Sustainable Agriculture Research; Vol. 13, No. 1; 2024
ISSN 1927-050X E-ISSN 1927-0518
Published by Canadian Center of Science and Education

Production Systems and Management Practices of Chicken Populations in Zambia

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Received: November 7, 2023 Accepted: December 29, 2023 Online Published: January 4, 2024

doi:10.5539/sar.v13n1p61 URL: https://doi.org/10.5539/sar.v13n1p61

Abstract

The study was carried out to describe the population, population dynamics, production systems and management practices of chicken types reared in Zambia, using the 2017/2018 livestock and aquaculture census data provided by the Zambia Statistics Agency and the Ministry of Fisheries and Livestock. Data on the chicken types - Indigenous, Broiler and Layer, was analyzed for both quantitative and qualitative parameters. The population estimates for the chickens were 15,313,780, 6,078,694 and 742,981 for indigenous, broiler and layer, respectively. Flock dynamics could not be ascertained conclusively due to inadequate information. Chicken ownership was significantly skewed towards the male gender for broilers (67%) and layers (79%) while almost equal for the indigenous chickens. Indigenous chickens were more prominent in provinces with high agricultural production (Southern, Central, and Eastern at 51%). Broilers and Layers were more prominent in provinces with commercial centres (Copperbelt and Lusaka at 68% and 75% respectively). The main purpose of rearing indigenous chickens was mainly sales for income (66.1%) and home consumption (32.3%). The main production systems were found to be traditional for indigenous chickens (87%) and intensive for broiler and layer chickens (70.3% and 44%, respectively). The main feeding practices were free-range feeding (80.6%) and free-range with supplementation (17.4%) for indigenous chickens). Diseases notably, Newcastle was found to be debilitating and a great hindrance to livestock production and productivity. The data collection instrument will require fine-tuning to obtain more technical details on production and productivity and better estimate the population dynamics.

Keywords: broiler, census, diseases, indigenous, layer, population dynamics

1. Introduction

The livestock sub-sector in Zambia is an important component of agriculture, contributing 42% of the agricultural sector's gross domestic product (GDP), which is equivalent to 3.2% of the national GDP, and 50% of employment in the rural areas (Bwalya and Kalinda, 2014). The sub-sector has great potential, as it can contribute to economic diversification, food security and nutrition, improved rural livelihood and sustainable income generation. The Government of the Republic of Zambia identified the livestock sub-sector as one of the key drivers of economic growth through enhancing livestock production and productivity, and prioritization of livestock research and development, as stated in the Eighth National Development Plan (8NDP) and the National Livestock Development Policy (MoFNP, 2022; MFL, 2020).

The livestock sub-sector in Zambia is largely cattle, goat, sheep, pig and poultry populations as the major livestock reared. Poultry constitutes domesticated avian species, including chickens, guinea fowls, ducks, geese, pigeons, and turkeys, that are kept for economic significance (Abadula et al., 2020; Adei and Asante, 2012). RALS (2019) affirmed that over 80% of smallholder households own at least one chicken. Chickens are thus the most common type of poultry and livestock owned by the majority of smallholder households in Zambia.

Chicken production, therefore, has the potential to play a significant role in the economy of Zambia because of its widespread distribution and the likely impact of interventions on livelihoods. Currently, the demand for animal protein sources does not match the supply and is expected to increase as a result of the increasing human

population (MoFNP, 2022; Sianangama et al., 2022). Consumption of livestock products directly correlates to income and affordability, implying that a higher income will indicate an increase in livestock products in the diet. Compared to other livestock, chickens are small-sized, cheaper to acquire and widespread in distribution, accounting for their incorporation into the diet. It has been revealed that women are more involved in the management of smaller-sized livestock such as poultry, sheep and goats (Banda and Tanganyika, 2021). Chickens would therefore be an important developmental tool in poverty alleviation.

The Government of the Republic of Zambia, in its quest to determine the contributions of livestock to the GDP, conducted a Livestock and Aquaculture Census in 2017-2018. The Ministry of Fisheries and Livestock, in its preliminary report, provided summaries of poultry production and its distribution across provinces and establishments (MFL, 2019). However, the information on chicken production systems and management practices was limited. In light of the above, this study was conducted to perform a detailed analysis of the chicken census data - the population dynamics, the production systems and management practices with a view to intrusively analyze the census data and point out areas of improvement. The study will also help identify the challenges of the production system and management practices and suggest areas of intervention. This knowledge will be useful in policy formulation, possible investment injection and resource allocation for the development of the livestock sector.

