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Original article

Rural poultry production and health management practices in central zone of tigray, Ethiopia

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ABSTRACT

The objective of this study was to assess rural poultry production and management practices in lowland and midland agro-ecological zones of central Tigray in Northern Ethiopia (13015' and 14039' North latitude, and 380 34' and 39025' East longitude). A total of 160 households, 80 from male and 80 from female headed households were selected randomly. All farmers in both agro-ecologies provided supplementary feed and water to their chickens but did not use feed trough, they simply poured the grain on the ground. About 62.5% of the households in midland and 40% in lowland constructed separate poultry house. There was positive correlation (r = 0.48, n=160) between separate housing and flock size. About 81.25% of the producers in the lowland and 87.5% in the midland selected hens for breeding purpose. Selection and culling of chickens were considered as best traditional breeding practices in both agro-ecologies. About 75% and 87.5% of the male and female headed households in lowland and 92.5% and 82.5% of the male and female headed households in midland, respectively selected hens for breeding purpose using different selection criteria. Culling age of cocks in midland (2.8±0.08 years) was significantly higher (P<0.0001) than in lowland (2.5±0.08 years). About 75% of the male and 50% of the female headed households in lowland and 72.5% of the male and 65% of the female headed households in midland treated their chickens at home traditionally. Different types of treatment methods were used to treat sick chickens and the type of traditional treatment

methods used by the households showed significant (X2=92.3; P<0.001) variation. Diseases, poor veterinary services, below standard housing, poor nutrition and neglecting the local chickens in extension packages are the major constraints of the system but the desire of the farmers to promote poultry production and their indigenous knowledge on culling and selection practice could be an opportunity to improve the sector.

1. Introduction

Agriculture is the backbone of the Ethiopian economy, employing approximately 85% of the total population, and livestock production accounts for approximately 30-40% of the total agricultural Gross Domestic Product (GDP) and 16% of national foreign currency earnings (Ayele et al 2003). It also plays an important role in the national economy as it contributes to 13-16% of the total GDP (Abassa 1995; Seifu 2000). There is no exact figure indicating the number of people raising chickens at the household level. However, it is believed that all the estimated agricultural households are engaged in small-scale household poultry production using indigenous chickens in different parts of the country depending on climatic conditions.

The chickens in free-range and backyard production systems are a function of natural selection mainly local or indigenous breeds. As a result the performance of chickens under rural conditions remain generally poor as evidenced by highly pronounced broodiness, slow growth rates, small body size and low production of meat and eggs (Kitalyi 1998; Sonaiya 2000; Gausi et al 2004). In most areas of the country separate poultry house is rare and the chickens live in family dwelling together with the human population with no or minimum feed supplementation. In addition, rearing them has been considering as a sideline agriculture activity. The rural areas of Central Tigray are some of the potential areas for household based poultry production system and almost every household rears chickens for economic and social benefits. In spite of its great importance in the household economy and food security, there was lack of information on the rural poultry production and management system as the practice was not well characterized in relation to the prevailing dominant agroecological set up of the area.

To investigate the poultry management systems in male headed and female headed households in the lowland and midland agro-ecological zones in central Tigray.

To identify the major constraints and opportunities of poultry production systems in the lowland and midland agro-ecological zone in central Tigray.

2. Materials and methods

2.1. Description of the study areas

The study area (central zone of Tigray) was stratified into midland and lowland agro-ecological zones (AEZs), as customarily used by the local administration and agricultural office. Two districts namely Adwa and Merebleke were selected to represent the midland and lowland agro-ecological zones with average elevation of 1907 and 1350 meter above sea level respectively. Adwa is located between 14o 19’ 25” North latitude & 39o 4’ 27” East longitude and Merebleke is located between 14o 32’ 11” North latitude & 39o 1’ 49” East longitude. The study area receives annual rainfall ranging from 400 mm to 650 mm with maximum and minimum daily temperature of 27 oC &12 oC in Adwa and 40 oC &18 oC in Merebleke.

