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Full Length Research Paper

A study of the prevailing chicken production constraints and possible technological interventions

***Abajifar Gidada[1], Asfaw Menen[1] and Abebe Yousuf[2], Nesib Jamal[2] and Sapalo Taqi[2]**

[1]Department of Animal Breeding and Genetics, Faculty of Agriculture, Adama University, Adama, Ethiopia.
[2]Department of Livestock Production, Faculty of Agriculture, Addis Ababa University, Addis Ababa, Ethiopia.

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A survey was conducted in Bure district, North West Ethiopia, from 2007 to 2008 to assess the existing village chicken production system. A participatory rural appraisal and a formal survey were used to collect all the relevant data, using a multi-stage sampling technique. Seven farmer administrative kebeles (two from high land, three from mid altitude and two from low land agro-ecologies) and a total of 280 village chicken owner households were considered for the study. The result revealed that the dominant (83%) chicken production system was an extensive/traditional type of production, using a majority (97%) of local chicken ecotypes, managed mainly on scavenging with seasonal supplementation of home grown grains and household food leftovers. The purposes of chicken production were sale for income (51.4%), egg hatching for replacement (45%), consumption (44.3%), use of birds for cultural and/or religious ceremonies (36.4%) and egg production (40.7%). The average flock size per household was 13 (ranged 1 - 57), with a hen to cock ratio of 3.7:1. Only 22.1% of chicken owners prepared a separate overnight house for birds and the rest (77.9%) kept birds in various night sheltering places. The result revealed that 97.5% of interviewed chicken owners experienced chicken disease problems, mainly Newcastle disease (98.2%). The result indicated that 95% of village chicken owners used only traditional means to treat sick birds. The average age of cockerels at first mating and pullets at first egg were 24.6 weeks and 27.5 weeks, respectively. The average number of eggs laid/clutch was 16 (ranged 8 - 28) and the number of total clutch periods/hen/year was 4 (ranged 2 - 6). The annual egg production performance of local hens, under farmer's management condition, was 60 eggs/hen (ranged 24 -112). The average number of eggs incubated/hen was 13 and 11 chicks, on average, were hatched from them. The average hatchability performance of local hens was 81.7%. However, survivability of young chicks was only 60.5% (ranged 0 -100%). High hatchability performance of local hens (81.7%) and high mortality of young chicks (39.5%) were the two contradictory features for the existing village chicken production system of the district. Seasonal diseases outbreaks (84.3%) and predation (11.4%) were the major causes of chicken loss in the district. Women were the major responsible members of the household involved in various chicken husbandry activities like cleaning bird's house (38.6%), feeding birds (81.7%), selling birds (83%) and selling eggs (54.6%). Only 37.5% of interviewed chicken owners got appropriate extension services related to modern chicken management practices. The result of the study revealed that there is a great interest to boost up the existing village chicken production and productivity. This should be considered as an opportunity and potential to design and implement interventions, aimed at improving production and productivity of village chicken in the district.

Key words: Ethiopia, local chicken ecotypes, village chicken production system.

INTRODUCTION

Animal production in general and chickens in particular play important socioeconomic roles in developing countries (Alders, 2004; Salam, 2005). Provision of animal protein, generation of extra cash incomes and religious-/cultural considerations are amongst the major reasons for keeping village chickens by rural com-munities (Alders et al., 2009). Nearly all rural and peri-urban families in developing countries keep a small flock of free range chickens (Jens et al., 2004). Village chickens are also an integrated component of nearly all-rural, many peri-urban and some urban house-holds and accounts for more than 60% of the total national chicken population in most African countries (Branckaert et al., 1999, Sonaiya, 1990). According to Robert et al. (1992) and Sonaiya (2005); small farming families, land-less laborers and people with incomes below the poverty line were able to raise village birds with low inputs and harvested the benefits of eggs and meat via scavenging feed resources. However; most rural communities lack the required husbandry skills, training and opportunity to effectively improve their chicken production (Mlozi et al., 2003).

