

## Research Article

# Assessment of Smallholder Chicken Production Practices, Marketing and Constraints in Two Districts of South-Omo Zone, Ethiopia

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## Abstract

**Objectives:** The study was conducted to assess the production practices, marketing and constraints smallholder chicken producers in two districts of South Omo zone.

**Materials and Methods:** Purposive sampling method was used to select districts, Kebeles and households. Based on this a total of 180 households (2x3x30) were selected to collect information focusing on village chicken production practices, marketing and constraints.

**Results:** The most dominating form of production practice was seasonal supplementation for local and mixed breeds, whereas, regular supplementation for exotic breeds. The feed supplementation trend, attitude toward chicken vaccination and medication, shelter provision, management responsibility, chicken and egg selling responsibility and extension approach of the farmer's changes as the farmers start rearing more productive breeds. Poor productivity, diseases, and old age were the main factors in all strata that determine chickens to be culled except lack of mothering ability for local breeds. There was no formal market channel, the process of transporting chicken and egg was manual, price of items depend on the number of merchants, there was price argumentation between producers and merchants, predict or seasonal outbreak of disease, weak extension access that focused only dissemination of exotic breeds, dissemination of breeds were not based on the scientific research output, no regular follow up and monitoring, and production hindering constraints.

**Conclusion:** Finally, due to weak extension services and other hindering constraints, farmers participated in poultry sector were losing a number of chickens by disease and predators. Therefore, there should be a planned vaccination schedule, scientific and chicken health trial research on local used medicaments, the ways of chicken and egg transporting and marketing should be improved and given equal attention should be to poultry sector with other agricultural sectors at lower levels.

**Keywords:** Breeds; Rearing; Scavenging; Smallholder; Strata

**Abbreviations:** DA: Development Agent; JARC: Jinka Agricultural Research Center; LS: Level of significance; Na: Not Available; Ns: Not Significant; SARI: Southern Agricultural Research Center; SNNPR: South Nation Nationalities and Peoples Region

## Introduction

Poultry production has a minimum impact on climatic change and maintains soil fertility through poultry house litter compared with other livestock production [1]. The most dominant chicken production system in Seka Chekorsa and Kersa Districts of Jimma Zone was the traditional (49.4%), where chickens totally maintain by scavenging, the second production practice was seasonal/conditional supplementation in addition to scavenging (33.2%), where farmers provide feed during crop harvesting and feed availability and the third was semi-scavenging production systems or regular provision feed at least once per day [2].

In Ethiopia, chicken production is mainly known by less attention for the production, by which there is little or no supplementation, no separate shelters except night shelter, low veterinary services, low level of bio-security, higher exposure to predators, devastation of flock by disease and predators and high levels of mortality [3]. Similarly, Smallholder chicken production is characterized by provision of poor quality feeds such as cereal grains, combination of local and improved breeds in one flock, weak veterinary services, local labor and traditional housing systems [4].

The market price of chicken was highly related to feather color, comb type, body weight, sex, health status of chicken and site of market [5]. Similarly, there was no formal poultry and poultry product marketing channel [6]. Diseases, feed shortage and predators (60.13, 20.59, and 19.8%), respectively, were economically important hindering factors of chicken production in North Wollo zone [7]. Similarly, disease and predators were the first and second chicken production constraints in Western Tigray [8].

Assessing the chicken production practices, marketing, extension access and constraints is very important to boost the productivity of the sector, put right kind of decision for the future improvement and provide research based information to policy designers regarding the sector. But, in the case of Debub-Ari and Bena-Tsemay districts there was no scientific research conducted regarding the chicken production practices, marketing, extension access and future and existing constraints. So, doing this research may put standard evidence for chicken producers as well as policy designers. Therefore, this study was targeted with the general aim of assessing smallholder chicken production practices, marketing, extension access and constraints of chicken in Debub-Ari and Bena-Tsemay districts of south-omo zone, Ethiopia.

## Materials and Method

### Ethical Statement

Ethical clearance for this study was obtained from the Jinka Agricultural Research Center (No. JARC-213-02-07-00-010/2020). All ethical issues were considered during individual household interviewing and mutual consent was made between interviewer and interviewers.

### Description of the Study Area

The study was conducted in the Debub-Ari and Bena-Tsemay districts of the South Omo Zone, South Nation Nationalities, and Peoples Regional State of Ethiopia. The Debub-Ari district is found in the southwest part of the South Nation Nationalities and Peoples regional (SNNPR) state. It is located 774 km southwest of Addis Ababa, the capital of Ethiopia, and 529 km south-

west of Hawassa, the capital of the regional state. The Debub-Ari district covers an area of 1,520 km<sup>2</sup> with a relative human population of 219,708. The district lies between 5°67'–6°19'N latitude and 36°30'–36°73'E longitude, with a respective elevation of 500–3,500 meters above sea level. The average annual rainfall ranges from 400 to 1,600mm, and the average temperature ranges from 10.1°C to 27.5°C. The major crops of the district are maize, sorghum, teff, wheat, barley, sunflower, pigeon pea, root crops, fruits, vegetables, and coffee. The dominant livestock types in the district are cattle, goats, sheep, donkeys, horses, and chickens [9].