Sampling and data collection methods

A total of 160 sample farmers, 80 households from each Wereda were selected randomly using lottery method from those households reared at least one chicken in the year. Disease prevention and controlling methods, selection and culling of chickens, management of broody hens and all aspects of chicken management practices like feeding, watering and housing were collected from individual households using pre-tested formal semi structured questionnaire. In addition four focus group discussions with an average group size of 16 individuals

were conducted with key-informants (model farmers, elders, women association leaders, experts from ARD and REST office, administrative bodies, youths and extension workers) in both agro-ecological zones. Tape recorder was used to record the forwarded ideas during the group discussion.

2.2. Statistical model and data analysis

The following nested statistical model was fit to the data:

Response= overall mean + effect of agroecology + effect of sex of household head nested within agroecology + residual error

Descriptive statistics such as mean, range and percentile were used. Chi- square test was employed for ordinal and nominal data such as chicken management practice like feeding, watering, housing and broody hen management. Pearson's Correlation was also carried out between housing and flock size of the households. All data were analysed using JMP5 (SAS, 2002).

3. Results

3.1. Poultry feed and feeding management

Even though scavenging was the main feed resource of rural poultry, all farmers in the study area provided supplementary feed to their chickens, although the amount of feed supplemented was not known. There was no any tradition of measuring supplementary feed for chickens both in the lowland and midland agro-ecological zones. About 20% and 7.5% of the respondents considered kitchen leftover feeds as secondary type of supplementary feed in lowland and midland areas. From the grain type supplementary feed sorghum, wheat and maize were ranked 1st, 2nd and 3rd in lowland whereas maize, Hanfets (barley and wheat mixture) sorghum were ranked 1st, 2nd and 3rd in midland agro-ecology based on their availability for poultry feed (Table 5).

All farmers in the study area did not use feed trough, they simply poured the grain on the ground. However, 10% and 27.5% of the male and female headed households in lowland and 7.5% and 5% of the male and female headed households in midland, respectively used any type of plastic sheet as a feeding trough (locally called meshemae) for injera and other household left over feeds. Similarly, Benabdeljelil et al (2001) reported that all rural poultry keepers in Morocco gave feed on the floor or archaic feeders. The rate of supplementation varied from household to household. About 50% of the male headed respondents in lowland and 52.5% in midland provided supplementary feeds 2 times a day while 45% of the female respondents in lowland and 40% in midland provided feed once a day. In addition, the feeding frequency of each household was not regular and depended on seasonal variation in feed availability. In the dry season mainly from December to May scavengable feed resource in the surrounding field was limited and the farmers preferred to provide supplementary feed 2 to 3 times per day. According to the interviewed household heads, farmers were forced to decrease the number of chickens for different reasons starting from the mid dry season (March) to the starting of the rainy season (June). These reasons included a shortage of the household's grain stock, increased temperature that favored the occurrence of high disease outbreaks and lower hatchability, and the arrival of the sowing season that necessitated a reduction in the number of scavenging chickens. With regard to feeding purpose, farmers in lowland provided feed to increase body weight of their chickens as first purpose and to improve broodiness as second purpose, whereas increasing egg yield and improving broodiness were first and second purpose of the farmers in midland, respectively (Table 1). This could be attributed to market access and production purpose of the farmers. Though, separate feeding of chickens was not practiced in the study area, nursing mother hens with their newly hatched chicks were kept separated at home (Fig. 1) and fed with injera and crushed grains.

The key informants in the group discussion pointed out that the provision of injera to lying hens may lead them to deposit more fat and eventually cause to cease lying egg but for growers it is required to achieve fast growth rate.

