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Research Paper

Production system of scavenging chicken strains in amuru district, western oromia, Ethiopia

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ABSTRACT

This study was undertaken to assess the production systems of different scavenging chicken strains in Amuru District of Horro Guduru Wallaga Zone, Western Oromia, Ethiopia. A total of 171 households were randomly selected from three agro-ecological zones namely, highland, midland, and lowland to participate in the study. Survey data was collected using semi structured questionnaires; focus group discussions, and personal observations. The results revealed that type of management systems practiced by respondents in the study district was extensive and semi-intensive accounting for 97% and 3%, respectively. Women and children played significant roles in managing chickens. The most common constraints faced by producers included disease outbreaks, predator attacks, lack of improved breeds, poor housing, and limited access to veterinary services. Despite these challenges, indigenous knowledge and adaptive strategies, such as using ethnoveterinary medicine and traditional hatching methods, were widely practiced. The study concludes that while indigenous chicken production is culturally and economically important in the district, there is a need for targeted interventions focusing on health care, control of predator's breed improvement, and management practices to enhance productivity and livelihoods.

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1. INTRODUCTION

1.1. General Back Ground

Chicken's contribution to global protein production is expected to increase to 40% by the coming 2050, with the importance of chicken expanding in developing countries [1]. In Ethiopia, the word "poultry" is synonymo us with domestic chicken (Gallus domesticus) due to almost nonexistent sources of eggs and meat from other types of poultry in Ethiopia [2]. Additionally, chicken contributes significantly to socioeconomic factors such as revenue generation, food security, and religious and other uses [2]. The largest proportion in the poultry flock structure consists of laying hens (34.26%), followed by chicks (32.86%). Pullets account for an estimated 11.36% of the country's population [3]. Cocks and cockerels ar e estimated at 11.2% and 5.74%, respectively. The rest are non laying hens, which represent about 4.59% of the country's total poultry population [2].

As number of scavenging chicken per household increased, income from chicken increased; also, father participation in labor division of chicken management increased but when number of chicken increased in each household, decision making for egg home consumption by father decreased, indicating that fathers transfer/share the responsibility with mother [4]. A major contributor to food security and revenue generation is the production of chicken, primarily by smallholders, and the demand for poultry products is increasing due to shifts in nutritional needs. Scientific data on Amuru district's chicken production systems is scarce, despite the district's great potential for producing livestock and poultry. Producers have not reaped the full benefits of a big population because of old farming methods, inadequate nutrition, sickness, predators, inadequate healthcare, uncontrolled introduction of exotic breeds, neglect of native breeds, and inadequate agricultural extension services. In order to fill these gaps and accomplish certain goals, this study was created.

2. RELATED WORK

Chicken production in Ethiopia is predominantly a village-based, low-input and low-output system, where households typically rear indigenous chickens under scavenging conditions [5]. Despite limitations such as disease prevalence, poor nutrition, and lack of improved breeds, poultry farming plays a critical socio-economic role especially for women and children by contributing to household food security and income [2]. The production systems vary based on scale and intensity, ranging from large-scale commercial farms, which rely on exotic breeds and high-input management, to backyard systems characterized by minimal input, free-ranging, and native chickens [6].

Large- and medium-scale commercial systems are more market-oriented and involve significant infrastructure and biosecurity measures, while small-scale systems are semi-intensive with limited biosecurity and rely on local materials and supplementary feeding. The dominant village system involves little to no housing or disease control, relying primarily on household scraps and scavenging, and often lacks access to veterinary services [7]. Although productivity remains low, the sector holds potential for improvement through enhanced management, improved breeds, and better access to inputs and markets [8], [1]. Village chicken production is a vital component of rural livelihoods in Ethiopia, with nearly all rural households owning chickens that contribute significantly to household nutrition and income through the provision of eggs and meat. However, despite the large chicken population, productivity remains low due to challenges such as inadequate feeding, poor housing, disease prevalence, and limited veterinary services [9], [10]. Scavenging remains the dominant feeding system, but feed supplementation using household leftovers and grains like maize and sorghum is also common [11]. Water is typically made available from natural and communal sources, with most farmers providing water freely or multiple times daily.