2. Materials and Methods

The Government of the Republic of Zambia, through the Ministry of Fisheries and Livestock and the Zambia Statistics Agency (ZAMSTATS), conducted the 2017/2018 Livestock and Aquaculture Census for households and establishments. The sampling exercise adopted a stratified cluster sampling method based on households raising livestock in the earlier 2010 Population and Housing Census. The sampling frame included both rural and urban areas, and the sampling size was deemed large enough to generate definitive estimates. All households in selected clusters were enumerated. Additional and detailed information on the sampling design specifications can be obtained from the summary report by the Ministry of Fisheries and Livestock (2019) and Odubote (2020).

2.1 Data Collection

Already cleaned data was obtained from Zambia Statistics Agency (ZAMSTATS). For this study, the data collected were those on chicken production, focusing on population and demographics, flock dynamics, ownership, production systems, management practices and health. Data related to egg production was not included in our study.

2.2 Data Analysis

The methods used to analyze the data included both qualitative and quantitative approaches. The collected data were analyzed using simple descriptive statistics (means, frequencies and cross-tabulations) in STATA 18 software. Basic descriptive statistics and the results were presented visually using tables and bar charts. The flock dynamics were estimated based on entry and exit characteristics to provide more insights into quantitative and qualitative patterns in the flock populations.

3. Results

The number of households raising chickens is presented in table 1, while chicken populations by type and province at household level are summarized in table 2. Table 3 highlights the chicken population parameters and household gender demographics.

Table 1. Number of Households Raising Chickens by Province as at 2018

Province	Chicken Types					
	Indigenous		Broiler		Layer	
	HHs	HH%	HHs	HH%	HHs	HH%
Central	173,108	12.9	2,975	10.0	320	10.0
Copperbelt	107,554	8.0	10,013	33.7	372	11.7
Eastern	218,685	16.3	2,258	7.6	302	9.5
Luapula	109,922	8.2	1,233	4.2	156	4.9
Lusaka	74,894	5.6	6,061	20.4	699	21.9
Muchinga	110,997	8.3	1,178	4.0	658	20.7
Northern	144,874	10.8	1,132	3.8	136	4.3
North-western	79,191	5.9	1,445	4.9	130	4.1
Southern	217,963	16.2	3,175	10.7	369	11.6
Western	105,651	7.9	224	0.8	43	1.4
Zambia	1,342,839	100.0	29,694	100.0	3,185	100.0

Table 2. Number of Chickens by Type, Raised by Households as at January 2018

Province	Indigenous		Broiler		Layer		Provincial overall	Provincial
	Number	%	Number	%	Number	%	Total	overall %
Central	2,618,909	17	409,017	7	56,670	8	3,084,596	14
Copperbelt	1,377,544	9	1,795,154	30	48,284	6	3,220,982	15
Eastern	2,011,608	13	322,272	5	9,237	1	2,343,117	11
Luapula	796,075	5	160,328	3	1,237	0	957,640	4
Lusaka	1,254,527	8	2,282,752	38	557,679	75	4,094,958	19
Muchinga	1,148,255	7	172,853	3	16,140	2	1,337,248	6
Northern	1,299,368	8	141,943	2	8,196	1	1,449,507	7
North-Western	755,366	5	354,069	6	10,433	1	1,119,868	5
Southern	3,150,184	21	409,691	7	17,538	2	3,577,413	16
Western	901,944	6	30,615	1	17,567	2	950,126	4
Zambia	15,313,780		6,078,694		742,981		22,135,455	

Table 3. Chicken Population Parameters and Household Gender Demographics

Characteristics	Description	N	Population	Percentage
Total Population			22,135,455	
	Indigenous		15,313,780	69%
	Broiler		6,078,694	28%
	Layer		742,981	3%
Number of HH	Indigenous	1,342,839		
	Broiler	29,694		
	Layer	3,185		
Flock Size (Mean)	Indigenous		11	
	Broiler		205	
	Layer		233	
Gender: Ownership F	Indigenous			45%
M				55%
F	Broiler			33%
M				67%
F	Layer			21%
M				79%

M = male; F = female

3.1 Chicken Population and Demographics

Results indicated that Southern, Central and Eastern provinces hold 51% of the total indigenous chicken

population. For broilers, Lusaka and Copperbelt provinces accounted for 68%, while Lusaka province alone was responsible for 75% of the total layer production. Households that kept indigenous chickens in Eastern, Southern, Central and Northern provinces constituted 56.2% of the total households, while the lowest numbers of households were observed in Lusaka and North-western provinces. Broiler raising households were more in Copperbelt and Lusaka provinces, making up 54.1% of the production base, whereas Western province recorded the lowest (0.8%). Lusaka, Muchinga, and Southern provinces comprised 54.2% of the total households for layer production, while Western province accounted for only 1.4%.