The Bena-Tsemay district is found in the southwest part of the SNNPR state. It is located 713 km southwest of Addis Ababa, the capital of Ethiopia, and 468 km southwest of Hawassa, the capital of the regional state. Bena-Tsemay covers an area of 2,922.8 km<sup>2</sup> with a relative human population of 61,061. The district lies between 5°01'–5°73'N latitude and 36°38'–37°07'E longitude, with a respective elevation of 500–2,500 meters above sea level. The average annual rainfall of the district ranges from 400 to 1,600mm, and the average temperature ranges from 10.1°C to 27.5°C. The major crops grown in the district are maize, sorghum, teff, fruits, sunflower, pigeon pea, and vegetables. The dominant livestock types in the district are cattle, goats, sheep, donkeys, horses, and chickens [9].

### Sample Size and Selection of Households

Purposive sampling method was used to select Kebeles from the study districts based on Kebeles potential for chicken production. Three kebeles were selected purposively from each districts, and from each kebeles 30 households who have better chicken producing practices were selected purposively and then stratified based on the breeds of chicken the farmers rear (local, exotic, and mixed breed (local, exotic and hybrid at one farm)). Therefore, a total of 180 (2x3x30) households were selected to collect information focusing on chicken production practices, chicken and chicken product marketing, extension access and constraints of chicken production from the members of households responsible for chicken management.

### Data Collection

Before the actual data collection, structured questionnaire was prepared and pre-tested taking few households with the kebele Developmental agents (DA) and farmers were briefed about the objective of the study. The interview was conducted at the farmers' residences with the assistance of kebele extension officers. Data like chicken production system, chicken management responsibility among households, management practices such as housing, water provision, disease and medication practices, culling, extension services, chicken and egg marketing, and constraints of chicken production were collected during the personal interview.

### Statistical Analysis

Descriptive statistics such as mean, standard error, frequency and percentage of the collected data were analyzed using Statistical Package for Social Sciences (SPSS) version 16 (SPSS Inc., Chicago, Illinois, USA, 2007). The chi-square test was determined for each data expressed as percentage and frequency.

Model for survey

$$Y_{ijk} = \mu + x_i + y_j + \epsilon_{ijk}, \text{ where:}$$

$Y_{ijk}$  = The value of the respective variable

$\mu$  = Overall mean of the respective variable

$X_i$  = The effect of  $i^{\text{th}}$  District ( $i=1-2$  districts)

$Y_j$  = The effect of  $j^{\text{th}}$  farmer on respective variables mentioned

$\epsilon_{ijk}$  = Random error term

## Results and Discussion

### Chicken Production practice

The number of respondents that keep entirely on scavenging were highest ( $P<0.01$ ) in local breed rearing strata (Table 1), which could be attributed due to farmer's weak perception toward local breed feed supplementation. In this system chickens search for feed around the garden starting from early morning to searching for night shelter and the chicken owners don't provide any feed rather than feed left-over during feed harvesting/pounding. The numbers of respondents that rear chickens on scavenging, plus seasonally/conditional supplementing were highest and similar in local and mixed breed rearing strata since both of them possess the local ecotypes which are threatened by owners perception due to their less production. The conditions that enable the owners to provide supplementary feed include feed harvesting time, availability of money and presence of chicks or laying exotic breeds. Similarly, Dana et al. [3] reported that, there is no planned feed supplementation and searching round the family dwelling is almost the only source of diet.

The numbers of respondents that supplement regularly (semi-scavenging system) were highest in exotic breed rearing strata. This is because farmers consider that, improved breeds are not as excellent as local ones to scavenge and expose to disease if there was no supplementation. In this production system the chicken keepers provide supplemental feed such as grain (maize, sorghum, sunflower, and pigeon pea), local used mixtures, kitchen left-overs and miller grinded waste. Similarly, Ermias, [6] reported that, about 15% of the respondents practiced semi-intensive production system. Differently, the most dominant chicken production practice in Bishoftu area was small-scale private commercial production [11], and this production differences might be due to the presence of different production facilities in Bishoftu area than the current study districts.

### Chicken Management Practices

The responsibility of chicken management is performed by

**Table 1:** Chicken production practice.

Variables (%)	Strata's			X <sup>2</sup> -test P-value LS	
Production practice	Local (N=60)	Exotic (N=60)	Mixed (N=60)	Overall (N=180)	41.36 0.00 ***
Traditional (Scavenging only)	25(41.7) <sup>a</sup>	3(5) <sup>b</sup>	7(11.7) <sup>b</sup>	35(19.5)	
Scavenging +conditional suppl <sup>a</sup>	28(46.7) <sup>a</sup>	23(38.3) <sup>b</sup>	28(46.7) <sup>a</sup>	79(43.9)	
Semi scavenging (Regular suppl <sup>a</sup> )	7(11.7) <sup>c</sup>	34(56.7) <sup>a</sup>	25(41.6) <sup>b</sup>	66(36.6)	

<sup>a,b,c</sup> means in the row with different letters are significantly different, \*\*\*=significant at  $P<0.001$ , N=number of households, LS = Level of Significance and suppl<sup>a</sup> = supplementation. Figures in the table represent frequency and percentage, respectively.

