Characterization of indigenous chicken production systems in Sheka zone, south western Ethiopia

Hailu Assefa*[1], Aberra Melesse[2] , Mestawet Taye[2]

*[1]*Mizan Agricultural Technical, Vocational, Educational and Training College, P.O. Box 217. Southern Nations Nationalities Regional State, Ethiopia*

[2] *School of Animal and Range Sciences, Hawassa University, P.O. Box 5, Hawassa, Ethiopia*
Corresponding author: E-mail: hailuhh2007@Gmal.com

Abstract
The survey was conducted in Sheka Zone to characterize the production system of indigenous chicken populations. A mixture of purposive and random sampling techniques was used to collect the data. Data on chicken production system were assessed through semi-structured questionnaire survey. Households who rear only indigenous chicken were considered in this study. The findings revealed that the mean flock size in the study area was 13.2 per household. About 38.3 and 61.7% of respondents replaced their flock through buying from market and from hatched, respectively. The primary purpose of egg production in the study zone was for income generation (80.4%). The study indicated that indigenous chicken production system in study area is characterized by scavenging with seasonal feed supplemented system. The most common supplementary feed was Ensete ventricosum (processed enset) (64.9%) in the study zone. About 52.5% of respondents keep their chickens in a separate house while the rest (47.5%) used different types of night sheltering systems. Newcastle disease (40.5%) was the main devastating diseases reported by the households. The mean age at first egg laying for pullets and sexual maturity for cockerels was 6.3 and 5.6 months, respectively. The total number of eggs per clutch and number of clutches per year were 13.6 and 3.0, respectively, resulting in total number of 40.8 eggs per year. About 8.7 eggs were incubated per clutch from which 74.1% of them were hatched with a survival rate was 59.3 %. Therefore, the present study suggests that indigenous chickens are able to produce and reproduce under scavenging system which calls for strategic interventions including selection among local chickens, improving the feeding and housing systems and provision of veterinary services on regular basis.

Key words: *Indigenous chicken, Sheka, scavenging system, productivity traits, agroecology*

INTRODUCTION

Poultry product consumption is progressively growing in the world and accounts for about 33% of the global meat consumption and is expected to grow at 2 to 3% per year in the world (Mammo, 2013). Chicken rearing for Africa plays a symbolic importance for socio-economic, cultural, integrated food production/security and religious purposes (Kondombo *et al.*, 2003; Muchadeyi *et al.*, 2004; FAO, 2008). Similarly Small-scale backyard or village level poultry sector has been contributing considerable portion to the economy of Ethiopia (Tadelle *et al.*, 2003; Aberra and Tegene, 2011; CSA, 2014). The total chicken populations in the country is estimated to be 56.87 million and of these 95.86 % are indigenous which are mainly kept by smallholder farmers in scavenging environments (CSA, 2014). This indicates the significance of local chickens as potential animal genetic resources in the country. Indigenous chicken contributes high quality animal protein in the form of eggs and meat for

home consumption as well as for sacrifices and are also easily managed by all even the poorest of the poor including women and children (Patricia, 2011). More than 90% of the chicken and egg output of the country comes from indigenous chickens kept under the traditional management system (Nigussie *et al.*, 2010). Besides this, scavenging chickens make best use of locally available resources including household wastes and they do not compete with humans for grain, require minimum input (husbandry) (Patricia, 2011; Solomon, 2003). Similarly, native chickens adapt well to the rural conditions as in contrast to those of exotic chickens, give meat and egg production is the most environmentally efficient animal protein production (Aberra, 2000; Nigussie *et al.*, 2010; Aberra, 2014).

However, they are challenged with numerous management factors (Patricia, 2011; Addisu *et al*., 2013; Melkamu and Wube, 2013; Aberra, 2014) which resulted to low production rate in terms of eggs and growth, and high mortality rate. Although they generally lay few eggs and grow very slowly, they have the potential to increase their productivity if they are given good care in terms of proper feeding, veterinary care and good housing (Patricia, 2011; Tadelle *et al.*, 2013). Information is lacking with regard to the production systems of the Sheka area's native chicken population. In order to exploit the current growing demand of chicken meat at local and international markets, research and development interventions are required with regard to the identification of alternative improvement and strategic production system and management of local chicken through appropriate policy. Therefore, this study was conducted systematically to explore the production system prevailing in the area, in order to facilitate their rational development and utilization strategies.

MATERIALS AND METHODS

Description of the study area

Sheka zone is found in the Southwestern part of Ethiopia in the South Nations, Nationalities and Peoples Region. Administratively Sheka zone has three districts, namely, Masha, Yeki and Andracha, which are further divided, into 57 Kebeles. According to the data from the Zonal Rural Development Office (RDO) the Zone lies between $7^0$12'- $7^0$50' North latitude and 35^0 10'- $35^0$45' East longitude with an elevation ranging from 1001to 3000 meters a.s.l. The mean annual temperature ranges from 15.1 ^{0}C to27.5 ^{0}C and the mean annual rainfall ranges from 1172 to 2200 mm.

Sampling design and data collection procedures

Sampling design

A purposive random sampling technique was used in order to determine the number of Kebeles and households to cover all the three districts. Accordingly, 7 Keble's from Yeki, 4 Kebeles from each Masha and Andracha districts (in which exotic birds were not delivered) were purposively selected. From each Keble, 16 households that own indigenous chickens were selected purposively. The total numbers of households considered therefore were 240 (15 x 16). Data were collected on flock composition and size, chicken production objectives, chicken husbandry practices such as chicken housing, and feeding as well as health management, and constraints for chicken production. Moreover, clutch size, number of eggs per clutch, resting day between clutches and female to male ratio were assessed through questionnaire survey. The semi-structured questionnaire were translated into Amharic, pre-tested and re-framed in such a way that interviewing households would respond without difficulty and biasness and then administered on study households' selected from Kebeles.