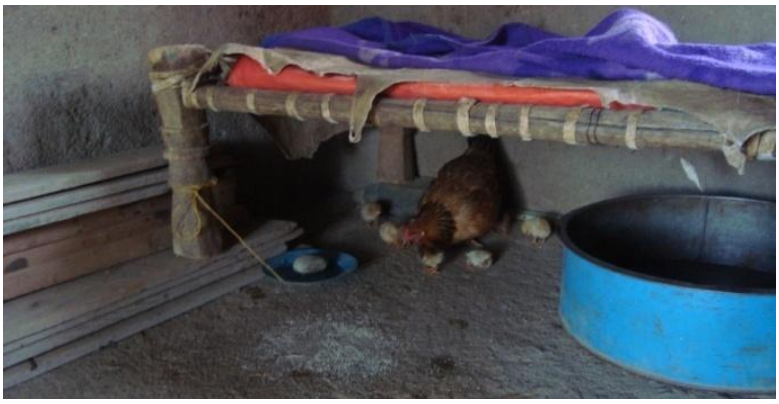


Fig. 1. New hatched chicks reared beneath family bed in the lowland.

Table 1
Type of supplementary feed, frequency of feeding and purpose of feeding in male and female headed households in the lowland and midlands agroecological zones of central Tigray.

Variables	Lowland		Midland			
	MHH (%) (n=40)	FHH (%) (n=40)	MHH (%) (n=40)	FHH (%) (n=40)	X2 value	P value
Provision of supplementary feed						
Yes	100	100	100	100	-	-
No	0	0	0	0		
Type of supplementary feed you provide						
Sorghum	60	35	2.5	5	160.9	<0.0001
Maize	32.5	7.5	57.5	45		
Wheat	7.5	57.5	0	0		
Hanfets	0	0	40	50		
Kitchen leftover as secondary feed type	10	27.5	7.5	5	10.31	0.0161
Source of supplementary feed						
Harvested	47.5	15	20	12.5	51.87	<0.0001
purchased	0	27.5	0	37.5		
Both harvested & purchased	52.5	57.5	80	50		
Presence of feeding trough						
Yes	0	0	0	0		
No	100	100	100	100	0.000	0.000
Use of plastic sheet as feed trough for Enjera	10	27.5	7.5	5	10.31	0.0161
Feeding frequency						
Once a day	40	45	42.5	40	1.81	0.9359
Two times a day	50	45	52.5	47.5		
Three times a day	10	10	5	12.5		
Purpose of supplementation						
Increase egg yield	30	25	50	57.5		
Increase body weight	45	40	20	20	15.34	0.0177
Improve broodiness	25	35	30	22.5		

n= number of respondents, MHH = Male Headed Households, FHH = Female Headed Households.

3.2. Poultry watering management

All households (100%) in lowland and midland agroecological zones of the study area supplied their chickens with water in different type of local watering trough. Fifty five percent of the surveyed farmers in lowland and 73.75% of the farmers in midland provided water in earthen pot type of watering trough (Table 2). Ninety percent of the respondents in lowland and 88.75% in midland agro-ecological zones provided water to their chicken once a day during the wet season whereas 83.75% and 68.75% of the respondents in lowland and midland provided water ad-lib (free access) to their chickens in dry season, respectively and there was no significance difference in rate of watering between the lowland and midland agroecology.

The study also revealed that 45% and 57.5% of the surveyed male and female headed households in lowland and 60% and 67.5% of male and female headed households in midland provided water for chickens with simple earthen pot placed on the ground at any corner of the barn. Exceptionally 10% and 7.5% of the male and female headed households in lowland used wooden type watering trough. The main sources of the water in lowland and midland agroecologies were spring water (50% and 41.3%) followed by hand pump (25% and 36.3%, respectively). Other sources of water mentioned by the respondents were shallow well and piped water. About 40% of the male headed households in lowland and 37.5% of the female headed households in midland washed the watering trough daily in the morning, about 15% and 322.5% of the male and female headed households in lowland and 20% and 35% of the male and female headed households in midland poured extra water to overflow and remove the dirt materials from the watering trough, and only 5% and 2.5% of the male and female households in lowland and 7.5% and 2.5% of the male and female headed households in midland, respectively never washed the watering trough. Hence the watering trough was always open and simply placed on the ground, possibility of contamination of water with cow dung (manure) and other dirt materials could be high. This might be a cause for the development of bacterial disease and other internal parasites that may affect the reproduction and productivity of the chickens. Contamination can occur not only in the drinking containers but also at the well or pond sources if not kept clean and sanitary.