In Ethiopia chickens are the most widespread and almost every rural family owns chickens, which provide a valuable source of family protein and income (Tadelle et al., 2003). The total chicken population in the country is estimated to be 32.2 million (CSA, 2005). The most dominant chicken types reared in Ethiopia are local ecotypes, which show a large variation in body position, plumage color, comb type and productivity (Teketel, 1986; Tadelle et al., 1996; Halima et al., 2007). However; the economic contribution of the sector is not still proportional to the huge chicken numbers, attributed to the presence of many productions, reproduction and infrastructural constraints (Aberra, 2000). Similar to the national system; the major proportion of chicken production (98%) in Amhara region (ANRS) is a traditional sector, at small holder level, from which almost the whole annual meat and egg production is produced (ANRS-BoARD, 2006). According to the recent agricultural census study (CSA, 2005); there were around 13.4 million chicken populations in Amhara region, accounting to 31.3% of the national chicken population. According to Cumming (1992) and Panda (1987) only little research and development works have been carried out on village chickens, despite the fact that they are more numerous than commercial chickens in most developing countries and they have been marginalized by decision makers. It is difficult to design and implement chicken-based development programs that benefit rural people without understanding village chicken production systems (Gueye, 1998; Pedersen, 2002). Hellin et al. (2005) also reported that understanding of village chicken functioning and marketing structure are a prerequisite for developing market opportunities for rural households and could be used to inform policy makers and development workers in considering the commercial and institutional environment in which village chicken keepers have to operate. There is presently no detailed study conducted in the district on identification of the existing village chicken production systems, production constraints and technological inter-ventions that could be affordable to the resource poor. This study was conducted to address the following objectives:

Objectives

To evaluate the production and reproduction performance of local chicken under farmer's management condition and to assess the prevailing chicken production con-straints and suggest possible technological interventions.

MATERIALS AND METHODS

Description of the study district

The study was conducted at Bure district, Amhara National Regional State, located in the North Western part of Ethiopia. According to ANRS-BoFED (2007), the district has an agricultural household size of 39,323 (6370 female and 32953 male) and the total human population was estimated to be 281,310 (141,683 males and 139,627 females). The district has a total of 27 administrative kebeles (the lowest political administrative structure of the country), from which 5 are urban and 22 are rural. From the total human population, 85% were rural community and 15% were urban dwellers (Bure, 2007). Bure, the administrative and commercial center of the district, is located 420 kms from Addis Ababa and 148 kms from Bahir Dar (the regional capital). The district has a total land area of 2207.2 km^2 and the average altitude was estimated to be 1689 masl (ranged 728 - 2832 masl). The average annual rainfall was estimated to be 1689.4 mm (ranged 713 - 2832 mm) and the average temperature was 19°C (ranged 13 - 24°C). Livestock production is considered as an important component of the prevailing crop-livestock mixed farming systems of the district. According to Burie (2007), the district was reported to have a total population of 129265 for cattle, 39066 for sheep, 6895 for goats, 16335 for donkeys, 479 for mules, 188310 for chicken and 13329 for bee hives.

Selection of the study area and sampling techniques

A Multi-stage sampling procedure (purposive and random) was applied for the study, hence the district was purposively divided in to three agro-ecologies based on altitude as; highland (>2500 masl), mid-altitude (1500 - 2500 masl) and low-land (<1500 masl). This agro-ecological classification was found relevant to investigate variation in village chicken production system, production and marketing constraints and suggest appropriate technological interventions relevant to each agro-ecology.

A total of seven representative kebeles were selected made up of two farmer kebeles from the high-land, two farmer kebels from low-land and three farmer kebeles from mid-altitude based on agro

*Corresponding author. E-mail: abajifargidada@gmail.com

Table 1. Socio-economic status of respondent chicken owners of Bure district, Ethiopia.