Indigenous chicken flock size ranged from 7 - 17, with an average of 15 chickens observed for Lusaka, Central, Southern and Copperbelt provinces. Contrarily, Luapula, Eastern, Northern and Western provinces recorded a range of 7 - 9, with an average of 8 chickens. Broiler flock sizes ranged from 125 - 377, with an average of 311 chickens observed in Lusaka and North-western provinces. Conversely, Northern, Southern and Luapula provinces had an average of 128 chickens. For layers, flock sizes ranged from 8 - 797, with an average of 605 chickens noted in Lusaka and Western provinces, with a range of 413 - 797. In contrast, an average of 21 was observed in Luapula, Muchinga and Eastern provinces, with a range of 8 - 31 chickens per household.

3.2 Flock Dynamics

Table 4 below shows negative flock dynamics for the chicken types. The overall net flow for the chicken types given in table 5 was equally negative, except for differences in the population decrease obtained.

Table 4. Entry and Exit of Poultry Between October 2016 and January 2018 (Annualized)

Characteristics	Description	Chicken Types		
		Indigenous	Broilers	Layers
Entry	Hatched		23,038	1,025
	Purchased/ bartered	1,443,783	1,478,552	66,214
	Received as gifts		6,240	9
	Subtotal	1,443,783	1,508,830	67,248
Exit	Sold	17,280,000	12,000,800	435,392
	Slaughtered (offtake)		346,819	45,014
	Disease (mortality)			
	Theft	847,490	64,016	499
	Accident	81,607	14,547	1,223
	Bartered out/ exchanged		72,854	63
	Given out	1,754,601	106,086	4,569
	Others	388,961	79,455	2,249
	Subtotal	20,352,658	13,483,797	489,008
	Net flow	(18,908,874)	(11,975,967)	(421,760)

Table 5. Net flow Population Decrease Between 2016 and 2018

Year	Number of Indigenous Chickens	Number of Broilers	Number of Layers
2016	21,300,000	8,988,613	1,147,805
2017/2018	15,300,000	6,078,693	742,981
Change in population	(6,000,000)	(2,909,920)	(404,824)
Per annum	-5142857	-2494217	-346992
% Decrease	28.2	32.4	35.3

3.3 Ownership

It was observed that 93.7% of the households owned indigenous chickens, with an average of 44.8% female household members (Fig 1). The highest percentages of female household members owning indigenous chickens were observed in Western and Central provinces. For broiler production, the average percentage of 33.1% of female members owning broilers was observed from the 69.2% owned by the households, which was relatively low across the provinces. Of the layers owned by the household, female members accounted for 21%.