3.3. Poultry housing systems

There were different types of housing systems observed in the study area. In the lowland agro-ecological zone, 45% of the male headed households and 35% of the female headed households constructed separate poultry house and in midland agro-ecological zone 72.5% of the male headed households and 52.5% of the female headed households had separate poultry house (Table 3). This might be attributed to the difference in extension services of the responsible bodies to create awareness of the people on the importance of separate chicken house. Though not significant, higher frequency of separate chicken house was recorded in male headed households (58.8%) than in female headed households (43.8%) in both agro-ecologies. Regarding the constructing materials, 10% of male and 6.3% of female headed households in the lowlands constructed poultry house from grass materials and mesh wire (gabion) hanged over large woody materials or pillars. In the midland agro-ecological zone 43.8% of the respondents constructed poultry house from rudimentary mason type with mud roof (Hidmo) (fig 4 f). The remaining 18.8% in lowland and 8.7% in midland used woody materials with grass (fig 3 c), plastic sheet or iron sheet roof. Only 5% of the respondents in lowland and 10% of the respondents in midland used corrugated iron sheet (fig 4 e). The difference in type of housing could be attributed to the type of construction materials available in the area and it could be due to the difference in environmental temperature. The woody type, mesh wire and grass type of houses were more ventilated than the mason type so that, such types of houses were found more frequent in lowland areas.

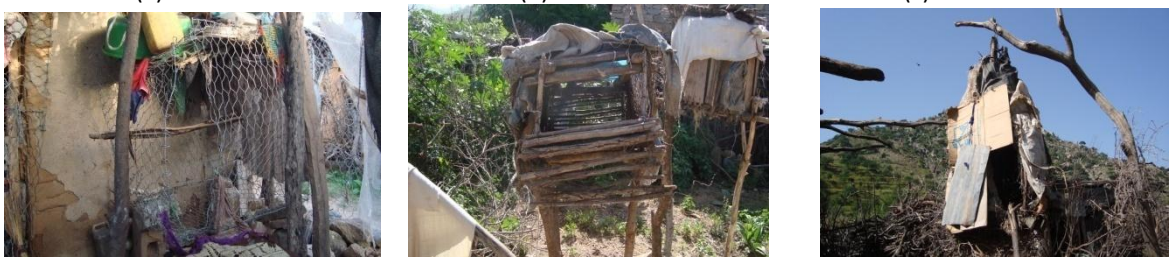
About 60% of the households in lowland and 37.5% households in midland did not construct separate poultry house except for night sheltering, 25% and 30% of male and female headed households in lowland and 12.5% and 27.5% of male and female headed households in midland sheltered the chickens to shared the same house with the family members placed on the ground covered with cartoon or grass made material (Kefer) or perched at one corner of the house, 15% and 20% of the male and female headed households in lowland and 10% and 15% of the male and female headed households in midland, respectively closed the chickens in kitchen to perch or confined on the floor.

Table 2
Provision of water, watering frequency, source of the water and watering trough in lowland and midland agroecological zones of central Tigray.

Variables	Lowland		Midland		X2 value	P value
	MHH (%) (n=40)	FHH (%) (n=40)	MHH (%) (n=40)	FHH (%) (n=40)		
Provision of water						
Yes	100	100	100	100	-	-
No	0	0	0	0		
Source of water						
Spring water	47.5	52.5	40	42.5		
Hand pump	22.5	27.5	35	37.5	10.51	0.3111
Shallow well	30	15	25	20		
Piped water	0	5	0	0		
Watering frequency						
Once a day	0	2.5	5	10		
Two times a day	7.5	15	17.5	15	11.37	0.25
Three times a day	5	2.5	5	10		
Adlibitum	87.5	80	72.5	65		
Type of watering trough						
Earthen pot	45	57.5	60	67.5		
Plastic made container	12.5	5	17.5	10	17.29	0.1389
Wood made watering trough	10	7.5	0	0		
Stone made watering trough	15	17.5	15	10		
Any type of can	17.5	12.5	7.5	12.5		
Washing of watering trough						
poured extra water	15	32.5	20	35		
Washed daily in the morning	40	35	32.5	37.5	9.58	0.6528
Washed every 3rd day	25	22.5	30	20		
Washed weekly	15	7.5	10	5		
Not washed at all	5	2.5	7.5	2.5		

n= number of respondents, MHH = Male Headed Households, FHH = Female Headed Households.

