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Study on major causes of chicken mortality and associated risk factors in Bahir Dar Zuria District, Ethiopia

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A cross sectional study was conducted to assess major causes of chicken mortality and associated risk factors from November 2013 to May 2014 in Bahir Dar Zuria District, Ethiopia. One hundred respondents were selected using simple random sampling technique. Data collected using questionnaire survey and from laboratory investigation of parasites were analyzed using STATA version 11. Among all respondents, 63 and 37% of the respondent used extensive/backyard and small-scale intensive poultry production systems, respectively. All respondents provided housing for their chicken under small-scale intensive system, while 96.8% provided housing under extensive production system. All small-scale intensive producers and 88.8% of extensive producers practiced house cleaning practices. About 56 and 5% of the respondents provided water as free accesses in small scale intensive and extensive production systems, respectively. Provision of commercial feed was practiced only by small scale intensive poultry producers. Presence of diseases, feed shortage, predators and bad weather condition/extreme weather condition/ were identified as the major causes of chicken mortality. Among diseases Newcastle diseases, Infectious bursal diseases and coccidiosis were cited in their order of importance. Among 69 fecal samples collected 44 (69.84%) were positive for nematodes, cestode and protozoal parasites. High mortality rates were recorded in both production systems. A 50% under extensive and 36% under small-scale intensive production systems, poultry producers dispose dead birds due to different diseases by throwing elsewhere near the farm/backyard area. Among all respondents, 24% vaccinated their chicken, whereas 76% did not practice vaccination to common diseases. Thus, poultry improvement program in the area should focus on minimizing and ultimately avoiding constraints of poultry sector to see the required performance at the expected level.

Key words: Chicken mortality, production systems and management practices.

INTRODUCTION

Rural poultry production is an important agricultural activity Africa providing scarce animal protein resource in the form of meat and eggs as well as being a reliable of pet each. Village chickens also fulfill a number of functions for which it is difficult to assign any monetary value (Alders and Spradbrow, 2000). According to

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Ministry of Agriculture, Ethiopia has a large population of chickens estimated about to be 48.89 million (CSA, 2011), reared in all agro-ecological zones of the country predominantly under traditional husbandry system. Poultry husbandry in an intensive system is also practical in some urban and per urban areas and only represents 1% of the total population in the country (Demelash and Ajebu, 2003).

The poultry sector in Ethiopia can be characterized into village or backyard, small scale and commercial poultry production system (Dawit et al., 2008). Backyard poultry production is the predominant system in Ethiopia which accounts for nearly 99% of the poultry population consisting mainly of local chicken breeds under individual farm household management. It is also common to find a few exotic breeds distributed through the extension programs in the backyard production system. The small-scale intensive poultry production system comprises a flock size ranging from 50 to 500 exotic breeds' operation commercial bases and outdoor with a low bio-security level. Commercial poultry production system is highly intensive production system that involves greater than 10,000 birds kept under indoor and heavily depends on imported breeds (Dawit et al., 2008).

In Ethiopia, the poultry sector has been adversely affected by a variety of constraints; of these poultry diseases continues to play the major role hampering its development. Poultry mortalities due to diseases are estimated to range from 20 to 50%, but it may rise as high as 80% during epidemics (Tadelle and Ogle, 2001). Diseases, feed shortage, bad /extreme whether condition and predation were the major constraints in all areas surveyed under village production system. The impact of diseases includes lost revenue, vaccination cost (prevention, eradication, decontamination and restocking) (Safari et al., 2004). Chick's mortality represents a major loss in scavenging village chicken production system in Ethiopia. Several reasons for the high mortality and low productivity have been suggested such as mismanagement, malnutrition, disease and predation (Negesse, 1991). Newcastle disease (Serkalem et al., 2005) and predator attack (Halima, 2007) have also been reported as a major constraints to chicken production in central and Northwest, Ethiopia. Thus, there are many constraints to the development of small holder's poultry production that need to be addressed. These comprise disease control, protection against various predators, better feeding, genetic improvement, marketing, training and management access to production imputes, infra-structural and capital farmer organization, and for most conducive institution and governmental policies (Aklilu et al., 2004).