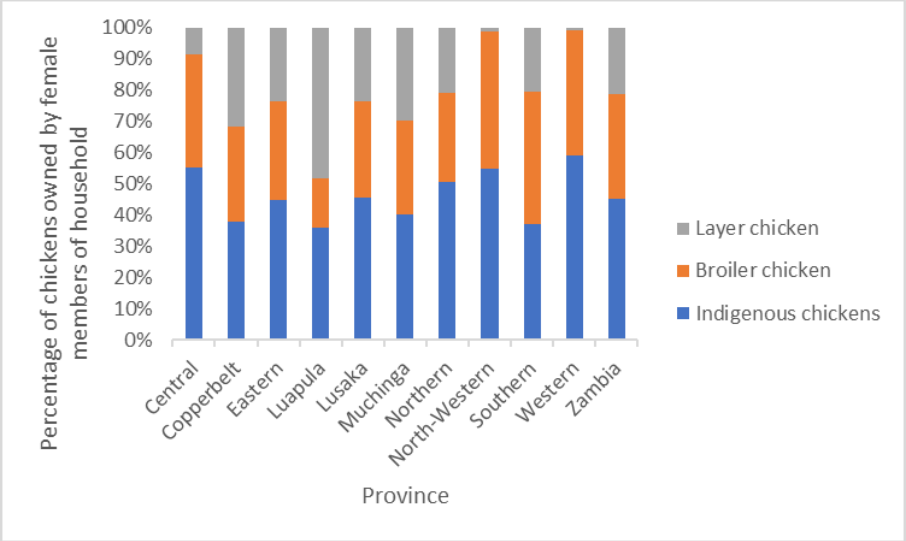

Figure 1. Percentage of Chickens Owned by Female Household Members

3.4 Purpose of Raising Indigenous Chickens

The main purpose of raising indigenous chickens in Zambia was income generation and home consumption as meat, as shown in table 6.

Table 6. Purpose of Raising Indigenous Chickens

Province	Meat (home consumption)	Selling/income	Eggs	Manure	Aesthetic value
	%	%	%	%	%
Central	34.9	58.4	6.7		
Copperbelt	39.3	60.6		0.1	
Eastern	53.3	46.7			
Luapula	100.0				
Lusaka	22.0	75.9			2.0
Muchinga	29.3	70.7			
Northern	22.7	77.3			
North-Western	14.1	85.9			
Southern	18.2	79.6			2.2
Western	36.0	64.0			
Zambia	32.2	66.1	1.0	0.0	0.7

3.5 Production Systems

The traditional system was the most practiced system for households that raised indigenous chickens, while the intensive was mostly used for broilers (table 7). Layers were raised using both traditional and intensive systems. A very low number of households raised indigenous chickens (1%) practiced intensive production system.

Table 7. Production Systems

Production Systems	Chicken Types		
	Indigenous	Broiler Chicken	Layer Chicken
	%	%	%
Traditional	87.0	7.7	33.3
Extensive	6.2	12.7	9.1
Semi-intensive	5.8	9.3	13.6
Intensive	1.0	70.3	44.0

3.6 Management Practices

The main feeding practices (table 8) included free range and free range with supplementation. Households that raised broilers mainly utilized feeding and feeding with supplementation. Layer raising households utilized all four feeding practices. Table 9 showed that above 80% of the households in Luapula, Northern, North Western, Muchinga and Western provinces raised indigenous chickens on free range. It was, however, noted that about 20% of the households in Southern, Copperbelt, Eastern and Lusaka provinces employed free range with supplementation. Broiler and layer keeping households mainly used zero grazing/pecking and supplementation (tables 10 and 11, respectively).

Table 8. Feeding Practices

Feeding system	Chicken Types					
	Indigenous		Broiler		Layer	
	HHs	%	HHs	%	HHs	%
Free range	1,081,849	80.6	1,460	4.9	741	23.3
Mainly feeding	10,609	0.8	9,170	30.9	483	15.2
Free range with supplementation	233,019	17.4	3,100	10.4	754	23.7
Feeding and supplementation	16,785	1.3	14,743	49.7	1,091	34.3
Other	579	0.0	1,220	4.1	115	3.6
Total	1,342,840	100.0	29,693	100.0	3,185	100.0

Table 9. Indigenous Chicken Feeding Practices

Province	Free range	Scavenging	Free range with supplement	Scavenging and supplement	Other
	%	%	%	%	%
Central	77.7	0.4	17.5	4.5	0.0
Copperbelt	75.3	1.3	21.6	1.6	0.2
Eastern	72.5	0.7	25.6	1.1	0.1
Luapula	93.6	0.03	5.8	0.6	0.0
Lusaka	70.4	2.1	24.7	2.7	0.2
Muchinga	86.6	1.1	12.1	0.2	0.0
Northern	94.3	1.1	4.3	0.3	0
North-Western	92.8	0.3	6.6	0.2	0.1
Southern	69.2	0.5	29.7	0.5	0.01
Western	89.9	1.3	8.6	0.3	0.01
Zambia	80.6	0.8	17.4	1.3	0.1