Housing and health management are crucial yet often neglected aspects of village chicken production. While some farmers construct simple shelters from local materials, many chickens are kept in family dwellings at night due to lack of resources or fear of theft [1], [6]. Disease outbreaks, particularly Newcastle disease, significantly impact flock survival, with farmers relying heavily on traditional medicines due to limited veterinary access and low vaccination awareness [11], [12]. These constraints highlight the

need for improved extension services and targeted interventions to enhance productivity and sustainability in village chicken systems [13].

3. METHODOLOGY

3.1. Data Collection

To determine the distribution of both domestic and exotic chicken breeds among rural communities, a quick assessment was done prior to the major survey. Data was gathered directly from household members in charge of managing and caring for the chickens using a semi-structured questionnaire that was created in English and translated into Afan Oromo.

Primary Data: Sources included

a. Open- and close-ended questionnaires
b. Personal observations
c. Key informant interviews

Secondary Data: Were sourced from

a. Published and unpublished documents, including journals, books, annual reports, and online sources.

3.2. Sampling Techniques

To gather representative data for the household survey, a multi-stage sampling technique was used. Based on pre-existing pre-survey data on chicken population density, agro-ecological conditions, and poultry production practices, the study area was purposefully chosen, with an emphasis on the Amuru district within the zone. Five kebeles in the district were specifically chosen because of their importance in the production of chicken.

From each selected kebele, households involved in poultry rearing were identified and listed. To ensure relevance and consistency, households with ownership of more than two chickens were targeted for sampling. The final sample size was determined using [14] formula**:**

$n = \frac{N}{1+N(e)2}$ Where:

a. n = required sample size
b. N = total number of targeted households
c. e = level of precision (set at 5%, or 0.05)

Substituting the values into the formula: $n = \frac{300}{1+300(0.05)2} = n = \frac{300}{1.75} = 171$

Accordingly, a total of 171 respondents were selected from the five kebeles through simple random sampling. The number of respondents from each kebele was determined using a proportional allocation method**,** ensuring fair representation from each location based on the population of poultry-keeping households.

3.3. Data Analysis

The collected data were analyzed using SPSS version 26. Descriptive statistics such as means, frequencies, percentages, and figures were used to summarize household characteristics and poultry production practices.

An index ranking method was also used to prioritize traits considered economically important by the respondents. The index was calculated using the formula:

Index =Σ (n x number of HHs ranked 1st) + (n-1) x number of HHs ranked 2nd) + …+ 1 x number of HHs ranked last) for one trait divided by the Σ (n x number of HHs ranked 1st+ (n1) x number of HHs ranked 2nd+… +1x number of HHs ranked last) for all traits, and Where: n = number of traits under consideration.

The variable with the highest index value was considered the highest economically important trait according to [15]. In summary, Figure 1 depicted the implemented methodology.