There is an increased demand for poultry and poultry products in Bahir Dar Zuria District, due to increased population growth and urbanization. The number of people involved in the small-scale intensive and extensive chicken production increased dramatically in the vicinity of Bahir Dar. This growth effort also supported by government extension programs through distribution of day old chicks and pullets to small scale intensive and village chicken producers. Despite the effort by small-holder farmers and government to enhance the sector, there are several constraints affecting the poultry sector not to perform at the expected level. Thus, there is a need to develop a systematic study conducted to identify the major causes of chicken mortality and propose feasible interventions in Bahir Dar Zuria District, Ethiopia. Thus, the objectives of this research work was to identify causes of chicken mortality and associated risk factors and recommend possible intervention options to reduce chicken mortality and enhance economic contribution in Bahir Dar Zuria District.

MATERIALS AND METHODS

Description of study area

The study was carried out in Bahir Dar Zuria District, which surrounds the capital city of Amhara regional state, Bahir Dar. It is located at 565 km northwest of Adiss Ababa. The center is located 11° 29' N latitude and 37° 29' E longitudes with an elevation of 1730 m.a.s. l. It receives a summer rainfall where the highest rainfall is between June and September and winter dry season (December to March). Its average annual rainfall is 1150 mm with temperatures ranging from 6.5 to 30°C.

Sample size determination and selection of study households

A total of 100 households were included in the study according to the formula given by Arsham (2002), $N=0.25/SE^2$, Where, N= Sample size, SE= Standard error. As a standard error of 0.05 was taken to calculate the total households to be involved in the questionnaire survey. $N=0.025/ (0.05)^2 =100$. Selection of households was in collaboration with Bahir Dar Zuria District Agricultural Office livestock experts from a total of 10 Peasant Associations (PAS) a list of 300 households were used as sampling frame. Then, using simple random sampling 100 households were selected to be included in the study.

Faecal sample collection and isolation of parasite eggs

A total of 69 feacal samples, 31 from exotic chicken under small scale intensive and 38 form local chicken under extensive/backyard production systems were collected during the study period and transported to Bhirdar Zuria District veterinary clinic using coded formalin containing bottles. Faecal samples were collected by inserting the applicator finger into the cloaca of the selected chicken to isolate eggs of gastro- intestinal nematodes and protozoas. Parasite eggs were identified using simple faecal floatation method developed by Zajac and Conboy (2006).

Procedures

Upon arrival to the laboratory, samples were kept at low temperature until processing. Floatation fluid was prepared using 400 g Nacl and 1000 ml water. The solution was stirred to dissolve adequately. Each coded faecal samples were mixed well with the floatation fluid and strained with tea strainer. Then, after removal of faecal, the debris and solution was poured in to coded test tubes.

Table 1. Characteristics respondents and production systems in the study area.

Sex of respondents	Percent (N=100)
Male	62
Female	38
Educational status of respondents	
Illiterate	36
Primary School	32
Secondary School	23
College and University	9
Age of respondents	
Young	21
Adult	79
Flock Composition Kept	
Exotic Chicken	43
Local Chicken	54
Crossbreds	3
Production Systems Used	
Extensive/Backyard	63
Small scale Intensive	37

After putting the test tubes on the rack, it was allowed to stay for 20 min according to the procedure developed by Zajac and Conboy (2006). Then, a drop of fluid from the supernatant was taken to prepare a smear and examine under microscope to identify parasite eggs.

Study populations

The populations studied were exotic chickens distributed by the government, crossbreds and local chickens (ecotypes) in Bahir Dar Zuria District.

Data collection and analysis

Household information, type of chicken reared, management, health and vaccination status of chickens, constraints, causes of mortality and common poultry diseases occurring in the area was collected using the questionnaire prepared for the survey. In addition to questionnaire data collection, general house inspection, feeding and health of poultry were carried out. Parasite infection presence and absence was also recorded. Eggs of the parasite identified helped to identify the most common parasitic diseases in the area. Data collected were analyzed using Stata software version 11 (STATA, 1999). Data of household characteristics, management practices (housing, feeding, watering), health care practices and common causes of mortality was summarized using descriptive statistics. Pearson's chi-square (χ^2) was used to determine the effect vaccination on chicken mortality.