**Table 2:** Responsibility for chicken management.

Variables (%)	Strata's			X <sup>2</sup> -test P-value LS	
Chicken management	Local (N=60)	Exotic (N=60)	Mixed (N=60)	Total (N=180)	21.89 0.00 ***
Women only	35(58.3) <sup>a</sup>	23(38.3) <sup>b</sup>	22(36.7) <sup>b</sup>	80(44.44)	
Husband	9(15) <sup>b</sup>	31(51.7) <sup>a</sup>	29(48.3) <sup>a</sup>	69(38.33)	
Children	16(26.7) <sup>a</sup>	6(10) <sup>c</sup>	9(15) <sup>b</sup>	31(17.23)	

<sup>a,b,c</sup> means in the row with different letters are significantly different; \*\*\* = significant at  $P<0.001$ ; N=number of households, LS=level of significance. Figures in the table represent frequency and percentage.

women were highest ( $P<0.01$ ) in local breed rearing strata (Table 2), due to lower productivity of the breeds the men and other family members intervention becomes weak and the management of chicken left to women. The interventions of men were highest in exotic breed rearing strata, due to the increase of income from sale of eggs and live chickens. This shows that when the production system changes from less producing local ones to high producing exotic breeds, the management intervention of farmers change among household members.

In generally as the respondents mentioned out feeding, water provision, waste management, and decision to sale are performed by women, whereas activities such as house construction and initial breed purchase need the intervention of men, but sometimes there was joint discussion of the family members especially husband and wife. Similarly, Ochieng et al. [12] reported that in extensive and backyard production systems, the responsibilities of chicken management and ownership are performed by women.

### Water Provision

There were significant differences ( $P<0.05$ ) among the three chicken breed rearing strata regarding water provision (Table 3). Although the production system was too traditional, farmers have practice of water provision, might be due to the free access of water. Plastic materials such as container of dye, water fetching materials, hand washing materials, bath, dish, fragments of clay and divisions of bamboo tree are water troughs in both districts, but, the habit of cleaning water trough is not common practice. Similarly, Emebet [13] reported that almost all of the respondents provided water *ad-libitum* and Worku et al. [14] about 86.2, 3.6 and 10.2% of keepers supplied during hot, cold season and throughout the year, respectively.

### Chicken Culling Practices

No significant differences ( $P>0.05$ ) among the three chicken breed rearing strata in chicken culling, but as the result of overall total indicated 98.33% of respondents have the practice of culling less productive, old and diseased chickens. Similarly, about 79.2 of keepers had experience of culling (Habite, 2019) and 78.9% of chicken keepers in Northwest Amhara Region and Central Tigray zone had practice of culling due to poor productivity (Mearg, 2015).

**Table 3:** Water provision and watering trough.

Variables (%)		Strata's		X <sup>2</sup> -test	P-value	LS
Water provision	Local (N=60)	Exotic (N=60)	Mixed (N=60)	Total (N=180)		
<b>Provision water for your chicken?</b>					10.28	0.006 *
Yes	55(91.7) <sup>b</sup>	60(100) <sup>a</sup>	60(100) <sup>a</sup>	175(97.22)		
No	5(8.3) <sup>a</sup>	0(0) <sup>c</sup>	0(0) <sup>c</sup>	5(2.78)		
<b>Sources of water</b>					6.69	0.17 ns
Any water available	38(69.1)	37(61.7)	37(61.7)	112(64)		
River	14(25.5)	14(23.3)	7(11.7)	35(20)		
tap water	3(5.5)	9(15)	16(26.7)	28(16)		
<b>Kinds of water trough</b>					4.68	0.32 ns
Fragments of Bamboo	15(27.3)	12(20)	16(26.7)	43(24.57)		
Fragments of clay pot	23(41.8)	22(36.7)	16(26.7)	61(34.86)		
Plastic/cover of painting ink	17(30.9)	26(43.3)	28(46.7)	71(40.57)		

<sup>a,b,c</sup> means in the row with different letters are significantly different; ns = not significant at P>0.05, \* = significant at P<0.05, N=number of households, LS = level of significance. Figures in the table represent frequency and percentage, respectively.

**Table 4:** Chicken culling practice.

Variables		Strata		X <sup>2</sup> -test	P-value	LS
Chicken culling	Local (N=60)	Exotic (N=60)	Mixed (N=60)	Overall (N=180)		
<b>Purposely cull chickens?</b>					2.03	0.36 ns
Yes	58(96.7)	59(98.3)	60(100)	177(98.33)		
No	2(3.3)	1(1.70)	0(0)	3(1.67)		
<b>Factors determine culling?</b>					30.32	0.00 ***
Poor productivity	16(27.6) <sup>b</sup>	23(39) <sup>a</sup>	16(26.7) <sup>b</sup>	55(31.07)		
Old age	12(20.7) <sup>b</sup>	9(15.3) <sup>c</sup>	15(25) <sup>a</sup>	36(20.34)		
Poor productivity/old age	3(5.2) <sup>c</sup>	9(15.3) <sup>b</sup>	15(25) <sup>a</sup>	27(15.25)		
Sickness/disease	15(25.9) <sup>b</sup>	18(30.5) <sup>a</sup>	12(20) <sup>c</sup>	45(25.42)		
Lack of broodiness	12(20.7) <sup>a</sup>	na <sup>c</sup>	2(3.3) <sup>b</sup>	14(7.9)		
<b>Forms or ways of culling</b>					1.69	0.79 ns
Consumption	12( 20.7)	14(23.7)	16(26.7)	42(23.7)		
Sale	45( 77.6)	42(71.2)	42(70)	129(72.93)		
Both	1(1.7)	3(5.1)	2(3.3)	6(3.37)		

<sup>a,b,c</sup> means in the row with different letters are significantly different; ns = not significant at P>0.05, \*\*\* = significant at P<0.00, N=number of households, na = not available, LS = level of significance and Figures in the table represent frequency and percentage, respectively.