Variables	Agro-ecology			Grand mean
	High-land	Mid-altitude	Low-land	
Sex of respondent households (%)				
Male	72.5	75.8	75	74.6
Female	27.5	24.2	25	25.4
Average age of respondents (years)	40.74 [a]	40.9 [a]	40.94 [a]	40.86
Education status of respondents (%)				
Illiterate	38.8	36.7	43.8	39.3
Reading and writing	31.3	38.3	20	31.1
Primary education	21.3	16.7	28.8	21.4
Secondary education and above	8.8	8.3	7.5	8.2
Average family size/hh (Mean SD)	6.44 2.4 [a]	6.11 2.02 [a]	6.07 2.1 [a]	6.19 2.17
Land holding/household (hectare) (Mean SD)	0.84 [a] 84	1.29 [b] 1.29	1.52 [c] 1.52	1.23 1.23
Livestock Holding (No. of animals)				
Cows	0.86	1.1	0.96	0.99
Oxen	1.36	1.75	2.05	1.73
Heifers and Steers	0.46	0.68	0.67	0.62
Calves	0.84	0.82	0.79	0.81
Total cattle size/hh (Mean SD)	3.5 2.9 [a]	4.4 3.9 [a]	4.4 3.8 [a]	4.16 3.6
Sheep	2.71	2.34	1.61	2.24
Goats	0.6	0.1	0.1	0.25
Donkey	0.51	0.61	0.47	0.54
Mule	0.01	0.01	0.05	0.02
Horses	0.1	-	0.01	0.03
Total chicken size/hh (Mean SD)	11.6 [a] 9.7	13.9 [a] 9.7	13.4 [a] 10	13.1 10

[a, b,c] Least square means with different superscripts within a row are significantly different ($P < 0.05$); SD = Standard deviation.

ecology representation, chicken production potential and road accessibility. All village chicken owner households in the selected seven kebeles were registered. Simple random sampling technique was applied to choose 40 chicken owner respondents in each of the selected kebeles. A total of 280 village chicken owner households were interviewed using a pre-tested structured questionnaire.

Data collection

Secondary data were collected from Bure district office of agriculture and rural development, West Gojam zone department of agriculture and rural development, Amhara region bureau of agriculture and rural development (ANRS-BoARD) and Amhara region bureau of plan and economy development (ANRS-BoPED). Primary data was collected through personal and house to house interviews and participatory rural appraisal, mainly through transect walks.

Data management and statistical analysis

The qualitative and quantitative data-sets were analyzed using SPSS software, version 12 (SPSS, 2002). The Duncan multiple range tests were used to locate treatment means that are significantly different. Descriptive statistics and General Linear Model (GLM) were also used. The following linear models were used during analysis of quantitative data:

Model statement regarding the effect of agro ecological differences on various productive and reproductive parameter of local chicken.

$$Y_{ij} = \mu + m_i + \varepsilon_{ij}$$

Where Y_{ij} is chicken performance parameter estimate for bird j in i agro ecology, μ is the overall mean, m_i is the fixed effect of agro ecology (I = 3; Highland, Mid-altitude and Lowland) and ε_{ij} is the residual error.

Model statement about the effect of agro ecological differences on distance traveled by chicken owners to the nearby local markets and urban markets. $Y_{ij} = \mu + m_i + \varepsilon_{ij}$

Where Y_{ij} is the distance traveled by household j in agro ecology i, μ is the overall mean, m_i is the fixed effect of agro-ecology (i=3; Highland, Mid-altitude and Lowland) and ε_{ij} is the residual error.

RESULT AND DISCUSSION

Household characteristics

The household characteristics of village chicken owner households were presented in Table 1. From the total of 280 interviewed 208 (74.4%) were males and 72 (25.6%)

Table 2. Chicken flock structure by altitude and mean flock size per household in Bure district, Ethiopia (N=280).

Agro-ecology	Chicken age group					Total flock size
	Hens (Mean ± SD)	Cocks (Mean ± SD)	Pullets (Mean ± SD)	Cockerel (Mean ± SD)	Young chicks (Mean ± SD)	(Mean ± SD)
High-land	3.4 ± 2.1 [a]	0.8 ± 1.3 [a]	1.6 ± 3.3	0.7 ± 1.8	5.1 ± 6.2	11.6 [a] ± 10
Mid-altitude	3.4 ± 2.1 [a]	0.9 ± 1.1 [a]	2.0 ± 3.4	0.9 ± 2.5	6.7 ± 7.1	13.9 [a] ± 10
Low-land	3.2 ± 1.8 [a]	1.0 ± .83 [a]	3.3 ± 5.4	1.0 ± 2.4	4.6 ± 5.4	13.4 [a] ± 11
Grand mean	3.3 ± 1.97	1.0 ± 1.1	2.3 ± 4.1	0.9 ± 2.3	5.6 ± 6.5	13 ± 10

[a, b] Least square means with different superscript within a column are significantly different (P < 0.05).

were females. 75% interviewed village chicken owners were household heads and 25% were other members ofthe household. The average age of respondents was 40.9 years (ranged 20 - 77). Education level of respondents showed 39.3% were illiterate, 31.1% had basic education (Reading and writing), 21.4% had primary education and 8.2% had secondary education and above. The number of illiterates observed in this study was lower than the reported 82.1% for North West Ethiopia (Halima, 2007). 94.6% of interviewed households were male headed and 5.4% female headed. The average family size per household was 6.2 people (ranged 1 -12). The average family size identified in the district was higher than the national average of 5.2 (CSA 2003) and the reported 5.4 for North West Amhara (Halima, 2007).