Focus group discussions were also held with DAs, key informants, community leaders and livestock health officers to collect information on general view of the respondents on the indigenous chicken production and management practices. Secondary data were also collected from Livestock and Fishery development main department of the study districts.

Statistical Analysis

Descriptive statistics were employed for describing management practices in each district. Data collected on production systems and qualitative traits of indigenous chicken populations were coded and statistically analyzed using Statistical Package for Social Science (SPSS 16). Distinct measurements on the qualitative traits were also analyzed using non parametric test Chi-square (χ^2) test. The statistical models used for the study was:

$Y_i = \mu + A_i + e_i$

Where: Y_i = response to the observed variable μ = overall mean

A_i = the effect due to i^{th} district ($_i$=1, 2, 3)

e_i= random residual error

RESULTS

Flock structure

As shown in Table 2, the average flock size per household was 13.6; 12.5 and 13.2 for Yeki, Andracha and Masha districts, respectively. The overall number of chicks, cockerels, pullets, hens and cocks in the study zone was 3.5, 2.4, 2.4, 5.5 and 1.9, respectively. The female to Male ratio was 3.9:1 (Table 1).

Mode of chicken acquisition and flock replacement

This study revealed that the main sources of stock to start chicken production were purchasing and gift (Table 1). High proportion of households (68.8%) in Yeki district practiced purchasing of chicken from the market to start production. The culling practice, and disease and predation incidence in the area forces the activity of flock replacement which was 38.3 and 61.7% of respondents replaces their flock through buying from market and from hatched, respectively. Flock replacement from the purchase was comparatively higher (42.2%) in Andracha district than the other two (Table 1).

Purpose of indigenous chicken rearing and culling practices

Purpose of chicken rearing

The primary purpose of egg production in all districts was for sell. About 74.1% of households in Yeki, 86% each in Andracha and Masha districts used egg production for income generation with overall mean of 80.4 % (Table 2).

Table 1. Flock size, mode of chicken acquisition, and flock replacement in the three districts of Sheka Zone

Variables	Yeki N=112	Andracha N=64	Masha N=64	Overall N=240	
Flock structure (Mean ± SD)					
Chicks	2.9±1.4[c]	3.6±1 .4[b]	4.4±2.4[a]	3.5±1.9	
Cockerels	2.2±0.9[b]	2.8± 1.1[a]	2.3±1.3[a]	2.4±1.1	
Pullets	2.6±1.7	2.2±1.3	2.2±1.4	2.4±1.6	
Hens	5.8± 1.9 [a]	5±1.7[b]	5.3±1.9[b]	5.5±1.8	
Cocks	2 ±1.1	1.8± 0.7	1.9±0.8	1.9± 0.9	
Flock size	13.6±4.2	12.5±3.7	13.2±4	13.0±4.0	
Female to Male ratio	3.9:1 ±2	4:1±2.1	3.9:1 ±1.7	3.9:1 ±1.9	
Mode of chicken acquisition (%)					
From purchase	68.8	51.6	45.3	57.9	24.2***
Gift	31.3	48.4	54.7	42.1	28.9***
Flock replacement (%)					
From purchase	36.6	42.2	37.5	38.3	9.5*
Existing flock	63.4	57.8	62.5	61.7	25.5***

[a,b,c] Means with different superscript were significantly different ($p<0.05$), *=$p<0.05$, ***=$p<0.001$.The Chi-Square values denote significant differences between districts ($p<0.05$), SD=standard deviation

Table 2. Purpose of chicken rearing and product utilization in the three districts of Sheka Zone

Variables	Yeki N=112	Andracha N=64	Masha N=64	overall N=240	X^2
Major Purpose of egg (%)					
Sell	74.1	86	86	80.4	20.5**
Hatching	20.5	4.7	11	13.8	34.7**
Consumption	5.4	9.4	3.1	5.8	46.6**
Major Purpose of chicken (%)					
sell	9.8	39.1	29.7	23	123**
Egg production	33	18.8	18.8	25	43**
Breeding	56	39.1	51.6	50.4	78**
Consumption	1	3.1	-	1.3	12*

The Chi-Square values denote significant differences between districts ($p<0.05$),*=$p<0.05$,**=$p<0.01$

The purpose of egg production for hatching and consumption in the study area was 13.8% and 5.8%, respectively. Higher proportions of respondents in the study zone rear chickens mainly for breeding purpose to produce birds for flock replacement followed by egg production. The major purpose of chicken rearing for breeding was 56.3%, 39.1% and 51.6% in Yeki, Andracha and Masha,, respectively with the overall mean of 50.4% (Table 2) while 25% of chicken owner's rear chicken for egg production.

Culling practices

The study result showed that culling was practiced by all of the respondents in the study area. As presented in Table (3), male and female chickens were culled at an average age of 5.6 and 4.6 years, respectively. The primary factors for culling chickens were low egg production due to aging and broodiness (71.4%). Low productive, aging, and increase in number (especially cocks) chickens were dominantly culled by selling (69%) while 31% of respondents used them for home consumption.