There were significant differences (P<0.01) among the three chicken breed rearing strata in factors that determine culling (Table 4). The numbers of respondent that cull due to poor productivity were highest in exotic breed rearing strata; due to the imbalance between poor productivity and high feed consumption, farmers take immediate action on less productive exotic breeds. Similarly, the numbers of respondents that cull for disease hesitation were highest in exotic breed rearing strata, due to lower resistance of breeds to harsh environmental conditions and stresses in tropical environment and this in turn attributed culling. The numbers of respondents that cull for lack of broodiness and mothering ability were highest in local breed rearing strata, because broodiness and mothering ability are the two distinctive features that make sustainability of rearing stock under smallholder producers. Similarly, poor productivity, old age and disease were factors for culling (Desalew *et al.*, 2013), home consumption and selling are means of culling [7] and chicken owners cull for income and both (consumption and income) (Emebet, 2015).

### Disease and Medication Practice

There were significant differences (P<0.01) among chicken breed rearing strata regarding the disease outbreak (Table 5). The outbreak of disease was highest in exotic breed rearing strata due to the lower resistance of breeds and unfavorable our local conditions.

No significant differences (P>0.05) among the chicken breed rearing strata regarding economically important diseases that cause the economic loss such as Newcastle, Gumboroo, Coccidiosis and parasitic diseases (Table 5). Similarly, economically important diseases such as Newcastle, coccidiosis, gumboro, fowl typhoid, infectious bronchitis and external parasites impacted the economy of chicken owners (Meseret, 2010).

There were significant differences (P<0.01) among the three chicken breed rearing strata regarding the action of farmers during disease outbreak (Table 5). The numbers of households that do not take any disease curing action were highest in local

**Table 5:** Disease and medication practice.

Variables	Strata			X <sup>2</sup> -test P-value LS	
Disease and medication	Local (N=60)	Exotic (N=60)	Mixed (N=60)	Overall (N=180)	
<b>Disease outbreak/year</b>					11.48 0.003 *
Yes	43(71.67) <sup>c</sup>	57(95) <sup>a</sup>	48(80) <sup>b</sup>	148(82.2)	
No	17(28.33) <sup>a</sup>	3(5) <sup>c</sup>	12(20) <sup>b</sup>	32(17.8)	
<b>Important diseases</b>					2.85 0.83 ns
Newcastle	16(37.2)	23(40.35)	18(37.5)	57(39.40)	
Gumboroo	14(32.56)	15(26.32)	17(35.42)	46(32.23)	
Coccidiosis	10(23.26)	11(19.29)	7(14.58)	28(32.23)	
Parasitic disease	3(6.98)	8(14.04)	6(12.5)	17(10.80)	
<b>Action while disease outbreak</b>					33.86 0.00 ***
Nothing	18(41.86) <sup>a</sup>	4(7.02) <sup>c</sup>	7(14.58) <sup>b</sup>	29(19.59)	
Treat with traditional medicine	13(30.23) <sup>b</sup>	18(31.6) <sup>a</sup>	6(12.5) <sup>b</sup>	37(25)	
Sold live chickens immediately	2(4.65) <sup>b</sup>	3(5.26) <sup>b</sup>	9(18.75) <sup>a</sup>	14(9.46)	
Treated with modern medicine	10(23.26) <sup>b</sup>	32(56.1) <sup>a</sup>	26(54.2) <sup>a</sup>	68(45.95)	
<b>Access for vaccination or drug</b>					4.46 0.11 ns
Yes	11(18.3)	20(33.3)	12(20)	43(23.9)	
No	49(81.7)	40(66.7)	48(80)	137(76.1)	
<b>Vaccination routine provider</b>					12.84 0.01 *
Extension	11(100) <sup>a</sup>	16(80) <sup>b</sup>	9(75) <sup>c</sup>	36(83.72)	
Self	0(0) <sup>c</sup>	0(0) <sup>c</sup>	3(25) <sup>a</sup>	3(6.98)	
Research institute/NGO	0(0) <sup>c</sup>	4(20) <sup>a</sup>	0(0) <sup>c</sup>	4(9.3)	
<b>Access for veterinary drug</b>					9.67 0.008 *
Yes	27(45) <sup>c</sup>	39(65) <sup>b</sup>	43(71.7) <sup>a</sup>	109(60.5)	
No	33(55) <sup>a</sup>	21(35) <sup>b</sup>	17(28.3) <sup>c</sup>	71(39.5)	

<sup>a,b,c</sup> means in the row with different letters are significantly different; ns = not significant at P>0.05, \* = significant at P<0.05, \*\*\* = significant at P<0.001, N=number of households and Figures in the table represent frequency and percentage, respectively, LS = Level of Significance.