Table 10. Broiler Chicken Feeding Practices

Province	Free range	Scavenging	Free range with supplement	Scavenging and supplement	Other
	%	%	%	%	%
Central	10.4	30.8	8.5	42.5	7.9
Copperbelt	1.5	22.7	8.7	60.6	6.5
Eastern	3.4	41.7	12.2	42.4	0.3
Luapula	10.7	23.6	18.4	45.6	1.8
Lusaka	3.9	30.9	14.1	48.8	2.4
Muchinga	17.5	20.9	7.6	52.6	1.4
Northern	14.5	42.1	6.7	30.9	5.9
North-Western	6.9	41.1	14.4	33.9	3.7
Southern	2.0	47.6	6.6	43.1	0.7
Western	10.7	22.2	16.9	50.2	0.0
Zambia	4.9	30.9	10.4	49.7	4.1

Table 11. Layer Chicken Feeding Practices

Province	Free range	Scavenging	Free range with supplement	Scavenging and supplement	Other
	%	%	%	%	%
Central	7.7	5.7	44.5	42.1	
Copperbelt	5.6	11.0	9.0	50.4	24.1
Eastern	10.2	28.9	1.0	59.9	
Luapula	49.3	12.2	35.9	2.6	
Lusaka	14.6	11.8	27.0	43.0	3.6
Muchinga	59.9	3.6	30.6	5.9	
Northern	9.7	23.8	45.2	21.3	
North-Western	27.0	39.2	22.1	11.7	
Southern	5.5	33.2	9.2	52.1	
Western	54.9	15.3	12.2	17.6	
Zambia	23.3	15.2	23.7	34.3	3.6

3.7 Housing

Provision of minimal housing accounted for 72%, 82.2% and 77.2% for indigenous, broilers and layers, respectively (table 12). The main flooring materials used for broilers and layers were concrete, while for the indigenous chickens, it was the bare earth floor. The roofing materials used for broiler and layer chicken housing were mainly iron sheets with wall and fence materials consisting of burnt bricks and cement blocks. Roofing materials for indigenous chicken housing, on the other hand, were mostly thatched with grass, reeds or stalks with walls and fences of wooden fences and burnt bricks or unburnt mud bricks.

Table 12. Types of Housing for Chicken Rearing

Type of Housing	Chicken Types		
	Indigenous	Broiler	Layer
	%	%	%
None	41.3	4.6	21.9
Confined in sheds	30.7	77.6	55.3
Confined in paddocks	1.2	6.6	2.3
Confined fences	1.4	4.8	5.8
Cage	11.5	3.9	11.3
Basket	8.4	0.8	2.2
Kraal	5.5	1.7	1.1
Total	100.0	100.0	100.0

3.8 Disease Prevalence and Control

It was found that 61.2% of households raising indigenous chicken reported being affected by diseases. Lower numbers were reported from households raising broilers (40.0%) and layers (36.7%), as shown in table 13. Newcastle disease was the highest in indigenous chickens at 78.4% compared to layers at 62.7% and broilers at 38.8% (Table 14). Luapula and Muchinga provinces recorded a high prevalence of Newcastle disease at 70.0% and 60.4%, respectively (Table 15). Gumboro was more prevalent in broiler chickens than layers and indigenous chickens. There were varied levels of confirmation of incidences of diseases by veterinary officers, as indicated in table 16, which could be reflective of the low curative treatments received.

Table 13. Disease Prevalence in Households

Prevalence	Chicken Types					
	Indigenous		Broiler		Layer	
	Number	%	Number	%	Number	%
Yes	821,530.35	61.2	11,862	39.95	1,168	36.7
No	521,285.02	38.8	17,830	60.05	2,016	63.3
Total	1,342,815	100.0	29,693	100.00	3,185	100.0

Table 14. Main Diseases Affecting Chicken Populations

Diseases	Chicken Types		
	Indigenous Chicken	Broiler Chicken	Layers Chicken
	Percent	Percent	Percent
Newcastle Disease (ND)	78.4	38.8	62.7
Infectious Bursal Disease (Gumboro)	7.4	26.2	12.2
Fowl Pox	4.5	2.6	2.2
Other	1.9	15.5	2.6
Don't Know	7.9	16.9	20.3
Total	100.0	100.0	100.0