Table 3. Local chicken culling practices in the three districts of study Zone

Variables	Yeki N=112	Andracha N=64	Masha N=64	Overall N=240	X^2
Culling practice (%)	100	100	100	100	
Age of Culling chicken (years)					
Male birds	5.9±1.8[a]	5.2±1.4[a]	5.4±2[a]	5.6±1.8	
Female birds	4.7±1.5[a]	4.5±1.3[a]	4.7±1.3[a]	4.6±1.4	
Reason of culling (%)					
Low egg production	63.4	81.1	75	71.4	17.8**
Aging	7.1	1.6	3.1	4.6	8.4*
Frequent broodiness	13.4	3.1	9.4	9.6	15.1**
When increase in number	6.3	4.7	4.7	5.4	11.3*
Aging and increase in number	9.8	9.4	7.8	9.2	2.6ns
Way of culling (%)					
Sell	75.9	56.3	70	69	65***
Consumption	24.1	43.8	28	31	18.2**

The Chi-Square values denote significant differences between districts ($p<0.05$), ns=not significant, *=$p<0.05$, **=$p<0.01$, ***=$p<0.001$

Family labor distribution for indigenous chicken management

This study showed that women were highly responsible for many activities like cleaning bird's house (54.5%), watering (60.4), feeding birds (54.5%), selling birds (28.3%) and eggs (35.4%). Children also participated in various husbandry activities like cleaning of bird's house, provision of supplementary feed and water. Men were responsible for construction of shelter (61.5%) and health care (37.3%) while women and men together take majority (39.1%) of responsibility for health care of their chickens (Table 4).

Feed resources and feeding system

About 79.6% of the chicken owners reared their chickens in an open scavenging with seasonal and regular supplementations (Table 5). Among supplementing households, about 41.4% of them provided some supplementations year round. The most common supplementary feed was *Ensete ventricosum* (processed enset)(64.9%). In Yeki district, maize (*Zea mays*) and sorghum (53.0%) were reported as the main supplementary feeds.

Table 4. Family labor distribution for the management of indigenous chickens in three districts of Sheka Zone

Variables	Responsible family members (%)						
	children	women	Men	children & women	women & men	children & men	all family
Activities							
House construction	5.0	7.5	61.5	4.5	15.0	5.0	1.5
Feeding	1.6	54.5	-	28.3	0.5	2.1	13.1
House cleaning	2.7	54.5	-	28.6	0.5	1.6	12.2
Watering	3.8	60.4	-	22.9	0.4	2.5	10.0
Egg selling	7.5	35.4	1.25	38.8	4.2	1.7	11.3
Chick sell	5.0	28.3	8.33	35.0	5.4	3.8	14.2
Health care	0.6	18.6	37.3	2.5	39.1	1.2	0.6

Table 5. Feed resources and feeding practices of indigenous chicken in three districts of Sheka zone

Variables	Yeki N=112	Andracha N=64	Masha N=64	Over all 240	X^2
Feeding system (%)					
Scavenging only	25.9	10.9	20.3	20.4	2.7^{ns}
Scavenging with feed supplement	74.1	89.1	79.7	79.6	9.1^{*}
Feed Supplementing season (%)	**N=83**	**N=57**	**N=51**	**N=191**	
August–October	45.8	19.3	29.4	31.5	10.1^{*}
August -march	4.8	77.2	-	27.3	112^{*}
Always	49.4	3.5	70.6	41.4	50^{***}
Available supplementary feed (%)	**N=83**	**N=57**	**N=51**	**N=191**	
Zea mays and *sorghum*	53.0	5.3	1.9	20.1	58^{**}
Kitchen by product	34.9	28	15.6	26.7	7.3^{*}
Ensete Ventricosum (processed enset)	12	66.7	82.3	64.9	21^{***}
Frequently supplemented groups (%)	**N=83**	**N=57**	**N=51**	**N=191**	
Chicks and brooding hens	59	29.8	64.7	51	15^{***}
All groups equally	38.6	68.4	35.3	47.6	16^{***}
Chicks, brooding and laying hens	2.4	1.8	-	1.4	1.2^{ns}

The Chi-Square values denote significant differences between districts ($p<0.05$), ns=not significant, ns=not significant, *=$p<0.05$, **=$p<0.01$, ***=$p<0.001$

About 66.7% of respondents in Andracha (midland) and 82.3% of in Masha (highland) districts reported that *Ensete ventricosum* was commonly used feed supplement. Agroecology has significant ($p<0.05$) effect on feed supplement sources between study districts. Among supplementing households, 51.0% of them frequently supplement chicks and brooding hens. About 59.0% of chicken owners in Yeki and 64.7% of Masha (provided

chicks and brooding hens frequently while 68.4% of households in Andracha provided for all groups equally (Table 5).

Chicken housing and management

Among the total interviewed, about half (52.5%) of respondents keep their chickens in a separate house while the rest (47.5%) used different types of housing systems for night sheltering. The proportion of households that use a separate housing system was higher (64.0%) in Andracha than in Yeki (48.2%) and Masha (48.4%) districts (Table 6).

