cost and availability.

In this study, iron sheets were Zambia's most popular roofing materials for broiler houses. This was reflected across all the provinces. Iron sheets were also reported to be a common roofing material for broiler houses in Rwanda ([Mbuza et al., 2017](#)).

Biosecurity is critical to proper and improved production and public health. However, this study revealed some gaps that may need attention, just like other studies reported ([Elkhoraibi et al., 2014](#); [Di Pillo et al., 2019](#); [Correia-Gomes and Sparks, 2020](#); [Ozdemir, 2020](#)).

In contrast to the findings by [Ismaael et al. \(2018\)](#), this study reported that over half of the respondents restricted visitors' access to their poultry houses. This restriction is key as humans have been implicated in the spread of diseases ([Gelaude et al., 2014](#)).

This study also revealed that few farmers used specific protective wear for their poultry houses. It was also uncommon not to find footbaths at most poultry houses. In a study by [Eltholth et al. \(2016\)](#) in Gharbia Governorate, Egypt, 85% of the respondents did not wear protective wear in their poultry house. In Khartoum North, [Gibril and Habib \(2019\)](#) reported the presence of footbaths in 75% of the broiler farms assessed. In a study done in Cameroon, 90% of the broiler farms had footbaths, but only 20% had protective clothing for their poultry ([Kouam et al., 2018](#)).

A weekly cleaning regime was found to be the most popular in Zambia, seconded by those who only cleaned as and when the need arose. [Mbuza et al. \(2017\)](#) reported that 62.20% did not clean their poultry houses adequately. However, cleaning poultry houses not only works as a biosecurity measure but also aids in producing clean birds that attract prospective buyers.

This study found that rodents did not have access to the poultry houses. In Agreement with our study's finding, a study by [Kouam et al. \(2018\)](#) in Cameroon reported that about 90% of the broiler farms in their area had limited rodent access to their broiler houses.

A study in Libya reported that over 90% of the broiler farms disposed of the dead birds by throwing them into rubbish and to fed pets ([Ismaael et al., 2018](#)). However, this study reports that the most common way of mortality disposal across all the provinces was burying.

This study established that despite most farmers vaccinating their chickens in all the provinces, disease outbreaks were common. Disease outbreaks are usually common in broiler production. [Tsegaye et al. \(2023\)](#)

also reported disease outbreaks in broilers in Ethiopia, where increased vaccination rates were observed. However, the high prevalence of vaccinations in this study disagrees with reports from Libya and Zimbabwe, where vaccinations were uncommon in their broilers ([Gororo and Kashangura, 2016](#); [Ismaael et al., 2018](#)). The difference may be attributed to factors like vaccine access and perceptions.

Nonetheless, almost all respondents across Zambia said they treated their chickens whenever the birds were sick. Other researchers have reported similar findings ([Tsegaye et al., 2023](#)). The attention given to disease control through treatments of sick chickens explains the importance and commercial value farmers attach to broiler production and signifies the role backyard broiler production plays in household food and economic security. They treat the chickens to reduce mortalities, as these translate into monetary losses. In treating sick broilers, a few farmers used ethnoveterinary medicines just as [Gororo and Kashangura \(2016\)](#) reported.

This study revealed a variety of challenges affecting backyard boiler production in Zambia. Feed costs were the most common challenge faced by broiler farmers in Zambia. Disease outbreaks were also a widespread challenge. Price fluctuations, lack of market, lack of capital, and shortage of day-old chicks were also mentioned as challenges. In a similar study by [Alemayehu et al. \(2019\)](#), disease outbreaks and feed costs were reported as the top two challenges faced by broiler farmers. Several researchers have published lists of challenges faced by broilers that are comparable to the list established in this study ([Kawsar et al., 2013](#); [Mbuza et al., 2017](#); [El-Menawey et al., 2019](#); [Parveen et al., 2021](#); [Gharib et al., 2023](#)).

Poultry meat is an important aspect of food security as it is one of the most widespread and affordable protein sources. [Parveen et al. \(2021\)](#) reported that poultry meat was preferred in their study. Similarly, this study revealed that almost all producers widely consumed broiler meat. As for the consumption frequency, most of them consumed broiler chicken meat 1–2 times a week. Only about 4.5% never consume the broiler meat they produce. [Pant et al. \(2010\)](#) reported that most people consume meat between 1 and 5 days.

The fluctuations in the demand for broilers reported in this study were also reported by [Kamruzzaman et al. \(2000\)](#). Farm gate selling and direct selling at the market were the two most common marketing channels. This finding is similar to the one found in India and is preferred by small-scale producers as it maximizes profitability by eliminating agents ([Lavanya et al., 2017](#)). Farmers might choose this marketing approach due to the small sizes of their flocks, as it allows them to maximize profits and eliminate intermediaries.