**Table 6:** Chicken house and housing access.

Variables (%)	Strata			X <sup>2</sup> -test P-value LS	
Housing	Local (N=60)	Exotic (N=60)	Mixed (N=60)	Overall (N=180)	
<b>Housing access for chickens</b>					25.55 0.00 ***
Yes	43(71.7) <sup>c</sup>	60(100) <sup>a</sup>	56(93.3) <sup>b</sup>	159(88.3)	
No	17(28.3) <sup>a</sup>	0(0) <sup>c</sup>	4(6.7) <sup>b</sup>	21(11.7)	
<b>Kinds of housing</b>					33.21 0.00 ***
From locally available materials	10(16.7) <sup>c</sup>	29(48.3) <sup>a</sup>	25(41.7) <sup>b</sup>	64(35.56)	
Share with human (kitchen)	28(46.7) <sup>a</sup>	25(41.7) <sup>b</sup>	23(38.3) <sup>b</sup>	76(41.22)	
Confined in the basket	5(8.3) <sup>c</sup>	6(10) <sup>b</sup>	8(13.3) <sup>a</sup>	19(10.55)	
<b>Made based on recommended</b>					16.44 0.00 ***
Yes	0(0) <sup>c</sup>	15(25) <sup>a</sup>	9(15) <sup>b</sup>	24(13.3)	
No	60(100) <sup>a</sup>	45(75) <sup>c</sup>	51(85) <sup>b</sup>	156(86.7)	
<b>Variables (Mean ±SE)</b>		<b>Strata's</b>			
N <sup>o</sup> of Cleaning per week	2±.303 <sup>b</sup>	2.95±.2 <sup>a</sup>	3.03±.2 <sup>a</sup>	2.66±.27	0.015 *

<sup>a,b,c</sup> means in the row with different letters are significantly different; \*\*\* = significant at P<0.001, \* = significant at P<0.05, N=Number of households, LS = Level of Significance and Figures in the table represent frequency and percentage, respectively.

**Table 7:** Chicken and egg marketing.

Variables (%)	Strata			X <sup>2</sup> -test P-value LS	
Egg marketing	Local (N=60)	Exotic (N=60)	Mixed (N=60)	Overall (N=180)	
<b>Determinants of market price of egg</b>					6.95 0.325 ns
Size/weight of egg	23(38.3)	23(38.3)	26(43.3)	72(40.0)	
Yolk quality	17(28.3)	24(40.0)	21(35.0)	62(34.4)	
Shell color	12(20.0)	5(8.30)	4(6.7)	21(11.7)	
Shell cleanness	8(13.3)	8(13.3)	9(15.0)	25(13.9)	
<b>Determinants of price of chickens</b>					2.16 0.904 ns
Body weight	28(46.7)	29(48.3)	28(46.7)	85(47.22)	
Feather color	17(28.3)	14(23.3)	13(21.7)	44(24.44)	
Comb type	9(15.0)	7(11.7)	9(15.3)	25(13.90)	
Sex	6(10.0)	10(16.7)	10(16.7)	26(14.44)	
<b>Variation of price of egg and chicken</b>					19.25 0.00 ***
Yes	56(93.3) <sup>a</sup>	50(83.3) <sup>b</sup>	37(61.7) <sup>c</sup>	143(79.44)	
No	4(6.70) <sup>c</sup>	10(16.7) <sup>b</sup>	23(38.3) <sup>a</sup>	37(20.56)	
<b>Responsibility of egg/chicken sale</b>					21.102 0.00 ***
Wife	42(70.0) a	29(50.0)c	36(61.7)b	107(59.44)	
Husband	2(3.30)c	22(35.0)a	15(23.3)b	39(21.67)	
Children	16(26.7)a	9(15.0)b	9(15.0)b	34(18.89)	
<b>regular client of egg and live bird</b>					10.69 0.03 *
Village collectors	19(31.7)a	8(13.3)b	10(16.7)ab	37(20.56)	
Collector in the market	38(63.3)c	48(80.0)a	41(68.3)b	127(70.56)	
Consumers	3(5.00)b	4(6.70)b	9(15.0)a	16(8.88)	
<b>Problems of egg and chicken marketing</b>					10.61 0.101 ns
Demand seasonality	31(51.7)	31(51.7)	29(48.3)	91(50.56)	
Lack of market place	18(30.0)	11(18.3)	10(16.7)	39(21.67)	
Poor infrastructure	9(15.0)	15(25.0)	21(35.0)	45(25.00)	
Unstable price	2(3.30)	3(5.00)	0(00.0)	5(2.77)	

<sup>a,b,c</sup> means in the row with different letters are significantly different; ns = not significant at P>0.05, \*\*\* = significant at P<0.001, \* = significant at P<0.05, N=number of households and figures in the table represent frequency and percentage, respectively, LS = Level of Significance.