Land holding

The average land holding per household was 1.23 1.2 ha (ranged 0.84 - 1.52). The result was similar with the reported 1.28 ha land holding/household of North West Amhara region by Halima (2007), but higher than the national average of 1.02 hectare (EEA, 2002). The total land holding/household showed a significant difference with the type of agro ecologies of the district. The highest (1.52 ha) land holding/household was recorded in the lowland agro ecology and the lowest land holding/-household (0.84 ha) was recorded in the high land agro ecology. It was attributed to the presence of low available arable land and relatively high population pressure in the highlands and vise versa in lowlands. Because of the fact that crop production was the main occupation for farmers of the district, the major proportion of the land was used for crop production activity.

Production system and flock size

Scavenging made up 82.9% of the production system using a majority (96.8%) of local chicken ecotypes, with only seasonal/conditional feed supplementation. Safalaoh (2001) and Lwesya et al. (2004) reported that almost 83% of the total. chicken population in Malawi small-holder extensive chicken production system was indigenous chicken eco-types, forming the largest proportion of birds kept. Huque and Paul (2001) also reported that chicken production systems of Bangladesh depend mainly on locally scavenging chickens that were reared in villages and they constituted more than 70% of the country's chicken population.

The study indicated that village chicken owners had, on average, 12.5 year of experience in village chicken rearing and the major (93.9%) source of birds for parent stock was market purchase. The average chicken flock size/household for hens, cocks, pullets, cockerels and young chicks was 3.3, 1, 2.3, 0.9 and 5.6 respectively; with a total flock size of 13 birds and a hen to cock ratio of 3.7:1 (Table 2). The result was in line with Gueye (1997), who reported flock size range of 5-20 birds per each African village households. However, a relatively higher flock size of 18.8 birds/household, with a hen to cock ratio of 4.4:1 was reported by Khalafalla et al. (2001) in Sudan. Similarly, 16 birds/household were reported in the central highlands of Ethiopia and South coast Kenya by Tadelle et al. (2003) and Njenga (2005) respectively. The result of the study revealed that the average flock size per household varied between seasons mainly due to availability of feed and the occurrence of diseases and predators. The majority of village chicken owners (83.2%) in the study area kept birds only during the dry season, when availability of feed is better and risk of predators was low. The result of the study showed that there were no cultural/religious taboos against consumption and marketing of chicken and eggs in the district. All family members provided labor for chicken husbandry practices. Men were responsible for few activities like construction of shelter (97.5%) and taking sick birds for treatment (89.3%). However, women were highly responsible for many activities like cleaning bird's house (38.6%), feeding birds (80.7%), selling birds (46.8%) and selling eggs (54.6%). Children also participated in various husbandry activities like cleaning of bird's house, provision of supplementary feed and water.

The result was similar with the findings of Bradley (1992), who declared that management of village chicken had been highly associated with women for various historical and social factors. Riise et al. (2004) and Kitalyi

Table 3. Purpose of keeping village chicken and producing eggs in Bure district, Ethiopia, (N=280).

Variables	First (%)	Second (%)	Third (%)	Forth (%)
Purpose of chicken (%)				
Sale for cash income	51	43.5	-	-
Hatching (Breeding)	49	45	6	-
Home consumption	-	6.1	44	24.8
Egg production	-	5.4	10	31.2
Cultural/religious ceremonies	-	-	40	36.4
To entertain guests	-	-	-	7.6
Purpose of eggs (%)				
Sale for cash income	14	58	21.4	
Hatching (Replacement)	72	26	9.6	
Home consumption	14	16	69	