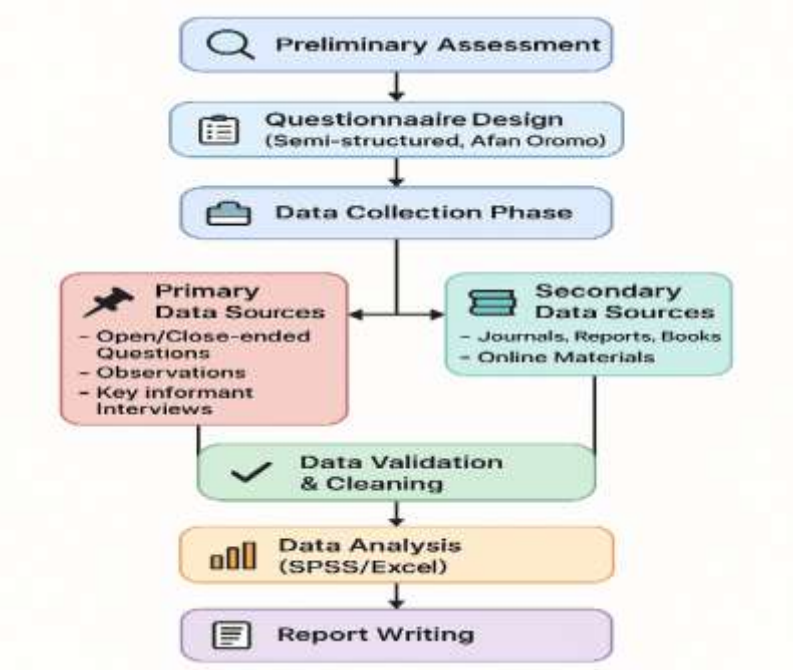

Figure 1. Applied Methodology Flow Chart

4. RESULTS AND DISCUSSION

4.1. Household Characteristics and their Profile

According to Table 1, the majority of households roughly 82% are female, while only 18% are male. This suggests that women are heavily involved in the decision-making and rearing of chickens, and that the money made from chicken and chicken products might be used to pay for household expenses. According to the report by [16], which showed that women made up the majority of respondents (82.5%) and that men made up the remaining 17.5%, males in the current study area are less involved in chicken production than females, who may be concentrating on crop production activities.

Table 1. Demographic Profile of Sample Households in Study Area

	Agro Ecology						Overall		P. Value
	Lowland		Midland		Highland				
	N=68	%	N=68	%	N=35	%	N=171	%	
Age	2	2.9	2	3	1	3	5	2.9	0.047
	7	10.2	7	10.3	4	11.4	18	10.5	
	41	60.3	45	66.1	22	63	108	63	
	16	23.5	12	17.6	7	20	35	20.46	
	2	2.9	2	2.9	1	3	5	2.9	
Sex	8	11.7	13	19.1	9	25.7	30	18	0.001
	60	88.3	55	80.8	26	74.3	141	82	
Marital status	62	91	61	89.7	28	80	151	88.88	0.001
	0	0	1	1.47	4	11.42	5	2.9	
	4	5.88	3	4.41	1	2.94	8	4.67	
	2	2.9	3	4.4	2	5.7	7	4	
	40	58.8	38	55.8	12	34.3	90	52.6	0.025

Educational Background	11	16	10	14.7	6	17.1	27	15.8	
	13	19.1	15	22	13	37.14	41	24	
	3	4.4	3	4.4	4	11.4	10	5.8	
	1	1.47	2	3	0	0	3	1.7	

N=Number of households

For the lowland, midland, and highland agro-ecologies, the corresponding mean family size is 6.32±0.35, which is 6.77±0.12, 5.48± 0.74, and 6.71± 0.19. The current study's mean family size is consistent with the results of [17], who found that the Gena Bossa District in the Dawro Zone in southern Ethiopia had mean family sizes of 6.8.

Compared to households in the midland and highland agro ecologies, those in the lowland had larger landholdings. One possible explanation for the disparity in landholding across the agro-ecologies is that lowland households were more widely distributed than those in the other occupations. Land is scarcer in the Midland and highland agro ecologies, which also had higher population concentrations. The average number of chickens, cattle, sheep, goats, and donkeys per family in the study district was 6.91±0.513, 3.17±0.41, 2±0.51, 1.59±0.126, and 1.15±0.276, respectively. In the study district, there was a significant difference ($P<0.05$) between the three agro-ecological groups with regard to livestock species, including donkeys, sheep, goats, and cattle.

4.2. Chicken Production Systems

The type of management systems practiced by respondents in the study district was extensive and semi-intensive accounting for 97% and 3%, respectively. This study result is closely similar with the result (94.2%) and (5.8%) reported by [18] for extensive and semi-intensive chicken management systems in Farta district of south Gondar zone, Ethiopia.