**Table 8:** Extension access.

Variables (%)	Strata			X <sup>2</sup> -test P-value LS	
Extension access	Local (N=60)	Exotic (N=60)	Mixed (N=60)	Overall (N=180)	
<b>Access to extension</b>					3.002 0.22 ns
Yes, but it is weak	29(48.3)	38(63.3)	31(51.7)	98(54.44)	
No	31(51.7)	22(36.7)	29(48.3)	82(45.56)	
<b>In what form</b>					20.94 0.002 *
Advice only	21(72.4) <sub>a</sub>	13(34.2) <sup>b</sup>	13(41.9) <sup>b</sup>	47(47.96)	
Provision of improved breeds	3(10.3) <sup>c</sup>	9(23.7) <sup>a</sup>	7(22.6) <sup>b</sup>	19(19.39)	
Veterinary service	5(17.3) <sup>a</sup>	2(5.3) <sup>c</sup>	4(12.9) <sup>b</sup>	11(11.23)	
In all form	0(00) <sup>c</sup>	14(36.8) <sup>a</sup>	7(22.6) <sup>b</sup>	21(21.42)	
<b>Frequency of getting DA</b>					2.59 0.63 ns
Once in a week	9(31)	13(34.2)	15(48.4)	37(37.76)	
Conditional follow up	11(37.9)	12(31.6)	9(29)	32(32.65)	
Once in a month	9(31.1)	13(34.2)	7(22.6)	29(29.59)	
<b>Reason for no extension</b>					10.53 0.005 *
Is not regarding poultry	27(87.1) <sub>a</sub>	10(45.5) <sup>c</sup>	20(69) <sup>b</sup>	57(69.51)	
Farness of service center	4(12.9) <sup>c</sup>	12(54.5) <sup>a</sup>	9(31) <sup>b</sup>	25(30.49)	
<b>Access of training</b>					3.15 0.21 ns
Yes	2(3.3)	7(11.7)	4(6.7)	13(7.22)	
No	58(96.7)	53(88.3)	56(93.3)	167(92.78)	

<sup>a,b,c</sup> means in the row with different letters are significantly different; ns = not significant at P>0.05, \* = significant at P<0.05, N=number of households and Figures in the table represent frequency and percentage, respectively, LS = Level of Significance.

**Table 9:** Constraints of chicken production.

Variables (%)	Strata			X <sup>2</sup> -test P-value LS	
Extension access	Local (N=60)	Exotic (N=60)	Mixed (N=60)	Overall (N=180)	
<b>Which is your main constraint</b>					5.29 0.98 ns
Feed competition with human	10(16.7)	12(20)	9(15)	31(17.22)	
Disease, vet. Drugs and vaccine	8(13.3)	13(21.7)	14(23.3)	35(19.44)	
Absence of extension	7(11.7)	8(13.3)	7(11.7)	22(12.22)	
Absence of separate poultry house	10(16.7)	5(8.3)	9(15)	24(13.33)	
Predator	6(10)	7(11.7)	5(8.3)	18(10)	
Thief	6(10)	4(6.7)	5(8.3)	15(8.33)	
Conflict with neighbor	7(11.7)	7(11.7)	6(10)	20(11.11)	
Capital	6(10)	4(6.7)	5(8.3)	15(8.33)	

ns=not significant at P>0.05, N=number of households, figures in the table represent frequency and percentage, respectively, and LS = Level of Significance.

breed rearing strata; whereas, the numbers of respondent that treat with modern medicine were highest in exotic breed rearing strata. This difference might be due to the farmer's attention difference between the two breeds which is attributed due to their productive potential difference. Lemon, garlic, onion, hot pepper, and cassava leaf are local used traditional medicines to treat sick chickens.

The limited/no numbers of animal health clinics, limited numbers of animal health workers, far-ness of veterinary clinics, absence of veterinary drugs and vaccines were the main obstacles that hinder modern ways of medications in both districts. Similarly, about 59.6, 19.2 and 19.1% of respondents did nothing, traditional medicine and human-related medicine, respectively, (Matiwos *et al.*, 2015) and about 74.4, 13 and 10% of respondents treated by veterinarian pharmacy, private pharmacy and traditional drug, respectively, (Alemayehu, 2017).

Due to the absence of live vaccines, vaccination schedule, awareness, and strong extension the vaccination program was not successful regarding the poultry sector. As respondents and development agents stated, there was frequent outbreak of disease in March to May and September to October due to the appearance of new weeds in the first rain and shifting up of season from rainy to dry period, respectively.

There were significant differences (P<0.05) among the three chicken breed rearing strata regarding vaccination provider (Table 5). About 83.72% of farmers get vaccination through extension and remaining by research center, NGO or self. Similarly, about 95.6 and 78.8% of farmers were not vaccinated and have no any experience of getting chicken to vaccination center, respectively, (Matiwos *et al.*, 2015); and (Desalew *et al.*, 2013).

As respondents stated, due to the far-ness of veterinary drug purchasing centers and absence of animal health clinics, 39.5% of respondents have no access for veterinary drug services (Table 5). Farmers with accessibility of veterinary drug mentioned that sometimes chicken keepers purchase drug from animal health experts, mix with water and allow to drink/sometimes forcefully. About 5, 22.2 and 12.4% of farmers in Bure, Fogera, and Dale districts, respectively, used veterinary drugs to treat sick chickens (Fisseha *et al.*, 2010).

### Chicken House and Housing access

There were significant differences (P<0.001) among the chicken breed rearing strata regarding the house access (Table 6). The numbers of respondents that provided housing access were highest in exotic breed rearing strata, due to the farmer's awareness on exotic breed's shelter requirement. As 11.7% of respondents stated, allowing chickens outside trees with perch decrease the disease exposure of chickens, simply allowing the free air movement and easy waste removal.