Table 15. Diseases by Province

Province	Chicken Types											
	Indigenous				Broiler				Layer			
	ND	FP	IBD	Other	ND	FP	IBD	Other	ND	FP	IBD	Other
Central	51.2	5.6	11.6	31.6	47.9	0.1	24.5	27.5	82.8	0.0	0.0	17.2
Copperbelt	63.8	2.8	18.8	14.6	34.0	1.1	26.0	38.9	30.2	0.0	39.2	30.7
Eastern	87.5	4.5	5.6	2.4	36.3	5.7	33.1	24.9	73.3	2.2	18.0	6.4
Luapula	87.8	1.6	6.6	4.1	70.0	6.0	19.0	5.0	100.0	0.0	0.0	0.0
Lusaka	61.1	5.7	10.9	22.3	28.6	2.1	20.6	48.7	27.9	0.0	14.6	57.4
Muchinga	92.1	1.2	3.2	3.5	60.4	0.0	33.5	6.1	95.2	3.2	0.0	1.6
Northern	94.5	0.4	2.0	3.2	42.2	0.0	44.4	13.4	88.0	7.9	4.1	0.0
North-western	90.6	0.6	4.5	4.4	56.4	0.8	24.0	18.8	31.3	0.0	0.0	68.8
Southern	75.0	6.8	9.9	8.3	38.8	6.0	27.9	27.3	6.0	26.8	28.2	38.9
Western	68.9	13.0	4.3	13.9	19.5	35.0	2.7	42.8	65.9	0.0	0.0	34.1

ND = Newcastle disease; FP =Fowl pox; IBD = Infectious bursal disease (Gumboro)

Table 16. Disease Confirmation by an Expert

Veterinary professional	Indigenous chickens	Broiler chickens	Layer chickens
	%	%	%
Yes	11.9	42.7	30.9
No	88.1	57.3	69.1
Total	100.0	100.0	100.0

3.9 Record Keeping

There was no specific request for information on record keeping directed at the chicken types. Rather, the questionnaire was generalized for all livestock. Nevertheless, only 4.3% of households keeping livestock were found to keep livestock records.

4. Discussion

4.1 Chicken Population and Demographics

Our findings that chickens were the most commonly owned type of livestock among most households agreed with the observations made in RALS (2019). Birhanu et al. (2023) also reported that a significant proportion of households in lower income countries accounted for 55%, engaged in poultry farming (mainly chicken). This underscores the importance of chickens in smallholder farming.

Bwalya and Kalinda (2014) reported that the majority of smallholder farmers in Zambia primarily raise indigenous chickens rather than broiler breeds. This is in agreement with our findings. It was also noted that agricultural based provinces raised more indigenous chicken production while the commercial centres focused on broilers and layers. This could be due to the fact that indigenous chickens are well suited to local conditions and require minimum input. By recognizing the prevalent livestock species and their significance in rural households, policymakers can design programs and initiatives that address specific needs and challenges related to livestock management. This targeted approach can improve productivity and enhance rural livelihoods (Machina and Lubungu, 2018).

4.2 Flock Dynamics

Flock dynamics could not be properly analyzed due to the non-collection of required information during the census. For instance, in the indigenous chickens, there were no records on the number lost due to diseases, little or no information on hatched chicks, and chickens received as gifts, slaughtered, bartered, or exchanged. There was limited information on the supply of day-old or point-of-lay chicks for broilers and layers. Hence it was not possible to realistically determine the entry and exit of the flocks. The above scenarios hampered a realistic analysis and supported earlier assertion by Pica-Ciamarra et al. (2014) on the challenges of livestock statistics.

Notwithstanding the above, the negative net flow and reduction in flock size are indicative of underlying issues such as theft and diseases, which need to be mitigated to ensure sustainable chicken production. The reduction in indigenous chicken populations could be attributed to a higher incidence of diseases like Newcastle disease during the rainy season, as Okeno et al. (2012) and DVS (2021) reported. Newcastle disease is known to affect indigenous chickens more severely than other chicken types and may have possibly contributed to the observed reduction.

The decrease in the layer and broiler populations could imply a concomitant drop in supply, highlighting the need for improved breeding programs and management practices for higher production and productivity. It has been reported that there is increased demand for chicken meat during festivities FAO (2014), and it is common for households to slaughter chickens for consumption and as gifts. This could lead to a temporary reduction in the population size of indigenous chickens as the census was carried out over the Christmas period.

The average flock size of 11 chickens reported in this study was the same as an earlier report by Phiri et al. (2017). Comparing the average flock size for indigenous chickens in Zambia to that of other countries indicates that there is room for improvement in the management of chicken populations, given that several authors have reported that households maintain flocks of between 5 to 30 (Nyoni and Masika, 2012).