(1998) also reported that women and children were generally in charge of village chicken husbandry practices in developing countries. Abubakar (2007) also reported that women and children involvement was by far the highest on village flocks management labor profile activities included; sheltering birds, cleaning bird's house, feeding and watering of birds in some parts of Nigeria and Cameroon. Mapiye et al. (2005) also reported that women in Zimbabwe were dominated in most village chicken production activities like; feeding (37.7%), watering (51.2%) and cleaning of bird's house (37.2%) whereas men were dominant in shelter constructions (60%) and treatment of birds (40%). Men and women were decision makers in various village chicken production and marketing activities including: selling eggs (78.2%), selling birds (69.3%), consumption of eggs (93.2%) and consumption of chicken (92.9%). However, men alone were decision makers of the household to buy drugs for sick birds (88.6%) and to buy replacement stock (67.9%).

Chicken eco-types and their importance

The result indicated that red was the dominant (53.9%) plumage color followed by white (46.1%). This study also revealed that red was the most preferred (83.6%) plumage color, followed by white (83.5%). Regarding comb type of local chicken, both single and double (rose) comb types were available in the district, while rose/-double comb was the most preferred (81.1%). This was mainly attributed to the preference of consumers in the market and presence of cultural attitude in favor of rose comb.

Regarding purpose of rearing village chicken, sale as source of cash income accounted for 51% (Table 3). The other purposes of rearing village chicken were egg hatching for breeding/replacement stock (45%), home consumption (44%), use of chicken for cultural and/or religious ceremonies (36.4%) and egg production (40.7%). Similarly, Tadelle and Ogle (1996) reported that the major purposes of village birds in central Ethiopian high lands were; sale for income (26.6%), use of sacrifice or healing ceremonies (25%), replacement (20.3%) and home consumption (19.5%). The result of the current study was also in line with the findings of Sonaiya et al. (2004), who stated that sale of live birds for income generation was the primary goal of keeping family chicken in developing countries.

The result of the study showed that 78% interviewed village chicken owners con-sumed chicken only during religious/cultural holidays, 20.3% every time when needed/available and only 0.7% reported that they never eat chicken. Use of eggs for hatching was the first (71.7%) function of eggs (Table 3). The second and third purpose of eggs was sale for cash income (58%) and home consumption (68.6%), respectively. Tadelle and Ogle (1996) also reported that the major uses of eggs in central Ethiopian high lands were; hatching for replacement (51.8%), sale for cash income (22.6%) and home consumption (20.2%). It is identified that 52.8% of village chicken owners of the district consumed eggs only during religious holidays, 42.5% every time when needed and available, 2.5% when only they got sick and only 2.2% reported that they never ate eggs.

Village chicken husbandry/management

Feed and feeding system

Supplementary feed was provided by majority (97.5%) of chicken owners, while 84.3% of them did this between the months of July to September. Grains and household leftovers were the major kinds of feeds stuffs (56.4%) supplemented by chicken owner farmers. Most these chicken owners (87.1%) used crop harvest (self produced grains) as supplementary feed. Wheat (70.4%), maize

Table 4. Housing condition of village chicken in Bure district, Ethiopia, (N=280).

Parameters	Agro-ecology			Grand total (%)
	High land (%)	Mid altitude (%)	Low land (%)	
Preparation of separate chicken house	15.0	24.2	26.3	22.1
Type of night sheltering (%)				
Perch inside the house	47.5	37.5	56.3	45.7
Ceilings of the house	5.0	1.7	5.0	3.6
Floor covered by containers	32.5	33.3	12.5	27.2
Under local sitting place (‘medeb’)	-	3.3	-	1.4
In separate chicken houses	15	24.2	26.3	22.1

(61.1%) and millet (55%) were the first, second and third types of grains provided as supplementary feed in the district, respectively, Halima (2007) also reported that 99.3% of chicken owners in North West Amhara Region provided supplementary feeds to village birds. Mapiye et al. (2005) also reported that 95.5% of the farmers in Rushinga district of Zimbabwe produced their own supplementary feeds and only 4.5% used purchased feed.

All village chicken owners (100%) of the district provided water to village birds; 85.4% only during the dry season and 14.3% through out the year. Concerning the frequency of watering; most chicken owners (78.9%) used *ad libtum* type. The major sources of water for chicken in the area were river (30.4%), spring (28.5%), locally made underground water (21.4%) and pipe water (19.7%).