There was significant difference (P<0.001) among the three chicken breed rearing strata in kinds of chicken house. The numbers of respondents that use separate poultry house were highest in exotic breed rearing strata, because presence of separate poultry house is the first criteria while distributing exotic breeds. The numbers of respondents that used kitchen as poultry house were highest in local breed rearing strata, because rearing in kitchen and sharing with a human was the predominant and known housing access under smallholder local chicken producers. Due to fear of night attacking predators some chicken keepers in all strata confined in basket and make free during day time for scavenging. Similarly, about 96.7% of producers kept in separate house (Ermias, 2015) and about 23.3% of producers used separate poultry houses (Salo *et al.*, 2016). About 25% of respondents in central Oromia region constructed poultry house based on recommended extension package (Ermias, 2015).

There was significant difference (P<0.05) among chicken breed rearing strata in chicken house cleaning frequency (Table

6). The highest and similar cleaning frequency was recorded in exotic and mixed breed rearing strata. As respondents stated chicken keepers add wood ash to dry and remove bad odor from chicken house after removing the solid part of waste. The house cleaning frequency may be daily for the farmers who use kitchen and basket as a night shelter, because they use the place for another purpose during the day time. Similarly, about 17.2, 31.8, 30.1, 11.1 and 9.8% of farmers cleaned daily, once a week, once a month, once a year and totally not practiced cleaning, respectively, (Emebet, 2015).

### Chicken and Egg Marketing

No significant differences ( $P>0.05$ ) among the three breed rearing strata regarding the factors that determine the market prices (Table 7). As respondents mentioned the yolk quality of egg (spoiled or normal) is checked by different ways such as seeing by different light sources, inserting in a container with water, and hearing the sound of egg simply by shaking. As respondents stated, Although there was no religious sacrificing trend currently, the market price of live birds with similar body weight but different feather colors (black and red) are not similar in market price because traditionally black chickens were sacrificed for different believes and bad idols. Similarly, single and double comb-type chickens are not similar in market price, but the basic reason behind variation due to the comb type is not known. Similarly, the market price of live chicken is highly related to feather color, comb type, body weight, sex, site of market, and health status of the chicken (Alemayehu, 2017).

There was significant difference ( $P<0.01$ ) among three chicken breed rearing strata regarding variation of the market price of live bird and egg at different places (Table 7). The numbers of merchants, consumers, chicken keepers, season and times of the year, presence of infrastructures such as market, road, and governmental offices are the main factors that bring variation of price of live bird and egg.

There was significant difference ( $P<0.01$ ) among chicken breed rearing strata regarding live chicken and egg selling responsibility (Table 7). The responsibility of chicken and egg selling performed by women was highest in local breed rearing strata, antagonistically; the responsibility of chicken and egg selling performed by husbands was highest in exotic breed rearing strata. This is because works with minimum income were threatened and left to women which is due to the productivity differences between the breeds (egg and body weight), this in turn, decreases the intervention of husband and other family members in local breed rearing households and vice versa. Similarly, women shoulder most of the responsibility in chicken and chicken product marketing (Fisseha et al., 2010).

There was significant difference ( $P<0.05$ ) among the three breed rearing strata regarding clients of live chicken and egg marketing (Table 7). The numbers of respondents that sale live chicken and egg to village collectors were highest in local breed rearing strata, and differently, the numbers of respondents that sale live chicken and egg to market collectors were highest in exotic breed rearing strata. This difference might be due to in exotic breed production the production aim seems a little business oriented and producers sale at weekly market to get full price including the local collectors get through local market channel.

Generally, there was no formal market channel, the process of transporting chicken and egg was too traditional, market

price depends on numbers of local merchants and there was price argumentation between the sellers and merchants without any market information. Similarly, there was no formal poultry and poultry product marketing channel (directly selling to consumers and local traders (Ermias, 2015) and about 34.4% in Ada'a and 50% in Lume district were selling eggs and chicken to local shopkeepers (Desalew, 2012).

### Extension Access

No significant differences ( $P>0.05$ ) among the three chicken breed rearing strata regarding the extension access and half of households have no extension access, might be due to far-ness of extension service center and service is not regarding poultry sector (Table 8).

There was significant difference ( $P<0.01$ ) among the chicken breed rearing strata regarding the forms of extension service (Table 8). The numbers of respondent that get extension service in the form of advice were highest in local breed rearing strata, due to less alertness of local breed keepers for other forms of extension rather than advice. The numbers of respondents that get extension service in the form of provision of improved breeds were highest in exotic breed rearing strata, because exotic breed keepers use extension as the primary source of rearing and breeding stock. Similarly, the numbers of respondents that get all forms of extension services were highest in exotic breed rearing strata; because improved breed keepers are more conscious for extension approach than others. Although the extension access is the major determining factor for productivity and adoption of smallholder chicken production, there was a week and conditional extension services. As chicken keepers stated, in-adequate extension access in the districts especially veterinary drugs and vaccines retarded farmers from technology adoption. This is because the poultry sector was masked by other agricultural extension works such as crop and livestock production, and less attention was given for the poultry sector except for dissemination (exotic breeds). The extension service in the study districts was only focused on disseminating improved breeds, there was no regular follow up or monitoring and dissemination of improved breed was not based on scientific research output about the complementarity of breed with environment. Due to this and other limiting factors, the farmers participated in poultry sector were not profited, and being losing numbers of chickens when the disease outbreak occurs. Similarly, lack of extension services was the main constraint that hinders the development of poultry industry in developing countries (Ovwigbo *et al.*, 2009), extension linkage between research output, ministry of livestock and farmers were extremely weak (Mekonnen, 2007) and about 58.8 and 46.6% of respondents in Ada'a and Lume districts have no extension services, respectively, (Desalew, 2012).