RESULTS AND DISCUSSION

The household characteristics of the respondents (Table1) revealed that higher proportion of male Respondents were higher than females. However, in others studies conducted at small scale and extensive level females dominates in poultry production as it was reported by Upton (2004), Muchadeyi et al. (2007) and Tadesse et al. (2013).

In the present study, higher number of respondents studied at primary and secondary school and College/University level in comparison with those reported by Halima (2007) and Moges et al. (2010). In Bahir Dar Zuria District 63% of farmers used the extensive/ backyard production system, however, considering as the whole Ethiopia 99% of chickens are raised under the traditional backyard system of management (Ashenafi and Eshetu, 2004). From the total of respondents 37% of the respondents used small scale intensive production (Table 1), which represents an emerging system in urban peri-urban areas of Ethiopia (Solomon, 2008).

Housing protects birds from harsh weather condition, predators and facilitates management of chicken. In the present study, under extensive system, nearly 97% of the respondents provide night shelter while about 57% provide daytime shelter for their chicken (Table 2), this is relatively higher than the findings of Moges et al. (2010) who reported 77.9% of village chicken owners provided night shelter in Bure District North West Amhara region. All small-scale intensive producers practiced cleaning of poultry house, whereas 88.8% respondents practiced poultry house cleaning under extensive system, this agreed with the finding of Khandait et al. (2011) who reported 84. 17% house cleaning practice in Bhandara

Table 2. Housing practices under intensive and extensive production systems.

House sanitation practices	Production systems used	
	Small scale intensive (N=37)	Extensive/backyard (N=63)
House cleaning practiced	37(100%)	56 (88.8%)
Chemicals use for house cleaning	24 (64.8%)	13 (35.2%)
Housing practices specific to extensive/backyard production system (N=63)		
Provision of night shelter		61(96.8%)
Provision of day time shelter		36(57.1%)

District of India. Higher proportion of respondents used chemicals including sodium chloride, diazinon and 5% chlorine for house cleaning under small-scale intensive than extensive production system.

Generally, in the present study the use of river and borehole as water source indicate lack of clean water source (pipe water) in Bahir Dar Zuria District (Table 3). In small-scale intensive system, majority of the respondents used pipe water (70%) as water source, while the rest used river and borehole water, similar watering practices was reported by Mengesha et al. (2011) in Jamma District, South Wollo and Moges et al. (2010) in Bure District, North West Ethiopia.

The current study disclosed that under extensive system, nearly 35% of the respondents used river as water source this is not in agreement with Tadesse et al. (2013) who reported (1.1%) in Ada'a and none of village chicken owners in Lume Districts used river as a water source. The same author reported free access provision of water in 96% village chicken owners in Ada'a and Lume Districts of Oromiya, which significantly higher in comparison with the current study. Feed constitute the major cost in poultry production, to make full use of the productive potential of chicken, nutritionally balanced diet should be provided. Provision of supplementary feed was practiced by small-scale intensive and extensive systems, where as there was no provision commercial feed under extensive system (Table 3). Lack and availability could be the factor that restrained farmers' not to use commercial poultry feeds in the area. As scavenging laying hen can find approximately 60 to 70% of their feed requirement (Rahman et al., 1997), providing supplementary feeds could help to express the laying potential of chickens at village level. In small-scale intensive system, above 62% of the respondents fed their chicken commercial diet, while under extensive system 73% of the respondents provided feed in addition to the common scavenging system. However, in the current study, there was no record of using scavenging for small-scale intensive and provision of commercial diet for extensive/backyard system.

In both production systems, diseases were identified as major causes of chicken mortality, this is in agreement with the finding of Moges et al. *(*2010) in North West of Amhara Region. Predators are also cited as causes of mortality in small-scale intensive and extensive systems, while nearly 6% respondents mentioned bad weather as cause of chicken mortality (Table 4).