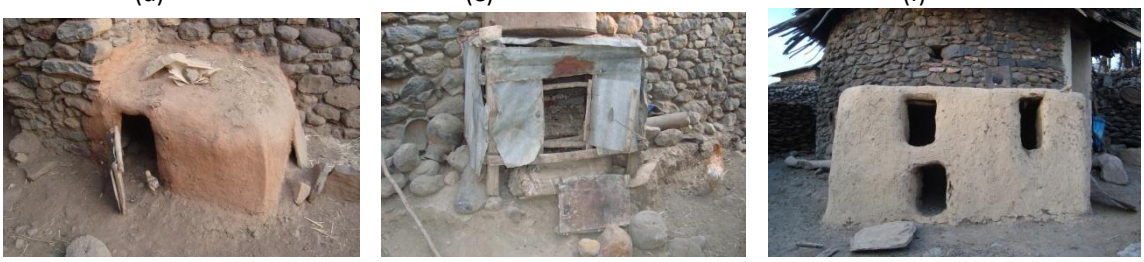
(a) (b) (c)



a= mesh wire, b= wooden type, c= grass type

Fig. 3. Poultry housing system in lowland areas of the study area.

(d) (e) (f)



d= wooden cemented with mud, e= iron sheet type, f= mason type

Fig. 4. Poultry housing system in midland areas of the study area.

Table 3

Chicken housing in male and female headed households in lowland and midland agroecological zones of central Tigray.

Variables	Lowland		Midland		X2 value	P value
	MHH (%) (n=40)	FHH (%) (n=40)	MHH (%) (n=40)	FHH (%) (n=40)		
Presence of separate poultry house						
Yes	45	35	72.5	52.5	12.45	0.006
No	55	65	27.5	47.5		
Type of separate poultry house						
Full wire mesh	10	2.5	0	0		
Grass made	10	10	0	0		
Wooden made	20	17.5	7.5	10	81.61	<0.0001
Iron sheet made	5	5	12.5	7.5		
Mason with mud roof	0	0	52.5	35		
No separate house	55	65	27.5	47.5		
Night sheltering places						
In house shared with the family	25	30	12.5	27.5		
In kitchen	15	20	10	15		
Perching on eave	15	12.5	2.5	5	18.63	0.0978
On trees	0	2.5	2.5	-		
In separate chicken house	45	35	72.5	52.5		
Reason for lack of separate poultry house	(n=22)	(n=26)	(n=11)	(n=19)		
Lack of awareness	22.7	19.2	36.4	15.8		
Lack of construction materials	13.6	26.9	9.1	31.6	9.67	0.3778
Risk of predators	54.6	34.7	54.5	36.8		
Lack of labor power	9.1	19.2	0	15.8		
Cleaning frequency of chicken house						
Daily	30	17.5	40	25		
Every other day (3rd day)	52.5	60	47.5	67.5	8.9	0.1789
Every week (weekly)	17.5	22.5	12.5	7.5		

n= number of respondents, MHH = Male Headed Households, FHH = Female Headed Households.

The major reasons for the lack of separate houses for their chickens mentioned by the farmers were risk of predators (44.65% in lowland and 45.65% in midland), lack of materials (20.25% in lowland and 20.35% in midland), lack of awareness (20.95% in lowland and 26.1% in midland), and in the case of the female headed households shortage of labor was the main constraint for not constructing separate poultry houses. There was

positive correlation (r = 0.48, n=160) between separate housing and flock size. Concerning cleaning frequency of chicken house, 23.75% of the households in lowland and 32.5% in midland cleaned it daily, 56.25% of the households in lowland and 57.5% of the households in midland cleaned the house every other day (3rd day) and the rest 20% and 10% of the households in lowland and midland agroecology, respectively cleaned the house every week.