Table 6. Chicken housing and chicken management in the study area

Variables	Yeki N=112	Andracha N=64	Masha N=64	Total N=240	
Separated chicken house (%)					
Yes	48.2	64.0	48.4	52.5	31.5^{***}
No	51.8	35.9	51.6	47.5	30.7^{***}
Other sheltering systems (%)	**N=58**	**N=23**	**N=33**	**N=114**	
In inverted coop(kanta)	15.3	26.1	15.3	17.5	2.4^{ns}
Perch in kitchen& human house	62.8	61	68	54.0	14.5^{**}
Sheep yard	11.9	13.0	10.2	14.0	3.4^{ns}
With human house	3.4	-	6.8	4.4	3.1^{ns}
Shelter cleaning practice (%)					
Yes	54.6	85.4	57.1	63.7	30.8^{***}
No	45.5	14.6	42.9	36.3	20.8^{***}
Shelter cleaning frequency (%)					
Daily	41.7	4.9	15.0	22.9	15.6^{***}
Weekly	39.6	73.2	45.0	53.1	24.0^{***}
Monthly	14.6	19.5	35.0	20.2	5.5^{ns}
Above a Month	4.2	2.4	5.0	3.7	0.5^{ns}

The Chi-Square values denote significant differences between districts ($p<0.05$), ns=not significant, ***= $p<0.001$

Inverted coop/woven basket (locally named *Kanta*), perch in kitchen, sheep yard and with human in main house were used for night sheltering of chickens. However, perch in kitchen was the predominantly used sheltering system at all districts (Table 6).

The overall percentage shows that, most (63.7%) of the chicken owners in the study area practices cleaning of chicken house at different levels of frequency (Table 6). Accordingly, about 85.4, 54.6 and 57.1% of households in Andracha, Yeki and Masha districts clean chicken shelters, respectively. The majority of households (53.1%) clean their chickens house weekly while 73.2% in Andracha were cleaning in the same manner which is higher than other districts.

Disease and health management and predator prevalence

The current study indicated that 93.8% of local chicken owners reported chicken disease as a major problem (Table 7). Newcastle disease (40.5) and fowl influenza (25.5%), coccidiosis (17.4%) and fowl pox (11.5%) were reported as most important poultry diseases in the study area. The householders also reported that beginning of the rainy season favored the incidence of disease outbreaks.

Incubation management practices

Chicken owners used different types of materials for incubation purposes (Table 8). Teff straw (52.5%), piece of old cloth and straw (14.6%), and straw and old sack (10.4%) were mostly used as bedding materials in the study zone.

Table 7. Type of chicken diseases and health management practices in the study area

Variables	Yeki N=112	Andracha N=64	Masha N=64	Over all N=240	
Disease occurrence (%)					
Yes	89	95.3	96.9	93.8	126***
No	11	4.7	3.1	6.2	5.8ns
Name of the disease (%)	**N=100**	**N=61**	**N=62**	**N=227**	
Influenza	31	18	27.4	25.5	6.7ns
Newcastle	31	59	31.4	40.6	22.1***
Coccidiosis	16	16.8	19.3	17.4	8.9*
Fowl pox	12.9	7	13.2	11.5	1.9ns
Time of disease occurrence (%)	**N=100**	**N=61**	**N=62**	**N=227**	
Start of rainy season (wet season)	45.6	80.4	67.7	64.5	18.3***
Always	54	6.6	24.2	28.1	38.7**
Dry season	1	13.1	8.1	7.4	11.6**
Affecting Predators (%)					
Wild bird	69.6	76.6	75	72.9	32.2**
Rat and Mongoose	30.2	23.4	25	28.1	13.2ns
Wild bird and wild cat	10.7	3.1	-	5.8	23**

The Chi-Square values denote significant differences between districts ($p<0.05$), ns=not significant, *= $p<0.5$, **= $p<0.01$, ***= $p<0.001$

Table 8. Incubation management practices in the study area

Variables	Districts			
	Yeki N=112	Andracha N=64	Masha N=64	Overall N=240
Incubating material (%)				
Pieces of old cloth	5.4	9.4	6.3	6.7
straw	50.0	50.0	59.4	52.5
old sack	4.5	14.1	15.6	10.0
Straw and old sack	17	3.1	6.3	10.4
piece of old cloth and straw	11.6	21.9	12.5	14.6
Old sack and piece of old cloth	10.7	1.56		5.8
Broodiness discontinuing practice (%)	79.5	56.3	67.2	67.6
Broodiness discontinuing mechanisms (%)				
Shift to neighbors	6.3	6.3	4.7	5.8
Tying upside down	66.1	46.9	50.0	54.3
Put other materials	7.1	3.1	12.5	7.6
No action	20.5	43.8	32.8	32.4

About 67.6% of chicken owners practiced discontinued broodiness when they want to postpone the incubation period and want to use the egg for other purposes rather than for incubation. Tying upside down(50%) and putting materials on the egg laying place(12.5%) were the most broodiness discontinuing mechanisms helps to initiate the restart of egg laying hens in the study districts with 32.8% of respondents did not take any action(Table 8).

Reproductive and productive performances of indigenous chicken

Some reproduction and production performances of indigenous chicken were significantly ($p<0.05$) different in the studied three districts (Table 9). The average age at first egg for pullets and at first mating for cockerels was 6.3 and 5.6 month, respectively. Cockerels from Masha district had the lowest mean age (5.4 month) of maturity which ($p<0.05$) differed from those of Yeki district. The average number of eggs per clutch laid by indigenous hens was 13.6. The reproductive cycle consists of 21 days incubation period, 27.6 laying period and 71.5 days brooding phase in those chickens reared in Sheka zone.