Cats and wild birds were identified as major predators for small scale intensive and backyard production systems, respectively. In other studies conducted by Tadesse et al. (2013) in Ada'a and Lume District, feed shortage cited as the third challenge and Melkamu and Wube (2013) cited predator as the primary causes of chicken mortality in Gonder Zuria District, Ethiopia. Birds of prey locally called "Culullee", cats and dogs and wild animals were identified as main chicken predator in rift valley of Oromyia, Ethiopia (Dinka et al., 2010). Mekonnen (2007) also reported a prey of snakes, rats, dogs and foxes in young birds in Southern, Ethiopia. This could indicate the presence of different agro-ecology could determine the presence of different chicken predators.

Faecal egg isolation and identification

Among 69 faecal samples collected 44 (63.78%) were identified positive for nematode, cestode and protozoan parasites. The major isolates were coccidian spp. (47.73%) and the other isolates were *heterakis galinarum, ralientina cesticillus*, subulura spp., capilaria spp., and prostlogonium spp (Table 5). Provision of training for farmers would help farmers to use the available feed resources at hand to enhances the economic contribution of the poultry sector. More than half (56.75%) of the respondents provided training on health care management of poultry under small scale intensive, while majority of the respondents (96.83%) respondents did not get training under extensive production systems (Table 6). This is comparable with the finding of Tadesse et al. (2013) who reported (47.2%) chicken owners provide poultry training in Ada'a and Lume District of Oromyia. Higher proportion of respondents got veterinary service in small-scale intensive (83.78%) than extensive (55.55%) production systems. The relative higher number of birds/area and convenience to provide treatment in small-scale intensive

Table 3. Chicken feeding and watering practices in Bahir Dar Zuria District.

Water sources used	Production systems	
	Small scale intensive (N=37)	Extensive/Backyard/ (N=63)
River	7 (18.92%)	22 (34.92%)
Pipe water	26 (70.27%)	28 (44.44%)
Borehole water	4 (10.81%)	13 (20.64%)
Frequency of watering		
Free Access	21(56.76%)	3(4.76%)
Two times/day	12 (32.43%)	42 (66.66%)
Once/day	4 (10.81%)	18 (28.58%)
Provision of additional feed		
Only scavenging	0 (0.00%)	17 (26.98%)
Provision of additional feed	14 (37.84%)	46 (73.02%)
Use of Commercial feed	23 (62.16%)	0 (0.00%)

Table 4. Major causes chicken mortality in Bahir Dar Zuria District.

Mortality causes	Production system used	
	Small scale intensive (N=37)	Extensive/backyard (N=63)
Diseases	24 (64.86%)	29 (46.03%)
Feed shortage	9(24.32%)	23 (36.50%)
Predators	2(5.40%)	7 (11.11%)
Bad weather Condition	2(5.40%)	4 (6.34%)
Total	37	63
Common mortality cause of diseases origin in their priority order		
Newcastle Diseases	22(59.45%)	35(55.55%)
Infectious Bursal Disease	9(24.32%)	22(34.92%)
Coccidiosis	6(16.22%)	6(9.52%)
Total	37	63

Table 5. Parasite eggs identified during the study from study chicken populations.

Parasitic eggs identified	Number of positive (N=44)
Coccidia Spp.	21(47.73%)
Heterakis galinarum	9 (20.45%)
Ascardia galli	6(13.64%)
Railientina cesticillus	3 (6.82%)
Subulura spp.	2 (4.54%)
Cappilaria Spp.	2(4.54%)
Prostlogonium Spp.	1(2.27%)
Total	44(100%)

than the backyard producers might lead farmers to seek more frequent veterinarian attention in small scale intensive production system. Provision of adequate veterinary services is also mentioned as major problem under extensive system as reported by Tadesse et al. (2013) and Mengesha et al. (2011).

Table 6. Health care practices followed in Bahir Dar Zuria District.

Health practices	Production system used	
	Small scale intensive (N=37)	Extensive/Backyard (N=63)
Provision of training	21(56.75%)	2(3.17%)
Provision of Veterinary Services	31 (83.78)	35(55.55%)

Table 7. Chicken mortality and disposal methods of dead chicken in and around Bahir Dar Zuria District.