3.4. Management of broody hen

In the study area broody hens were the only means of incubation and rearing chicks at household level except one incubator operated intermittently by user groups which was provided by Relief Society of Tigray (NGO) in Rama (town of Mereb-leke district) and another private incubator in Adwa town. The study revealed that all farmers in the study area collected the eggs on daily basis and 77.5% of them stored the eggs in safe container mixed with grains, 8.1% stored mixed with flour, 11.9% stored in any available material that could be grass made or plastic made container and exceptionally 5% of the households in lowland stored the egg mixed with sand placed on any container (Table 4). The logic for the storage of eggs in grains, flour and sand was to keep the eggs cool until the time of incubation. All households selected the last 8-12 eggs purposely for hatching and stored in separate container until the hen is ready for brooding. Such practice might have positive impact on increasing the hatchability rate of the eggs. Storage time can influence the viability of the eggs by reducing the thick white content of the eggs and on the other hand by increasing the amount of thin white and air space inside the eggs. Selection of broody hen was practiced by 68.75% of the households in lowland and 63.75% of the households in midland agroecology and of which 61.8% of the households in lowland and 54.9% in midland look on the previous performance of the hen and 38.2% of the households in lowland and 45.1% in midland look on the body size of the hen. About 47.5% of the respondents in lowland and 38.75% in midland selected eggs for incubation purposely by inspecting the size of the eggs, 23.75% of the respondents in lowland and 33.75% in midland examined the shell condition of the eggs, 7.5% of the respondents in lowland and 10% in midland checked the shape of the eggs. About 60% and 67.5% of male and female headed households in lowland and 70% and 72.5% of male and female headed households in midland mixed eggs for incubation from different hens when the number of eggs laid by a single hen are less than 5 or when they need to incubate eggs from exotic breeds. Very occasionally, 2.5% of the households purchased eggs for incubation from the market or from neighboring farmers during sudden loss of eggs by breakage or predators attack.

A variety of local materials were used for the incubation of eggs in both agroecology. About 30% and 22.55 of the male and female headed households in lowland and 32.5% and 35% of male and female headed households in midland, respectively used clay pot, 25% of both male and female respondents in lowland and 35% and 27.5% in male and female headed household in midland, respectively used grass made incubator (Kefer), 20% of the female respondents in both agroecology used plastic made (Meseben) and 22.5% of the male headed respondents in lowland and 12.5% of both male and female headed households in midland used any cartoon box for incubation while the rest 5% and 12.5% of the male and female respondents in lowland and 5% of each male and female headed households in midland set the eggs on the ground with deep litter. About 73.8% of the respondents in the lowland agroecology used sand as a bedding material whereas straw (by 47.5%) and manure (by 47.5%) of the households used as bedding materials in midland agro-ecology. According to the key informants in the group discussion sand was used almost by all farmers as bedding material to keep the environmental temperature low and maximize hatchability. High environmental temperature caused the broody hen restless and interrupted incubation for long time then resulted in poor hatchability. According to the respondents, March, April and May in lowland and July, August and May in midland agroecology were not preferred for incubation and brooding. Low hatchability of eggs due to high environmental temperature in lowland and high mortality rate of chicks due to predators and low temperature during the rainy condition in midland were some of the reasons forwarded by the farmers in the group discussion for the not preferred months. Farmers practiced different methods to break the broody behavior of the hens. About 32.5% and 37.5% of the respondents in lowland and midland agroecology, respectively tied the hen's wing up with stick placed on the back of the hen, 23.75% of the respondents in lowland and 41.25% in midland shifted the hen to another house, 21.25% of the respondents in lowland and 8.75% in midland hanged the hen upside down on a tree or under any shade, 16.25% of the respondents in lowland and 12.5% in midland disturbed the nest, and the remaining 6.25% of the households in lowland did not use any method at all.

Table 4
Incubation and broody hen management in male and female headed households in lowland and midland agroecological zones of central Tigray.