Table 9. Productive performances of indigenous chicken populations in Sheka zone

Variables	Districts			
	Yeki N=112	Andracha N=64	Masha N=64	Over all N=240
	Mean±SD	Mean±SD	Mean±SD	Mean ±SD
Maturity age of pullets (month)	6.3± 0.6	6.3±0.6	6.2±0.6	6.3±0.6
Maturity age of cockerels (month)	5.7±0.5[a]	5.5±0.6[ab]	5.4±0.7[b]	5.6±0.6
No. of egg/clutch	11.2±3.4 [b]	15.5±5.2 [a]	14.2±4.5[a]	13.6±4.8
length of laying phase (days)	27±7.9	26.9±7.3	29.2±6.5	27.6±7.6
Chick brooding length(days)	70.6±14.4[b]	78±21.3 [a]	67±15.3[b]	71.5±17.8
Clutch No./year	3.1±0.4[a]	2.9±0.5 [b]	3.2±0.7[a]	3.0±0.6
No. of egg/year	34.7±10.4[b]	45.0±16[a]	45.4±18.7[a]	40.8±16.3
Mean incubated egg No./clutch	8.2±2.2[b]	8.7±2.7[ab]	9.4±3[a]	8.7±2.7
Mean hatched egg No./clutch	6.3±2.0	6.5±2.1	6.5±1.8	6.4±2.0
Mean hatch percentage/clutch	76.2±13.6 [a]	75.5±16.6 [a]	69.7±17.5[b]	74.1±16.4
Survival rate (3-4 month) (%)	64.1±37.7[a]	52.4±16.3[b]	57.6±15.2[ab]	59.3±28.6

[a,b] Means with different superscript letters are significantly different ($p<0.05$)

Thus one reproductive cycle takes 120.1 days in the study zone. The average clutch number per year was 3.0 with total number of 40.8 eggs per annum. The mean length of laying period was 27.6 days while high length of laying period (29.2) was reported from Masha district. The overall length of chick brooding was 71.5 days. The longest brooding period (78 days) was noted in Andracha district which was ($p<0.05$) higher than those reported in other districts. The number of clutches per year in Andracha district was 2.9 which is ($p<0.05$) different from Yeki (3.1) and Masha chickens (3.2). The highest egg numbers (45.0 and 45.4) were observed in Andracha and Masha districts which differed ($p<0.05$) from Yeki district (Table 9). The number of eggs incubated varied significantly ($p<0.05$) being higher in Masha district than Yeki and Andracha districts with total mean of 8.68 eggs incubated per clutch. The lower (69.7) hatchability ($p<0.05$) was recorded in Masha district.

Discussion

Flock structure

The flock size in the current study was consistent with the reports of Patricia (2011), Kugonza *et al.* (2008), Fisseha (2009) and Melese and Melkamu (2014). However, it was higher than those of Halima (2007), Mekonen (2007), Meseret (2010). In contrary to our results, higher flock size was reported in Zimbabwe (Mapiye and Sibanda, 2005; Muchadeyi *et al.*, 2004) and Ghana (Hagan *et al.*, 2013). The explanation for this variations might be due to the tradition of a given society that favor chicken rearing and the existence of favorable environment and intervention packages that encourage chicken production. The number of chicken kept as reported by the farmers varied considerable due to continuous culling of chicken through home consumption, sale for cash and loss of chickens due to disease and predators. The result of the current study revealed that in addition to the seasonal feeding management due to supplementary feed scarcity, seasonal incubation by itself causes seasonal flock size variation which is consistent with the reports of Fisseha (2009).

The female to male ratio (3.7:1) reported by Fisseha (2009) was in agreement with the current results. However, the ratio in the current study was higher than reported by Mekonen (2007). Sex ratio in chicken production is an important factor that affects fertility (Alsobayel and Albadry, 2012). The recommended sex ratio of female to male (10:1) contradicts with the current findings (3.9:1) which might cause unhealthy competition resulting in physical injury among the cocks. Thus, farmers should need to be educated on the importance of keeping a minimum number of hens in ratio to the cock's sizes.

Mode of chicken acquisition and flock replacement

The report of Patricia (2011) showed that 38, 17 and 15 % of households bought, gifted, and both bought and gifted, respectively were the main sources of first stock to start production which is in line with the current result. Kugonza *et al.* (2008) also reported the same trend in Ugandan chickens. The higher percent of purchase as a source of chicken to start production in the Yeki district might show low social practices towards gifting to their relatives or neighbors. Households buying chickens from the market for starting and flock replacement gives the opportunity to reduce inbreeding and will increase probability of heterogeneity in the population. High flock replacement practices through purchase were also reported in Andracha district which could be due to high flock loss due to disease and predators.

Purposes of indigenous chicken rearing and culling practice

Purposes of chicken rearing

Eggs were used by the households as a means of generating cash which is in line with findings of Meseret (2010). Many of the households in the study area have reported that they put chicken breeding as their primary purpose which suggests that chicken caretakers has a good attention to keep their flock as continuous business which in turn avoids re-establishment of another flock.

This study suggest that the large percent of the households using chicken for breeding purpose was the best indicative of replacement of the flocks lost due to incidence of disease and predators. In addition to this, the study further suggests that the practice of giving more emphasis in putting chickens for breeding purpose allows to construct the continuously vigor flock structure for sustainable utilization of chicken products. This also might lead to widen the thinking of the continuous local chicken breeding which might broaden random mating among flocks that give possibility reducing inbreeding among the local chicken population as well as favors to increase flock size.

About 23% and 25% of the respondents reported that they rear chickens for selling and egg production purposes, respectively. This kind of practice is important for income generating, and laid egg goes for sale, consumption and hatching purposes. Using chicken for sale indicated as way of culling was important for households which have more than one cock in the flock.