4.3. Chicken Breed Composition, Flock Size and Structure in the Study Area

The mean number of exotic breeds (Sasso) was 5.61±3.17, the local flock size was 7.925±1.637, and the average number of chickens per home was 6.91±0.513, according to

Table 2. Chicken Breed Composition, Flock Size and Structure in the Study Area. The overall mean size of the chicken flocks per family in the current study was somewhat less than the findings of [19], [20], who discovered that the average size of the flocks per household in the southern Ethiopian region of Halaba was 8.5±0.28, but in the southwest district, it was 8.68±0.28.

There is a significant ($P<0.05$) difference between the three agro ecological zones, in terms of lay ers and cockerels. The number of local hens in the lowland are higher than in highland and midland, and t he number of exotic breeds in highland and midland are higher than lowland agro ecology which might be due to the distance of those breeds distribution area. The percentage of each sex and age group in the flock is used to characterize the group's composition. The most common types of chicken that respondents owned were pullets (2.15±0.71) and layers (4.01±0.186). Strong desire for producing eggs and chicks is indicated by the flocks' higher percentage of layers and pullets.

Table 2. Chicken Breed Composition, Flock Size and Structure in the Study Area

Attribute	Agro-Ecology				P-Value
	Lowland	Midland	Highland	Overall	
Exotic/sasso	4.60 ±3.721	6.51±1.25	5.88 ±0.79	5.61 ±3.17	0.00018
Local	7.12 ±0.702	6.07 ±1.57	6.18 ±1.6	7.925±1.637	0.0013
Chicks	1.33±0.95	1.26±0.61	1.49±0.18	1.36±0.95	0.0632
Pullets	2.15±0.71	2.13±0.11	2.17±0.91	2.15±0.71	0.873
Layers	$3.62±0.19^{a}$	$3.48±0.23^{b}$	$3.45±0.14^{b}$	4.01±0.186	0.581
Cockerels	$0.22±0.022^{b}$	$0.24±0.14^{a}$	$0.20±0.59^{a}$	0.22±0.13	0.951
Cocks	0.27±0.44	0.31±0.31	0.29±0.002	0.29±0.12	0.048

$^{a-b}$; Means with different superscripts within a row are significantly different ($P<0.05$)

The type of management systems practiced by respondents in the study district was extensive and semi-intensive accounting for 97% and 3%, respectively. The dominant chicken production system in the study area was free scavenging (95%) and the rest was semi-scavenging production system (5%).

4.4. Husbandry Practices of Chickens

4.4.1. Feed Resources and Feeding Practices

The study found that all respondents (100%) across the agro-ecologies of the district practiced a scavenging system with supplementary feeding, though the feed provided was often inadequate in quality and quantity. Similar findings were reported in other regions of Ethiopia, including West Amhara (97.8%) [21], Central Tigray (100%) [22], Bench Maji (100%) and Gomma (100%) [21], where most or all chicken producers supplemented scavenging with additional feed. In the study area, 74.4% of supplementary feed came from farm harvests and market purchases, while 25.6% was solely market-sourced. Feeding frequency varied significantly among agro-ecologies, with 42.6% feeding once, 35% twice, 17% three times daily, and 5.4% feeding adlibitum, likely reflecting differences in grain availability, awareness, and prioritization among farmers in lowland, midland, and highland areas.

4.4.2. Water Source and Watering System

According to the current survey, there is a highly significant difference (*P<0.001*) between the district's (woredas) lowland, midland, and highland agro ecologies. River water accounts for 58% of the water used by scavenging chickens in the study region, followed by tap water (27%), and spring water (15%). This could be because different elevations have varying kinds and quantities of water sources.
The result of this study showed that all the interviewed farmers in the study area had watering troughs for their chickens. 82% of the watering troughs in the research region were constructed of plastic, twelve percent were made of wood, and six percent were made of Meta

4.4.3. Chicken Housing System

According to this study, chickens are mostly left to scavenge for feeds during the day and confined at night. About 80 % of interviewed farmers in the study area did not have separate chicken houses and they shared with family dwellings 35.3%, in the kitchen 27.7%, on veranda 5.7%, in basket 11.3% at night as their residencies, respectively. Only the rest 20% of respondents had a separate chicken house which was for exotic/improved breed chickens.