Majority of chicken owners (98.2%) had watering trough. Broken clay material, locally called *“shekila”*, (37.3%), wooden trough (32.7%) and plastic made trough (28.2%) were the most widely used types of watering troughs in the district. Regarding the frequency of cleaning watering trough, 50% of chicken owners cleaned sometimes when they remembered it and 23.9% cleaned every day. However, 24.3% of chicken owners responded that they never cleaned the watering trough.

Housing system of village chicken

From the total of 280 chicken owners interviewed, only 62 farmers (22.1%) prepared separate overnight houses for village birds (Table 4). However, the majority (77.9%) of village chicken owners kept birds on various night sheltering places including; perches inside the house (45.7%), on the floor covered by bamboo made materials (27.1%), on ceilings of the house (3.6%) and under locally constructed sitting place (1.4%). Lack of attention to village birds (34.6%), lack of construction materials (25%), lack of knowledge and awareness (19.6%), risk of predators (12.1%) and shortage of labor and time (5.4%) were some of the major reasons mentioned by village chicken owners for not preparing a separate house for village birds.

Chicken health and disease control measures

The result of the current study indicated that 97.5% of village chicken owners of the district experienced chicken disease problems. Newcastle disease (NCD) was the most prevalent and economically important (98.2%) disease problem affecting village birds and it is reported to be the first major causes of chicken death/loss in the district. Similarly, Halima (2007) reported that the major causes of death for local birds in North West Amhara were seasonal outbreaks of diseases, specifically New-castle disease. The prevalence of the NCD and mortality of chicken were higher at the start of rainy season, mainly on April (66.8%) and May (31.4%). Yongolo (1996) and Spradbraw (1993) and Gueye (1998) also supported the argument that NCD was the most devastating disease and considered to be a major constraint to the deve-lopment of both village and commercial chicken industry in Africa.

Serkalem et al. (2005) also reported that NCD was one of the major infectious diseases affecting productivity and survival of village chickens in central high lands of Ethiopia. Similarly, Kusina et al. (2000) reported that NCD was identified and accepted as the greatest danger to the expansion of chicken production in Zimbabwe. Various studies estimated the mortality of village chickens due to NCD disease as followed: 50% up to eight weeks of age in Burkina Faso and Northern Ghana (Wilson, 1986 and Veluw, 1987), 66% in 12 weeks of age in Senegal (Gueye, 1998) and 80% in rural Africa (Spradbrow, 1993). Gueye (2000) also reported that mortality of village chicken was high and could reach up to 53% until four weeks of age in tropical Africa.

The result showed that 96.4% of interviewed village chicken owners had no any culture of vaccinating birds against diseases. Lack of awareness about the presence of chicken vaccines (71.4%), lack of attention to village birds (13.6%) and low availability of vaccines (15%) were the major reasons mentioned by village chicken owners for lack of vaccination against diseases. A t raditional

Table 5. Production performance of local chicken in Bure district, Ethiopia.

Variables	Agro-ecology			Grand total (Mean SD)
	High-land (Mean±SD)	Mid-altitude (Mean±SD)	Low-land (Mean±SD)	
Average age of cockerels at 1st mating (weeks) (N = 280 hh)	24.6 2.0 [a] (12) *	24.5 1.6 [a] (12)	24.6 2.0 [a] (12)	24.6 1.9 (12)
Average age of local pullets at 1st egg (weeks) (N = 280 hh)	26.9 2.5 [a] (8)	27.6 2.5 [b] (12)	27.9 2.3 [b] (8)	27.5 2.4 (12)
Average number of eggs layed/hen/clutch (N = 560 hens)	16.7 3.2 [b] (18)	16.1 3.1 [b] (18)	14.4 3.0 [a] (16)	15.7 3.21 (20)
No of clutch periods/hen/year (N=560 hens)	3.6 0.7 [a] (3)	3.8 .752 [a] (4)	4.1 0.8 [b] (3)	3.83 0.8 (4)
Total egg production/hen/year (N = 560 hens)	60 9.3 [a] (44)	61 11.4 [a] (80)	59 11.9 [a] (72)	60 11 (88)

[a,b,c] Least square means with different superscripts within a raw are significantly different (P < 0.05); * Numbers in bracket are range, hh = household.

treatment (ethno-veterinary) was the major type of treatment used by majority of village chicken owners (95%) against NCD. Accordingly provision of a mixture of local alcohol (‘*Arekie*”), lemon and onion to sick birds against NCD was the most widely used (42.9%) type of traditional treatment. Other common types of traditional treatments observed were; use some herbs like *„semiza”* (*Justitia schemperina*) and *„endod”* (*Phytolacca dodecandra*) (33.2%), use of tetracycline capsule (11.8%) and cutting around the wing of chicks to remove ‘infected’ blood (7.1%).