Culling practices

Bogale (2008) reported that old age and poor productivity (25%), poor productivity (46.5%) were the main reasons for culling of chickens in Fogera district. On the other hand, Fisseha (2009) indicated that 93.9% respondents in Burei district practiced chicken culling of which 51.5% were due to old age and 23.6% due to poor production. These reports had similar notions of culling practices with different proportions of the current study. Cocks in Fogera district (Bogale, 2008) were culled at 2.7 years age which is comparatively lower than found in the current study. Mekonen (2007) reported that only 86.9% of households practiced culling which disagrees with the current value. According to Halima (2007), about 75% of chicken owners culled their chickens due to low egg production which is in line with the current finding. Mekonen (2007) reported that 86.5% of households sold their chickens to reduce cock fight and 3% due to low production. The proportion of culling determinant and way of culling was in line with the reports of Melese and Melkamu (2014) such as due to low productivity (57%) and old age (28.9%), and culling through selling (90%). Patricia (2011) emphasized that appropriate culling is the reasonable mechanism for preventing fighting of cock and for balancing hen to cock ratio to establish a better flock.

Family labor distribution for flock management

According to the results of the current study, all family members provided management for chicken husbandry practices. Similar proportion of family labor disributionss were reported by Fisseha (2009), Mekonen (2007), Meseret (2010), and Mapiye and Sibanda (2005). Participation of all family members in chicken husbandry might suggest that chicken rearing was unbiased practice which allows earning and sharing of taking benefits obtained from the chicken.

Feed resources and feeding system

The reports of Fisseha (2009) (97.5%), Halima (2007) (99.28%), Mekonen (2007) (98.1%), Melese and Melkamu (2014) (100%), Meseret (2010) (97.8%), Addisu *et al.* (2013) (89.97%), Hagan et al. (2013) (92.6%), and Dessalew *et al.* (2014) (97.8%) indicated that higher proportion of households in different parts of rural Ethiopia rear indigenous chickens under scavenging with seasonal supplementary feeding system which disagrees with the current findings. This might be due to the difference in feed resource and managing tradition of different locations. In the current study about 79.6% of households provide seasonal and sometimes year round supplementary feeding.

The frequency of feeding was in agreement with the reports of Mekonen (2007), Melese and Melkamu (2014) and Meseret (2010). The current study showed that frequent

supplementation of baby chicks over the other group of flock might be important to enhance their growth until they reach the age of full scavenging potential. The information from group discussion confirmed that the main reason for some households year round supplementing was harvesting bulk of maize and sorghum with enset cultivar. Surveyed respondents complained that mostly chicks lost due to disease might be related to their susceptibility because of poor nutrition or poor quality of the supplements.

Chicken housing and house management

According to Kugonza *et al.* (2008) and Muchadeyi *et al.* (2004), about 78 and 82% of respondents, respectively provide close enclosure for their chicken which differs from the present study. Halima (2007) and Patricia (2011) reported that 50% of households in the studied areas provided separate shelter which is in agreement with current study. However, Fisseha (2009) and Addisu *et al.* (2013) reported only less than 20% of households provided a separate housing for their chickens. Provision of sheltering to chickens in the Sheka zone might be due to the prevalence of predators year round. According to the reports of Melese and Melkamu (2014) and Fisseha (2009), poor night shelters did not satisfy chicken welfare by affecting flock size and productivity. Most of the chickens were under poor hygienic condition exposing them to pathogens. As observed during the survey, most of the chicken shades were full of fecal materials, which suggest that households may not have knowledge about cleaning poultry houses. This observation was similar to those reported by Yusuf *et al.* (2014) in South Africa, and Halima (2007) and Tadelle (2003) in Ethiopia. The respondents reported that they used different locally available and cheap building materials such as Wood sticks, 'Tawla' for constructing chicken houses.

Disease and health management and predator prevalence

In Ethiopia, chicken disease is considered to be the most important factor responsible for reducing both the number and productivity of village chickens (Fisseha, 2009). The findings of Hoaua *et al.* (2015) showed that, disease and predators are the main challenges (15.7%) in the local chicken production in Cameroon which is in agreement with current result. Most of chicken owners did not pay attention to health care of their chickens; all have never accessed to give vaccine nor provide any treatment and veterinary technical assistances. Similar trend was reported by Addisu *et al.* (2013) and Fisseha (2009). The result of current study revealed that there is a need of intervention to control the incidence of diseases so as to improve chicken production and productivity in the study zone.

Among the infectious diseases NCD, coccidiosis and fowl pox are considered to be the most important causes of mortality to local chickens while predators are considered additional threats (Hunduma *et al*., 2010). Nigussie *et al.* (2003) reported that Newcastle disease (NCD) is believed to be the most devastating chicken disease in free ranging system and the main cause of the high chicken mortality irrespective of age and sex, which occurs almost any time of the year.

Incubation management practices

Fisseha (2009), Meseret (2010), Mekonen (2007) and Melese and Melkamu (2014) reported usage of incubation materials such as dry grass, cereal straw, pots and nested handmade woven boxes made from bamboo, twigs, mud, etc. which are in line with the current study. However, in the current study some of households neither use appropriate places (e.g. incubating near fire) nor proper materials which maintain incubation temperature. This poor practice might lead to poor hatchability and poor resistance of chicks to diseases even after being hatched.

Addisu *et al.* (2013) reported that 96.7% of respondents in north Wollo zone practiced discontinuing of broodiness, Nigussie (2011) and Nebiyu *et al.* (2013) did the same trend in different parts of Ethiopia, which is in good agreement with current findings. This might give the opportunity to increase clutch and egg number per year by reducing non production days spent due to brooding.