4.5. Major Constraints of Scavenging Chicken Production

Table 3 shows the production constraints in the research area for several scavenging chicken strains in an indexed sequence. Disease outbreaks, particularly Newcastle disease, were the first and most significant factor limiting the production of scavenging chicken in the study district. Newcastle disease (NCD) is the most common and economically significant illness issue affecting village birds. It is the district's leading source of chicken deaths and losses, with coccidiosis coming in second.

Table 3. Indexed Order for Different Scavenging Chicken Strains Production Constraints in the Study Area

Constraints	C_1	C_2	C_3	C_4	C_5	Index	Rank
Diseases	92	45	30	4	0	0.295	1st
Predators	33	66	34	20	18	0.235	2nd
lack of veterinary health service	23	34	59	44	11	0.210	3rd
Lack of awareness	20	26	23	82	20	0.182	4th
Feed shortage	3	0	25	21	122	0.101	5th

According to reports, predators were the second main cause of chicken losses in the research region and the other economically significant issue affecting village chicken production. According to respondents, the most frequent predators in the study area were cats, such as the local Julundi, eagles, known locally as "Risa," particularly in low-lying areas, and hawks, known locally as "Culullee," which

primarily prey on chicks and wild animals like foxes, dogs, and cats, in that order of significance in all agro-ecological systems. One of the most significant ways that respondents in the study area prevented predators was by keeping dogs in the house. Lack of veterinary health services was the third biggest constraint to the scavenging chicken production system in the study area. In terms of economic relevance, this was followed by a lack of awareness, a paucity of supplemental feed, subpar chicken housing, and a lack of extension services. The primary obstacles to chicken production in the study area were depicted in Figure 2.

Figure 2. Indexed Order for Different Scavenging Chicken Strains Production Constraints

4.6. Production and Reproduction Performances of Scavenging Chickens

Table 4 shows that, for lowland, midland, and highland agro ecologies, the average age at first lay for local chickens in the study district was 6.32±1.32 months (6.7± 1.25, 6.24±0.48, and 6.04±0.92). Recent findings about the age at which local hens laid their first eggs were in line with [5], who reported that the Baco Tibe district of east Shewa, Oromia, had local birds that laid their first eggs at 6.15±1.01. The overall average number of eggs per clutch, number of clutches per year and number of eggs per hen per year of local chicken was 14±0.33, 3.44±0.05 and 51.6±0.22 respectively. The average number of eggs per clutch and number of clutches per year of local chicken was not significantly different among agro ecology.

Table 4. Performances of Scavenging Local Chicken in the Study Area

Variable	Agro Ecology			Overall	P-value
	Lowland	Midland	Highland		
Productivity of local chicken (%)					
Age at first egg (month)	6.7±1.25	6.24±0.48	6.04±0.92	6.32±1.32	0.529
Number of eggs per clutch	13±0.45	14.6±0.32	14.1±0.25	14±0.33	0.0142
Number of clutches per hen per year	$3.7±0.065^{b}$	$3.5±0.089^{a}$	$3.13±0.01^{c}$	3.44±0.05	0.472
Number of eggs/hen/years	$51.73±0.17^{b}$	$52.16±0.25^{a}$	$50.92±0.31^{c}$	51.6±0.22	0.0063
Incubation materials used%					
Clay pot	80.9	30.3	12.9	34	0.00092
Bamboo basket	54	46	38	46	0.046

Carton	10	18	36	20	0.0001
Bedding materials used					
Teff straw	98	100	99	99	0.951
Barely straw	0	1	2	1	0.0036

[a-c]; Means with different superscripts within a row are significantly different (P<0.05).