Understanding the factors influencing flock dynamics is crucial to developing appropriate management practices to improve productivity and profitability. Flock structure is influenced by factors such as production systems, management practices, and feed resources available in subsistence farming (Mtileni et al., 2009). It is therefore suggested that a follow-up census should include more information on disaggregated data (the number of hens, cocks, pullets, cockerels, and chicks) to assist in making informed decisions regarding flock management. It would also have been beneficial if information on the genetic groups of the different chicken types had been collected for analysis.

4.3 Ownership

Our findings on the ownership of indigenous chickens agree with the findings made in RALS (2019), which revealed a higher proportion of livestock ownership observed among ma-headed households than female-headed households. The percentage of female ownership in this study was considerably smaller for broiler and layer production, thus showcasing a gender gap in ownership and management. Exploring the underlying causes and identifying potential obstacles or openings for expanded female ownership in broiler and layer production will require more investigation. Nonetheless, Kitalyi (1998) and Muchadeyi et al. (2004) opined that women, in particular, often undertake various tasks related to indigenous chicken production, including feed distribution, cleaning, watering, and selling eggs and live chickens. The authors further suggested that this may be attributed to lower literacy levels among women, allowing them to stay at home and care for the livestock while men engage in other professional or business activities.

4.4 Purpose of Raising Chickens

Our findings indicated that indigenous chickens were primarily raised for both income generation and consumption as meat, which is consistent with similar studies conducted in areas with moderate to high agricultural potential (Okeno et al., 2012; Wilson et al., 2022). Their short generation intervals, low input requirements and efficient feed conversion into protein make them easily available for sale. They, therefore, serve as the first response to a growing demand and make a convenient cashpoint (El-Yuguda et al., 2007). Furthermore, they are reported to be consumed in a single meal and therefore do not require complex storage facilities, and their products have no cultural or religious taboos (Mahoro et al., 2017; Okeno et al., 2012).

4.5 Production Systems

The traditional production system found to be the most prevailing is consistent with reports from other developing countries, although it included the extensive/free range system (Dana et al., 2010; Mahoro et al., 2017; Okeno et al., 2012). Typically, the traditional system encompasses family poultry, including scavenging chickens and backyard raising. There are variations in the classification of the production system for raising

indigenous chickens. FAO (2014) classified production systems into four, namely, small extensive scavenging, extensive scavenging, semi-intensive and intensive production systems, while Bett et al. (2011) classified the systems into free ranging/scavenging, semi-scavenging, semi-intensive and intensive systems, with some systems not having distinctive differences. For this study, the traditional production system is synonymous with the small extensive and free-range/scavenging for FAO (2014) and Bett et al. (2011).

4.6 Management Practices

Management practices for the indigenous chickens were minimal, as little or no effort was made regarding housing, feeding or health care. In certain cases, households adopt a semi-intensive system, where specific groups within the flock receive supplementary feed based on their growth stage. This includes young chicks, productive birds, and sick birds requiring additional nutrition and water. Managing a flock in such systems requires careful attention to balance the diverse needs of different groups within the flock. Alabi et al. (2012) also emphasized that to maximize productivity, it is crucial to meet the optimal requirements of indigenous chickens regarding protein, lysine (an essential amino acid), and energy. Protein levels in the diet were also reported to optimize feed intake and growth (Kingori et al., 2007). In this study, what constituted feeding with supplementation was not clearly elucidated, despite being significant. However, it is assumed that the chickens, through scavenging, would meet their nutritional requirements, but this will require further investigation.

Layer and broiler chickens were predominantly raised in intensive systems, as noted in the results; this was also reported by Wilson et al. (2022) and Mushi et al. (2020). This is because both layer and broiler production systems rely heavily on concentrate feeding offered in an intensive production system. The intensive system offers better control over feeding, protection from predators and thefts, and efficient flock management. Formulated balanced feed is provided to enhance the nutritional intake of the birds and promote optimal growth and productivity.

Okeno et al. (2012) proposed that utilizing indigenous chickens' genetic potential and production environment is economically beneficial in free-range or semi-intensive systems but not in intensive systems. Therefore, strategic interventions such as selective breeding of local chickens, enhancing feeding and housing systems, and regular veterinary services are crucial to optimize the performance of indigenous chicken farming. Odubote (2022) had noted that improvements in management practices can enhance the productivity of indigenous livestock species which can, in turn, result in a rise in household income per annum (Sarkar and Golam, 2009).