Reproductive and productive performance of indigenous chicken

The current findings with regard to productive and reproductive performances of local chickens is in line with those reported by Hagan *et al.* (2013) and Dankwa *et al.* (2003) in Ghana, Fisseha (2009) and Bogale (2008) in various parts of Ethiopia. AI-Qamashou *et al.* (2014) in Omani chicken reported that, the hens produced an average of 5.2 clutches per year with a total of 12.3 eggs per clutch, resulting in 64.5 eggs per year and with 88% of hatchability which is higher than observed in the current findings. Fisseha (2009) reported 16 eggs per clutch, 4 clutches per year with hatchability of 81%, while mortality in this chicken population accounts about 39.5%. Bogale (2008) also reported 15.7 eggs per clutch and 3.8 clutches peryear. Hagan *et al.* (2013) reported 12.9 eggs per clutch, 3 clutches per year resulting in 38.7 eggs per year with hatchability and chick mortality rates of 84.5% and 36.6%, respectively.

CONCLUSION

The small flock size (13) per household in the study area compared to the most of the African countries might be due to different factors hindering the sector. High female to male ratio (1:3.9) affects fertility and performance of local chicken in the study zone. The higher percent of farmers practicing flock replacement through market indicates frequent loss of former flock at their home due to different causes; but this practice favors the opportunity to create heterogeneous flock by inclusion of new chicken from market and it avoids inbreeding. Seasonal incubation practices by using natural brooding was common in the study zone. This indicates farmers could not able to run chicken production year round due to seasonal feed shortage, absence of proper chicken house and related factors. Poor production performance from local chicken under scavenging environment was observed in the study zone which calls to give due attention to improve this sector.

The results of this study tend to suggest the recommendations such as the improvement strategies have to consider the traits that favors direct economical importance's received from such chicken population at scavenging environment. Vaccination, feed source development, housing management, technical and awareness creation interventions have to be implemented to make the sector sustainable, improved and productive.

Acknowledgment: The authors are indebted to express unpaid gratitude to all those who genuinely and affably devoted their times to contribute to the research by participating in focus group discussions (the cooperation of extension workers and that of farmers in the study area). Moreover, the authors would like to thank the staff of zonal and districts livestock development officers for providing needed information, required farmers selection for purposive study and facilitating the entire data collection.

Competing interests

The authors have no competing interests to declare.

References

Aberra M., 2000. Comparative studies on performance and physiological responses of Ethiopian indigenous (*Angete melata*) chickens and their F1 crosses to long term heat exposure. PhD dissertation, Martin-Luther University. Halle-Wittenberg Germany. Pp 127.

Aberra M. and Tegene N., 2011. Phenotypic and morphological characterization of indigenous chicken populations in southern region of Ethiopia. Animal Genetic Resources Vol. 49, 19-31.

Aberra M., 2014. Significance of scavenging chicken production in the rural community of Africa for enhanced food security. Small-scale Family Poultry Production. World's Poultry Science Journal, Vol. 70,593-606 .

Addisu H., Hailu M. and Zewdu W., 2013. Indigenous chicken production system and breeding practice in North Wollo, Amhara region, Ethiopia. Scholarly Journal of Agricultural Science Vol. 3(10), pp. 433-444. http:// www.scholarly-journals.com .

Al-Qamashoui B., Mahgoub O., Kadim I., and Schlecht E.,2014. Towards Conservation of Omani Local Chicken: Phenotypic Characteristics, Management Practices and Performance Traits. The Journal of Animal Science, Vol.27,No.6:767-777. http://dx.doi.org/10.5713/ajas.2013.13541. www.ajas.info

Alsobayel AA, Albadry MA, 2012. Effect of age and sex ratio on fertility and hatchability of Baladi and leghorn laying hens. The Journal of Animal and Plant Science, 22(1): 15-19.

Bogale K, 2008. Isitu characterization of local chicken ecotypes for functional traits and productions stems in Fogera Woreda, Amhara regional state. A Thesis submitted to Haramaya University. Ethiopia, pp: 123.

CSA, 2014. Central Statistical Authority. Statistical Report on Livestock and Livestock Characteristics (Private Peasant Holdings). Statistical Bulletin 578. Volume II, March 2015. Addis Ababa.

Dankwa D., Nelson F. S., Mzamo K. B. and Oddoye E. O. K. 2003. Rural poultry management in the West Mamprusi and the Ga rural district of Ghana. Proceedings of the 12th Biennial Conference. Achimota, Ghana. pp. 80-89.

Dessalew T., Singh H., Ashenafi M., Wondimeneh E. and Tadelle D., 2014. Study on management practices and marketing systems of village chicken in East Shewa, Ethiopia. International Journal of Agribusiness and Resource Economics Vol. 1 (2), pp. 018-023. www.internationalscholarsjournals.org

FAO, 2008. Review of the new features of the Ethiopian poultry sector; Biosecurity implications, by Pagani P. and Abebe W.
FAO, 2010. Smallholder poultry production – livelihoods, food security and sociocultural significance, by K. N. Kryger, K. A. Thomsen, M. A. Whyte and M. Dissing. FAO Smallholder Poultry Production Paper No. 4. Rome.

Fisseha M., 2009. Studies on production and marketing system of local chicken ecotypes in Bure Wereda, North west Amhara M.Sc. Thesis, Hawassa University, Hawassa, Ethiopia. p 166.

Hagan J. K., Bosompem M. and Adjei I. A., 2013. The Productive Performance of Local Chickens in three Ecological Zones of Ghana. Asian Research Publishing Network (ARPN), Journal of Agricultural and Biological Science. www.arpnjournals.com.

Halima H. M., 2007. Phenotypic and genetic characterization of indigenous chicken populations in northwest Ethiopia. PhD thesis. Faculty of Natural and Agricultural Sciences, Department of Animal, Wildlife and Grassland Sciences, University of the Free State, Bloemfontein, South Africa. P 175.