Variables	Lowland		Midland		X2 value	P value
	MHH (%) (n=40)	FHH (%) (n=40)	MHH (%) (n=40)	FHH (%) (n=40)		
Egg storages						
Mixed with grain	92.5	85	67.5	65		
Mixed with flour	2.5	0	15	15	33.06	0.0001
Put on sand	5	5	0	0		
Put in any container	0	10	17.5	20		
Selection of broody hens						
Yes	65	72.5	60	67.5	1.46	0.6916
No	35	27.5	40	32.5		
Criteria for selection of broody hen	(26)	(29)	(24)	(27)		
Previous performance						
Body size	61.5	62.1	54.2	55.6	0.53	0.9116
	38.5	37.9	45.8	44.4		
Purchase of eggs for incubation						
Yes	0	2.5	2.5	5	2.82	0.4196
No	100	97.5	97.5	95		
Selection criteria of eggs						
Size of the eggs	42.5	52.5	40	37.5		
Shell condition of the eggs	22.5	25	27.5	40	6.13	0.7269
Shape of the eggs	10	5	12.5	7.5		
No selection practiced	25	17.5	20	15		
Mixing of eggs						
Yes	60	67.5	70	72.5	1.58	0.6649
No	40	32.5	30	27.5		
Type of materials for incubation						
Clay pot	30	22.5	32.5	35		
Grass made brooder	25	25	35	27.5	5.84	0.9239
Cartoon	22.5	20	12.5	12.5		
Plastic made (Meseben)	17.5	20	15	20		
On the ground	5	12.5	5	5		
Bedding material for incubation						
Straw	30	22.5	50	45		
Manure	0	0	40	55	152.17	<0.0001
Grass	0	0	10	0		
Sand	70	77.5	0	0		
Practices used to break broodiness						
Tie wing of the hen						
Moving to neighbors	35	30	35	40		
Hanging	25	22.5	45	37.5	16.81	0.1567
Disturbing the nest	20	22.5	7.5	10		
No practice	15	17.5	12.5	12.5		
	5	7.5	0	0		
Brooding methods (chick rearing)						
Broody hen	77.5	77.5	90	82.5		
Hay box brooder	20	12.5	5	5		
All methods	2.5	10	5	12.5	9.81	0.1329

n= number of respondents, MHH = Male Headed Households, FHH = Female Headed Households.

Almost all of the households (86.25%) in midland and 77.5% in lowland used broody hen to rear their chicks but 16.25% of the respondents in lowland and 5% in midland used hay box brooder and the rest 6.25% and 8.75% of the households in lowland and midland agroecology, respectively used both broody hen and hay box. Hay box brooder was used only by the farmers who owned exotic breeds.

3.5. Selection and culling of chickens

Selection and culling of chickens were considered as best traditional breeding practices in both agroecologies. About 75% and 87.5% of the male and female headed households in lowland and 92.5% and 82.5% of the male and female headed households in midland, respectively selected hens for breeding purpose using different selection criteria (Table 5). In view of that, 36.7% of the male and 20% of female headed households in lowland and 48.7% of male and 54.6% of female headed households in midland used egg production, 33.3% of the male and 54.3% of female respondents in lowland and 24.3% of the male and 21.2% of female respondents in midland used good broodiness behavior, 16.7% of the male and 14.3% of female respondents in lowland and 13.5% of the male and 12.1 of the female respondents in midland used body size of the hen and the rest 13.3% of the male and 11.4 of the female respondents in lowland and 13.5% of the male and 12.1% of the female respondents in midland used plumage color as selection criteria. Good broodiness behavior of hens was considered as main criteria in lowland areas to maximize hatchability (44.6% of the households) whereas egg production was used by 51.4% of the respondents as the main criteria for selection of hens in midland areas.

About 73.75% of the respondents in lowland and 81.25% of the respondents in midland practiced selection of cocks for breeding purpose, and out of which 28.8% of the respondents in lowland and 32.6% of the respondents in midland looked on body size and conformation, 20.45% of the respondents in lowland and 18.35% in midland looked on plumage color, 20.25% in lowland and 17% in midland looked on plumage color and comb type and 30.5% in lowland and 32% in midland looked on comb type, plumage color and activity of the cock.