4.7 Housing

In this study, the majority of the indigenous chickens reared did not have any housing units, while those housed were in sheds, cages, baskets and kraals. Mahoro et al. (2017), and Okeno et al. (2012) all reported that chickens are mainly housed in kitchens and households at night and left to scavenge during the day. The availability of resources may have influenced the choice of housing or lack thereof (Muchadeyi et al., 2004). Typically, farmers will construct houses from locally available materials. It would therefore be beneficial to determine if this will lead to substantial growth in production levels.

According to Simainga et al. (2011), farmers reportedly secure their indigenous chickens from predators and bad weather by keeping them in undeveloped poultry structures at night, with predation and thefts identified as the main causes of chicken losses. Providing appropriate and adequate housing for chickens is essential for effective management and raising them to marketable age as quickly as possible. Proper housing protects chickens from predators, adverse weather conditions, and disease outbreaks. Housing should provide a conducive environment for egg-laying, brooding, feeding, and general movement, ultimately impacting their growth and productivity (Oloyo and Ojerinde, 2020). Additionally, having good quality housing can improve the overall efficiency of the chicken production system, as it helps to minimize stress and increases the overall health and welfare of the birds. The significant levels of theft and possible mortalities observed in this study could be attributed to the non-provision of housing.

4.8 Disease Prevalence and Control

Our finding that Newcastle disease was the major disease in indigenous chickens, exacerbated by low vaccination practices, agrees with studies undertaken in other developing countries in Africa (Dana et al., 2010; Harrison and Alders, 2010; Moges et al., 2010; Okeno et al., 2012). Limited access to veterinary services and medications was evident in rural areas like Muchinga and Luapula provinces of Zambia. Furthermore, Hernández-Jover et al. (2019) relayed that traditional systems, in comparison to intensive systems, were characterized by minimal disease prevention and major outbreaks, which are usually higher in the hot-dry and wet-rainy seasons.

Sensitization on best practices in chicken husbandry and health should be carried out to mitigate and reduce infections and mortalities, thereby boosting production and productivity to considerable levels (DVS, 2021). Furthermore, it may be beneficial to schedule vaccination programs in dry seasons and thus enabling immune systems to be strengthened before the onset of the wet season (Okeno et al., 2012). There will be a need to propose improvements in the production systems, which will ultimately reduce disease incidence and thus improve production and productivity.

4.9 Record Keeping

The paucity of records in the data collected is of great concern as it hinders effective monitoring and evaluation of the chicken production system. Glatz and Pym (2013) reported that records of production, growth, feed, egg weights, mortalities, treatments given, and treatment response should be maintained to assist investigations of sub-optimal performance and future improvements. The above information is necessary to identify the underlying issues affecting productivity and profitability.

5. Conclusions

Indigenous chickens are the most common type of chickens raised by the majority of smallholder farmers, with higher populations in provinces with high agricultural production. The traditional production system was the most adopted for indigenous chickens at household level, with minimal input in feeding, housing and disease management, while broilers and layers were raised under intensive systems fixated in commercial hubs. Flock ownership was gender balanced for the indigenous chickens, while a notable gender disparity was observed for layer and broilers, with males displaying higher ownership. The majority of the households raised chickens for income generation showing the economic importance in smallholder livelihoods. Newcastle disease was found to be prevalent and possibly responsible for the high mortality reported. The flock dynamics could not be adequately addressed due to inadequate information. Record keeping among farmers was reported to be poor. Most of the technical information required for productivity analysis was not collected in the census, hence there is a need to improve the data collection instrument.

Acknowledgements

The author wishes to acknowledge the Zambia Statistics Agency (ZAMSTATS), formerly Central Statistics Office and the Ministry of Fisheries and Livestock (MoFL) for the conduct of the 2017 Livestock and Aquaculture and providing the PUMS dataset for this study.

Author contribution

Dr. IKO came up with the concept for the paper, census data and structure for the manuscript, while MBM performed the statistical analysis. SJH led the preparation of the manuscript. All the authors took part in the preparation and review of the manuscript before submission.

Funding

No funding was received during preparation of this manuscript.

Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Informed consent

Obtained.

Ethics approval

The Publication Ethics Committee of the Canadian Center of Science and Education.

The journal's policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

Provenance and peer review

Not commissioned; externally double-blind peer reviewed.

Data availability statement

The data that support the findings of this study is available on request from the corresponding author. The data is not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data is available.

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