Hunduma D., Regassa C., Fufa D., Endale B.and Samson L.,2010. Major Constraints and Health Management of Village Poultry Production in Rift Valley of Oromia, Ethiopia. Global Veterinaria 5 (1): 06-10.

Kondombo, S.R., Nianogo, A.J., Kwakkel, R.P., UDO, H.M.Y. and Slingerl, M. (2003) Comparative analysis of village chicken production in two farming systems in Burkina Faso. Tropical Animal Health and Production 35: 563-574.

Kugonza D. R., Kyarisiima C. C. and Iisa A., 2008. Indigenous chicken flocks of Eastern Uganda: I. Productivity, management and strategies for better performance.Volume 20, Article #137.http://www.lrrd.org/lrrd20/9/kugo20137.htm.

Mammo M., 2013. Biophysical and the socio-economics of chicken production. African Journal of Agricultural Research review. Ethiopian Institute of Agricultural Research, Debre Zeit Agricultural Research Center; Debre Zeit, Ethiopia. Vol. 8(18), pp. 1828-1836. Academic Journals, available at http://www.academicjournals.org/AJAR

Mapiye, C. and Sibanda S., 2005. Constraints and opportunities of village chicken production systems in the smallholder sector of Rushinga District of Zimbabwe. Livestock Res. Rural Dev. 17(10). http://www.cipav.org.co/lrrd/lrrd17/10/mapi17115.htm. Acessed: 04/1l/2005.

Mekonnen G., 2007. Characterization of the Small Holder Poultry Production and Marketing System of Dale, Wonsho and Lokaabaya Woredas of SNNPRS. MSc Thesis. Hawassa University. Hawassa, Ethiopia. P 95.

Melese G. N. and Melkamu B., 2014. Assessment of Chicken Production under Farmers Management Condition in East Gojam Zone, Amhara Regional State, Ethiopia. Greener Journal of Animal Breeding and Genetics Vol. 1 (1), pp. 001-010, February 2014. www.gjournals.org.

Melkamu B. Y., Wube A., 2013. Constraints and Opportunities of Village Chicken Production in Debsan TiKara Keble at Gonder Zuria Woreda, North Gonder, Ethiopia International Journal of Scientific and Research Publications, Volume 3, Issue 9, September 2013 1 ISSN 2250-3153 . www.ijsrp.org

Meseret M., 2010. Characterization of Village Chicken Production and Marketing System in Gomma Wereda, Jimma Zone, Ethiopia. M.Sc Thesis, Jimma University, Ethiopia.

Muchadeyi, F.C., Sibanda, S., Kusina, N.T., Kusina, J. and Makuza, S. (2004). The village chicken production system in Rushinga district of Zimbabwe. Livestock Research for Rural Development 16 (40). http://www.lrrd.org/lrrd16/6/much16040.htm.

Nebiyu Y. Berhan T. and Kelay B., 2013. Characterization of village chicken production performance under scavenging system in Halaba district of southern Ethiopia. Ethiop.Vet.J., 17(1),69-80.http://dx.doi.org/10.4314/evj.v17i1.6

Nigussie D., Tadelle D., Van der WaaiJ H.L. and van Arendonk A.M.J., 2010. Morphological features of indigenous chicken populations of Ethiopia. Animal Genetic Resources, 46, 11–23.

Nigussie D., 2011. Breeding programs for indigenous chicken in Ethiopia: analysis of diversity in production systems and chicken populations PhD Thesis, Wageningen University, the Netherlands. p 149.

Nigussie D., Alemu Y., Tadelle D. and Samuel W., 2003. On-station and on-farm evaluation of the 'hay-Box chick brooder' using different insulation materials at Debre Zeit Agricultural Research Center and Denbi village, Adaa woreda. In: Proceedings of the 10th annual conference of the Ethiopian Society of Animal Production (ESAP), August 21–23, held in Addis Ababa, Ethiopia. pp. 211–216.

Patricia N. p., 2011. Characterization and Production Performance of Indigenous Chickens in Northern Namibia Regions. A PhD, Dissertation Submitted to the University of Namibia in Animal Science. p 222.

Solomon D., 2003. Growth performance and survival of local and White Leghorn chickens under scavenging and intensive systems of management in Ethiopia. Livestock Research for Rural Development (15)11 www.Irrd.org/Irrd15/11/deme1511.htm.

Tadelle D., Esatu, W., Waaij, L.V., Zegeye, F., Gizaw, S., Mwai, O. and van Arendonk, J. 2013. Village chicken production in the central and western highlands of Ethiopia: Characteristics and strategies for improvement. Nairobi, Kenya: International Livestock Research Institute.

Tadelle, D., 2003. Phenotypic and genetic characterization of local chicken ecotypes in Ethiopia. Ph.D. Thesis submitted to Humboldt University of Berlin, Germany, pp: 208.

Tadelle D., Million T., Alemu Y., Peters K., Tadelle, D., Million, T., Alemu, Y. & Peters, K.J., 2003. Village chicken production systems in Ethiopia: 2. Use patterns and performance valuation and chicken products and socioeconomic functions of chickens. Livestock Research for Rural Development, 15(1) (available at http://www.cipav.org.co/index.php?option=com_wrapper&Itemid=64).

Yusuf G. F. S., Lategan S. F. and Masika J. P.., 2014. Characterization of Indigenous Poultry Production Systems in the Nkonkobe Municipality, Eastern Cape Province South Africa. Journal of Agricultural Science, 5(1-2): 31-44.