The age at which Zambian backyard broiler producers sell their chickens is comparable to other studies. For instance, [Gororo and Kashangura \(2016\)](#) reported that most broiler chickens are sold between 5 and 8 weeks in Zimbabwe. Broilers can be marketed or slaughtered at various ages, however, the production system of broilers determines the age of marketing and slaughter which may be from as young as 33 days ([Karaman et al., 2023](#)) to as late as 8 weeks ([Mbuza et al., 2017](#)).

This mean price (ZMW 99.18, approximately US\$4) at which broilers were sold in Zambia is relatively lower as broilers have been reported to be sold as high as US\$ 6.10/chicken in Zimbabwe ([Phiri et al., 2023](#)). However, it surpasses the reported price range of ₦1,700–₦3,500 for live broilers in Nigeria, which at the time of this study is estimated to be 1.74 USD–3.91 USD. Nonetheless, the price of live broiler chickens varies with the area as different areas have varying production costs mainly driven by transport costs, feed costs, and other inputs.

Value addition is integral to ensuring more income and maximum utilization of nutrients. This study reported limited value addition in their broiler business. Most chickens were sold as live birds, similar to what [Gororo and Kashangura \(2016\)](#) reported.

The study revealed a variation in profits between provinces with Lusaka having the highest profit and Southern province having the lowest profits compared to the rest. However, most farmers across the country had a mean gross profit of ZMW 5932. However, this profit only considered the difference between the total sales and costs of feed, DOC, and medications/vaccines. Due to the nature of backyard production in Zambia, where broilers are raised within household premises, farmers found it difficult to separate certain costs, such as electricity for lighting and heating, as these are shared with household usage. They could not provide precise estimates of the electricity used exclusively for broiler production. Similarly, labor costs were not clearly defined, as most producers rely on family labor, which they do not quantify or assign a monetary value to.

The profit revealed in this study is way above the national minimum wage for most domestic employees imposed by the government. It is comparable to the average national household income (ZMW 5,546.6) reported by the (CSO). This underpins the importance of backyard broiler production as a potential for economic security among households. Nonetheless, broilers' profitability may be influenced by factors such as sex, age, farming experience, household size, education, and cooperative membership ([Muazu et al., 2024](#)). Furthermore, it is reported that profitability of broiler farming is significantly influenced by factors such as training in broiler production, farming experience, education level, access to extension services and credit, as well as household size ([Phiri et al., 2023](#)).

Broiler production is costly, and this study sought to identify the most significant expense. Feed costs were reported to comprise the largest proportion. DOC, heating, Labor, and Transportation were also mentioned by accounting for an insignificant proportion of the cost of production. This is in contrast to a study by [Karaman et al. \(2023\)](#) who found that heating was the largest cost in the production line. Heating costs vary depending on the materials used for heating and its costs.

5 Conclusion

This study offers an in-depth investigation of backyard broiler production in Zambia, emphasizing its advantages and identifying areas that require enhancement. This production is concentrated in urban and peri-urban agriculture that constitute a contextual dimension that is often overlooked. The growing involvement in this area in the past 5 years highlights its capacity to improve household food security and economic stability. The study revealed that many producers are well-educated, indicating this sector's potential for growth. Most farmers have formal employment, suggesting that backyard broiler production provides an extra source of income. Despite the challenges and gaps identified such as feed cost, and disease outbreaks, the high literacy levels among producers present an opportunity for significant improvements in this sector such as the introduction of appropriate technologies as education enhances the adoption of such. This study's findings form a foundation for developing targeted interventions and policies. The results of this study provide a basis for creating specific interventions and policies that aim to increase the efficiency and long-term viability of backyard

broiler production. Ultimately, these efforts will help to enhance food security in Zambia.

Data availability statement

The original contributions presented in the study are included in the article/[Supplementary material](#), further inquiries can be directed to the corresponding authors.

Author contributions

SL: Conceptualization, Formal analysis, Investigation, Methodology, Software, Writing – original draft, Writing – review & editing. KO: Data curation, Methodology, Validation, Visualization, Writing – review & editing. TT: Data curation, Software, Supervision, Validation, Writing – review & editing. SC: Data curation, Validation, Visualization, Writing – review & editing. SW: Data curation, Validation, Visualization, Writing – review & editing. YO: Supervision, Validation, Visualization, Writing – review & editing. DZ: Validation, Visualization, Writing – review & editing. XS: Supervision, Validation, Visualization, Writing – review & editing. RX: Funding acquisition, Project administration, Validation, Writing – review & editing, Conceptualization, Methodology, Resources. NQ: Funding acquisition, Project administration, Validation, Writing – review & editing, Supervision, Visualization.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fsufs.2025.1446060/full#supplementary-material>

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