The result of the current study revealed that there is a need for serious intervention in disease control activities so as to improve village chicken production and productivity in the study district. Control of chicken diseases in the study area could be achieved through improvement in veterinary and advisory services. It is also found vitally important to conduct further studies focusing on identification NCD virus strain and prevalence rate of infectious bursal disease (IBD) so that preventive and control programs could be formulated. Further research interventions focusing on identifying the effectiveness of those ethno-veterinary medications could also be vitally important.

Risk aversion strategies used by village chicken producers

The result indicated that 83.2% of village chicken owners reared birds only during the dry season, when the risk of disease outbreak and predation impact is low. 96.4% of those chicken owners, who reared birds throughout the year, used various types of risk aversion strategies during high risk seasons. Accordingly, reduction of flock size and keeping only some productive hens and cocks at hand (83.6%) was the most preferred strategy implemented. Other identified strategies included; housing all birds and treating them at home until the favorable season sets in (7.5%), housing some birds and send the rest to other places with the agreement of sharing eggs and chicks hatched in the mean time (5.3%).

Production and reproduction performance of village chicken

The production and reproduction performances of village birds were evaluated under the existing farmer’s manage-ment condition. The production and reproduction history of at least two local hens per each household was collected during data collection. The average age of local cockerels at first mating and pullets at first egg were 24.6 and 27.5 weeks, respectively, (Table 5). Similar studies by various authors also indicated that sexual maturity age of female village birds were; 28 weeks in Tanzania (Katule, 1992), 24 weeks in Mali (Kassambara, 1989) and Nigeria (Sonaiya and Olori, 1998), 32 weeks in Sudan (Wilson, 1979), 28 - 36 weeks in Benin (Assan, 1990) and 25 weeks in Senegal (Sall, 1990). The average number of eggs/hen/clutch and the number of total clutches/hen/year were 15.7 and 3.8, respectively. The total egg production/hen/year of local hens was estimated to be 60 eggs.

The average number of eggs/clutch identified in this study was similar to the reported 9 -19 eggs in North West Ethiopia by Halima (2007), 12 - 18 eggs in Nigerian local hens by Gueye (1998) and 6 - 20 eggs in Tanzania by Aichi (1998).

This study shows that local chicken ecotypes were late maturing This is in conformity with the findings of Aberra (2000) that one of the expressions of low productivity of local chicken ecotypes was late maturity. The current study showed that local broody hens were the only means of egg incubation and brooding young chicks. The average number of eggs incubated once/hen was 13

Table 6. Mean (range) hatchability performance of local hens in Bure district, Ethiopia (N = 560).

Variables	Agro-ecology			Grand total (N = 560)
	High-land (N = 240)	Mid-altitude (N = 240)	Low-land (N = 240)	
Average number of eggs incubated (Mean SD)	14 2.2[b] (10 - 21) *	13 1.9[a] (8 - 20)	13 2.2 [a] (7 - 20)	13 2.2 (7- 21)
Average number of eggs hatched (Mean SD)	12 2.2[b] (5-16)	11 2.2[b] (0 - 19)	10 2.4[a] (5-19)	11 2.3 (0 -19)
Average percent of birds reached grower stage (Mean SD)	60.4 13.8[a] (25 - 92)	60.8 15.9[a] (22 -100)	60.2 19.3[a] (0-100)	60.5 16.4 (0 -100)
Average hatchability performance of local hens (%) (Mean SD)	85.7 10[a] (47 - 100)	84.6 12.6[a] (0 - 100)	76.9 11.2[a] (53 - 100)	82.6 11.5 (0 -100)

a, b,c

Least square means with different superscript within a raw are significantly different (P < 0.05); * Numbers in bracket are range value.

eggs (ranged 7 - 22 eggs) and high (11chicks) (range 0 - 19) numbers of chicks were hatched. Accordingly the average hatchability percentage of local hens was 82.6% (Table 6).