### Constraints of the Future Expansion of Chickens

Although there was no significant difference ( $P>0.05$ ) among the three chicken breed rearing strata (Table 9), the important constraints and their burdens are discussed as follows.

Disease in one hand and absence of veterinary drugs and vaccine in another hand were the first and most hindering factors of chicken production in study districts (Table 9), due to the chickens pre-access to scavenge freely. The Disease outbreak due to absence of scheduled vaccination caused flock loss and culling, this in turn retarding the future expansion of chicken production especially more sensitive exotic breeds. Similarly,

disease problem was the major health constraint that hinders the expansion of village chicken production (Addisu *et al.*, 2013).

The second hindering factor of the future expansion of chicken production was in-availability of feed and competing with human for grain feeds. Due to the high cost of grain feeds, smallholder chicken keepers are suffering to purchase, this in turn hindering those planning to rear more consuming exotic breeds. Similarly, poultry industry in developing countries was facing some challenges due to increase in the cost of feed (Abbas, 2013) and the productivity of poultry sector in tropics limited by the scarcity and high prices of feed (Abera *et al.*, 2011).

The 3<sup>rd</sup> constraint that hinders the future expansion of chicken production was the absence of separate poultry house. Due to awareness limitation and capital problem majority of farmers use kitchen, basket and trees around the garden as a night shelter, this in turn exposed chickens to wild predatory animals and retarding the future expansion of chicken production. Similarly, due to the absence of strong extension service farmers did not make the right kind of shelter (Ermias, 2015) and chickens are confined within family dwelling during night and released for scavenging at day time that cause mortality (disease or predators) (Meseret, 2010).

The 4<sup>th</sup> constraint that affects the future expansion of poultry production was absence of strong extension service, which acts as a technology disseminator between the research outputs and end users. The disseminated exotic breeds were not productive due to in-complementarity of genotype with environment, attributed due to weak linkage between research and extension works. As respondents explained, conditional extension service in the study districts was promising farmers not to expand chicken production more. Similarly, there was no organized linkage between technology participants and agricultural offices (Ermias, 2015) and the extension linkage between research output, ministry of livestock and farmers were extremely weak (Mekonnen, 2007).

The 5<sup>th</sup> factor that hinders the future expansion of chicken production was the conflict of neighborhoods due to damage of newly emerging crops while searching for feed and worms. As the producers explained chickens damage the gardens of neighbors while scavenging and due to which chickens confined at home without enough feed and this in turn retarding the future expansion of chicken production by increasing the disease exposure. The 6<sup>th</sup> and 7<sup>th</sup> factors that hinder the future expansion of chicken production were presence of predator and thief. Due to the absence of intensive production practice chickens are exposed to predatory wild animals especially, exotic breeds due to exotic breed's lower ability to flight and less intelligence to refuse catching. Similarly, birds called "cululle" (34%), cats/dogs (16.3%) and wild animals (15%) were the major causes of chicken mortality (Shishay, 2016).

The 8<sup>th</sup> factor that retards the future expansion of poultry production in the study districts was the absence of capital to fulfill inputs such as feed, breed, house constructing materials. There was hesitation to rear exotic breeds due to the absence of capital in one hand and absence of opportunity for accesses of credit services on another hand. Similarly, the major constraint to the adoption of recommended technology was lack of capital (Heaven light, 2013), and the access to capital and credit services was a severe constraint to the utilization of local chicken production technology (Olaniyi *et al.*, 2008).

## Conclusion

The most dominating form of production practice was seasonal/conditional supplementation for local and mixed breed keepers, whereas, regular supplementation for exotic breed keepers. As farmers change less producing local breeds by high producing exotic ones, the management intervention of farmers and selling responsibility change among the family members, due to the income level which is attributed by the productivity difference of breeds. Exotic breed rearing households have better awareness on chicken husbandry practices such as supplementary feed provision, separate house provision, disease curing action, and extension approach than the mixed and local breed rearing households might be attributed due to lower productivity. There was no formal market channel, the process of transporting chicken and egg was traditional, market price depends on the numbers of merchants and there was price argumentation between the producers and merchants. There was weak extension service that only focused on disseminating improved breeds and dissemination of improved breed was not based on scientific research output about the complementarity of breed with environment. Finally, due to weak extension services and other hindering factors farmers participated in poultry sector were losing a number of chickens and are hesitating to rear chicken as an income-generating business. Therefore, there should be a planned vaccination and follow up schedule, scientific and health trial research on traditionally used medication routines, the chicken and egg marketing chain should be improved and equal attention should be given to poultry sector with other agricultural sectors at lower levels.

## Author Statements

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### Conflicts of Interest

The authors declare no conflicts of interest.

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