The results also indicate that the majority of respondents (46%) commonly used bamboo baskets as incubating materials while clay and cartons constituted (34%) and (20%) respectively. Overall, 99% of respondents in the study district provide ''teff'' straw and 1% barley/wheat straw as bedding materials for incubation. In other parts of Ethiopia, clay pots, bamboo baskets, cartons or evensimply a shallow depression on the ground were common materials and locations used for egg setting.

As indicated in Table 5, the average age at first lay for Sasso chickens in the study district was 5.53±0.06 months, with significant variation (P<0.05) among agro-ecologies: 6.12±0.03 months in lowland, 5.43±0.048 in midland, and 5.06±0.012 in highland areas.

Maturity was delayed in the lowland, likely due to differences in management practices such as feeding, housing, healthcare, and environmental conditions. Better management was observed in midland and highland agro-ecologies. These findings align with [23], who reported the age at first lay for Sasso chickens as 6.02 and 5.86 months in lowland and midland agro-ecologies, respectively, with an average of 5.93 months in Central Tigray, Northern Ethiopia.

Table 5. Performances of Scavenging Sasso Chicken in the Study Area

Parameters	Lowland	Midland	Highland	Overall	P. Value
Age at first egg (month)	6.12^{a}±0.03	5.43^{b}±0.048	5.06^{b}±0.012	5.53±0.06	0.042
No of eggs/hen/week	5.12^{b}±0.10	5.64^{a}±0.03	5.8^{a}±0.042	5.52±0.057	0.0058
TN eggs laid/hen/year	221.05^{b}±1.19	241.23^{a}±1.34	240^{a}±1.67	234±1.4	0.0043

[a-b]=Means with different superscripts within a row are significantly different (P<0.05)

The overall mean eggs laid per hen per week for Sasso chickens was 5.52±0.057, with significant differences (P<0.05) among agro-ecologies: 5.12±0.10 in lowland, 5.64±0.03 in midland, and 5.8±0.042 in highland areas. This variation may be due to environmental differences across agro-ecologies.

Similarly, the average annual egg production per hen was 234.42±2.01, with 221.05±1.19 in lowland, 241.23±1.34 in midland, and 240±1.67 in highland areas, showing a highly significant difference (P<0.001). Higher production in midland and highland areas may be attributed to better management practices and favorable environmental conditions.

5. CONCLUSION

The effect of agro ecology on both local and exotic chicken breeds in terms of reproductive and productive performance of chicken was significant which might be because of the ecological difference, accesses to market, extension and veterinary services among the study areas.

Chicken diseases, predators, lack of veterinary service and lack of extension services were among the major poultry production constraints in the study area that low per household chicken stock holding and uncontrolled distribution of disease vulnerable exotic breed chicken might escalate the problem.

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Author Contributions Statement

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Chala Feleke Kebede	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓
Demisu Hundie		✓			✓	✓				✓			✓	
Firisa Woyessa					✓	✓				✓		✓	✓	

C: **C**onceptualization
M: **M**ethodology
So: **So**ftware
Va: **Va**lidation
Fo: **Fo**rmal analysis
I: **I**nvestigation
R: **R**esources
D: **D**ata Curation
O: Writing - **O**riginal Draft
E: Writing - Review & **E**diting
Vi: **Vi**sualization
Su: **Su**pervision
P: **P**roject administration
Fu: **Fu**nding acquisition

Conflict of Interest Statement

There is no competing interests or personal relationships that could have influenced the work reported in this paper.

Informed Consent

Informed consent was obtained from all individuals who participated in this study. Participants were informed about the objectives, procedures, and their right to withdraw at any time.

Ethical Approval

This research complied with all relevant institutional policies and national regulations regarding human subjects. The study was approved by the Institutional Review Board of Wallaga University and adheres to the tenets of the Helsinki Declaration.

Data Availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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