Zelleke (2005) reported that the average hatchability performance of modern incubators found in governmental poultry breeding and multiplication centers of Amhara region, under standard breeding conditions, was 69%, which is lower than the hatchability performance of local broody hens of the study area. Similar hatchability performance results of village hens were reported by different researchers as follows; 50 -100% and 60 - 90% in United Republic of Tanzania and Burkina Faso local chicken, respectively by Minga et al. (1989) and Bourzat et al. (1990), as sited by Aichi et al. (1998) and an average hatchability of 82% was reported in communal area of Zimbabwe by Kusina et al. (2000). According to Kitalyi (1998), the reasons for the differences in hatchability performance of local hens might be attributed to the time/season of the year, since hatchability of eggs was affected by season of incubation.

Regarding culling of birds, 93.9% of chicken owners had their own indigenous knowledge of culling birds purposely. The major type of birds culled from the flock were; old aged birds (51.4%), lower producers (23.6%), sick birds (16.8) and chicken more than need, mainly cockerels (8.2%). The average culling age of local cocks was 2.7 years. The result indicated that 70.7% of chicken owners had their own cocks and the rest (29.3%) used cocks of their neighbors. It is identified that 50% of those cock owners used local breeds and the rest (20.7%) used either pure exotic/cross breed cocks or a combination of local and exotic breed cocks. The major sources of local cocks were; home hatched/grown (36.8%) and those purchased from market (13.2%). Regarding selection of cocks for replacement, 92.2% of chicken owners had the tradition of selecting cocks. Plumage color (45.4%), physical stand (37.1%), comb type (8.6%) and parent's performance (1.1%) were the major criterion's used for selection of cocks. Related to selection of broody hens, 86.4% of village chicken owners had a culture of selecting broody hens for breeding/incubation purposes. Hen's past egg incubation performance (73.9%), presence of big body size (7.9%), presence of thick feather (2.1%), size of eggs laid (2.5%) were some of the major criteria's used in selection of broody hens.

Challenges of village chicken production system

As discussed above high incidence of chicken diseases, mainly Newcastle disease was the major and economically important constraint for the existing chicken production system of the district. The other village chicken production and reproduction constraints observed in the study included the following; predation, poor productivity of local chicken, lack of proper agricultural services with related to chicken husbandry and poor chicken husbandry management by producer farmers. Halima (2007) also reported that predation was one of the major village chicken production constraints in North West Ethiopia. Bell and Abdou (1995) also reported that a large proportion of village birds were being lost due to predators in some African countries.

Wild birds (locally called *"chilfit")* were the most dangerous type of predators (59.3%) affecting village birds. The attack of wild birds was very serious on young chicks (73.2%). The prevalence of wild birds was severe in all seasons of the year. However, other types of pre-dators were dominant mainly during the rainy season, when vegetation was higher around the home stead. Protection of young chicks, especially from wild birds was critical, as this is the time when they are most vulnerable to predators. The study revealed that only 37.5% of village chicken owners got proper agricultural extension service related to chicken production like; advisory service, trainings, credit and input

facilities. On the other hand, agricultural extension was the main source of infor-mation about improved chicken production system for only small proportion (37.5%) of chicken owners. Lack of access to get extension agents was the main reason (31.8%) for absence of extension service with regard to village chicken production.

SUMMARY AND RECOMMENDATIONS

The following recommendations are suggested based on the result of the current study:

1. Local chicken ecotypes were dominant and more adapted for the existing scavenging chicken production system of the district.

2. The result revealed that there is strong need for appropriate intervention in diseases and predator control activities so as to reduce mortality and improve productivity of birds.

3. Control of diseases could be achieved through improvement in veterinary and advisory services. Since several traditional (ethno veterinary) medicines are being used in the study area against NCD, studies under controlled conditions are needed to determine the efficacy and veterinary properties of these medications.

4. The problem of predators could be reduced by convincing farmers to construct and housing birds in predator proof separate chicken houses, especially during the night.

5. As most of village chicken production activity is managed by women, provision of successive trainings on modern chicken husbandry practices to women would be essential for the improvement of chicken production and productivity.

6. Provision of credit facilities to chicken owners and linking the production with marketing will encourage chicken owners and contribute to the improvement of the sector.

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