Production system used			Disposal methods of dead chicken			Total
			Throwing elsewhere	Burying	Burning	
Extensive/Backyard	Mortality (N=63)	High (96.82%)	50(82%)	11(18%)	0.0%	61(100%)
		Low (3.17%)	1(50%)	1(50%)	0.0%	2(100%)
Small scale intensive	Mortality (N=37)	High (97.29%)	13(36%0)	20(55.6%)	3(8.3%)	36(100%)
		Low (2.70%)	0.0%	1(100%)	0.0%	1(100%)

More than half of the respondents of small scale poultry producers got adequate training on poultry rearing. However, a very few number of respondents got training on poultry training under extensive system and this might suggest to increase the number of trainings to be provided for village chicken owners. In other studies, relative higher number of farmers provided training and extension services in Ada'a and Lume District of East Shewa and Jamma District of South Wollo as reported by Tadesse et al. (2013 and Mengesha et al. (2011), respectively.

Nearly 97% of respondents in both small-scale intensive and extensive production systems experienced high mortality, while very few nearly 3% experienced lower mortality (Table 7). High chicken mortality was also mentioned as common problem in other studies conducted on village chicken by Tadelle (2001); Tadelle et al. (2003); Nigussie et al. (2003) and Serkalem et al. (2005). Disposing dead chickens using methods such as burying and burning could help farmers to prevent the transmission of the diseases into new flock and enhances the overall bio-security in small-scale producers. According to the present study 82% of the respondents used throwing elsewhere, while 18% used burying to disposed dead chicken under the backyard system (Table 8). None of the respondents used burning under extensive system. Burying is unlikely to pose environmental impact (Ritter and Chirnside, 1995).

Under small-scale intensive system 55.6 and 8.3% of the respondents used burying and burning methods to dispose dead chicken. Even though more than half the respondents used proper disposal methods of dead chicken, 36% of the respondents throw dead birds elsewhere near the farm. Burning/incineration process is expected to destroy all infective agents (NABC, 2004). The practice of throwing of dead chicken elsewhere in both production systems might indicate the need for further awareness of the farmers about the role using proper disposal method in prevention of infectious poultry diseases. Farmers should be aware about merits and drawbacks different disposal methods currently available (Ritter and Chirnside, 1995). Provision of further training on farm bio-security including disposal dead chicken would be beneficial as it could reduce the transmission of disease agents. Among respondents 24% vaccinated and 76% did not vaccinate for common diseases in the area. In other studies on village chickens conducted by Moges et al. (2010a); Leta and Endalew (2010); Mengesha et al. (2011) and Takele and Oli (2011) there was no record of village chicken vaccination practice by farmers in different parts of the country at village level.

In the current study, however, the mortality of chicken in vaccinated and non-vaccinated flocks did not show a significant difference ($p>0.05$). Most vaccines are sensitive to heat; an adequate cold-chain system often has to be created and maintained to preserve the quality of a vaccine before it is administered (Galazka et al., 1998). Thus, the high mortality in the vaccinated chicken could indicate that the vaccines used might not be maintained in suitable cold chain before providing for the chickens.

Conclusion

Despite the socio-economic role of chicken in the study area, diseases were cited as the major cause for chicken loss, followed by feed shortage, attack of predators among other factors. Thus, the poultry improvement program in the area should focus on minimizing and

Table 8. Chi Square analysis of provision of vaccination and mortality.

Vaccination status		Mortality		X^2	P-value
		High	Low		
Vaccinated	24	23(95.8%)	1(4.2%)	0.148	0.701
Not vaccinated	76	74(97.4%)	2(2.6%)		

ultimately avoiding these challenges. Thus, if the economic contribution of chicken is required to perform at the expected level, provision of a hand on training on importance of providing additional feed (about 27% practiced at backyard), provision of free access watering (practiced by about 57% small-scale intensive and 5% under extensive), housing and health care of chicken would have a paramount importance.

RECOMMENDATIONS

(i) Training and extension service provision should address farmers involved at extensive, backyard level;
(ii) Use of river and borehole water could expose chicken for infection, thus government should establish clean water supply so that farmers can provide clean water for their chicken;
(iii) The use of locally available underutilized feed resources should be considered to reduce feed shortage;
(iv) Awareness should be created on proper disposal methods of dead chicken for the farmers.

Conflict of Interest

The authors have not declared any conflict of interest.

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