According to the key informants, selection of breeding hens and cocks was commonly practiced by the farmers in the study area during purchase of a starter flock and to improve some traits of the present flock. Purposeful culling of chickens was also practiced by 88.75% of the households so that poor egg lying hen by 36% of the respondents in midland and poor hatchability performance of the hen by 34.2% of the respondents in lowland were some of the reasons for culling chickens and the reasons of culling chickens used by the farmers in lowland and midland agroecology showed significant ($X2 = 16.16$; $P<0.05$) difference.

The study revealed that, 19.7% of the households consumed the culled chicken, 21.1% sold the chicken and 59.2% sold or consumed the culled chicken. Culling was also used to keep the size and composition of the flock when the farmer needs to reduce the number of the chickens for fear of disease outbreak and arrival of the sowing season. Average culling age of cocks in lowland and midland agroecology was 2.8 and 2.5 years, respectively. Average culling age of cocks in lowland (2.8 years) was significantly higher ($P<0.05$) than in midland (2.5 years). This might be due to the difference in perception of the farmers living in lowland and midland agro-ecology towards the purpose of poultry production. Most of the farmers in midland tried to maximize their income from sale of chickens and eggs rather than consumption, thus did not kept cocks for long time.

3.6. Disease prevention and controlling methods

About 75% of the male and 50% of the female headed households in lowland and 72.5% of the male and 65% of the female headed households in midland treated their chickens at home traditionally but 17.5% and 6.25% of the farmers owned exotic breed chickens in lowland and midland agroecology, respectively brought to veterinary clinic for treatment whereas 16.25% of the households in lowland and 18.75% in midland slaughtered their chicken immediately after they observe any emerging symptom of disease but in this case consumption of infected chickens could be a direct means for disease transmission from birds to human beings, therefore it is essential to train the farmers on how to prevent pathogenic diseases. Different types of treatment methods were used to treat sick chickens and the type of traditional treatment methods used by the households showed significant ($X2=92.3$; $P<0.001$) variation (Table 6).

Fifteen percent of the respondents in lowland and 24.9% in midland used tetracycline powder or any other capsule mixed with water, 22.4% of the respondents in lowland and 40.3% in midland treated their chickens with mixture of different plants like Ere (Aloe), Shinfae (Lepidium sativum) and Garlic (Allium sativum). In addition mixture of Neam leaf (Azadiracta indica), Chenaadam (Ruta chalepensis), lemon juice, oil and table salt together with water by 48.1% of the respondents and cutting beneath the wing (armpit) to remove the infected blood by 14.3% of the respondents in lowland were used as method of treatment whereas 34.85% of the households in midland used 'holy water' as common method of treatment. This study revealed that 85% of the households in the lowland area and 91% of the households in midland area had no any culture of vaccinating their chickens against disease.

Table 5
Selection and culling practices in male and female headed households in lowland and midland agroecological zones of central Tigray.

Variables	Lowland				Midland				X2 value	P value
	MHH (n=40)	(%)	FHH (n=40)	(%)	MHH (n=40)	(%)	FHH (n=40)	(%)		
Selection of chickens for production purpose										
Yes	75		87.5		92.5		82.5		5.15	0.1611
No	25		12.5		7.5		17.5			
Criteria used for selection	(30)		(35)		(37)		(33)			
Egg production										
Good broodiness	36.7		20		48.7		54.6			
Large size	33.3		54.3		24.3		21.2		13.44	0.1434
Plumage color	16.7		14.3		13.5		12.1			
	13.3		11.4		13.5		12.1			
Selection of cocks for breeding purpose										
Yes	75		72.5		77.5		85		2.1	0.5515
No	25		27.5		22.5		15			
Selection criteria of breeding cocks	(30)		(29)		(31)		(34)			
Body size and conformation	30		27.6		38.7		26.5			
Plumage color	16.7		24.2		16.1		20.6			
Color and comb type	23.3		17.2		19.4		14.7		3.04	0.8681
Color, comb type and activity	30		31		25.8		38.2			
Purposely culling of chickens										
Yes	82.5		92.5		92.5		87.5		2.69	0.4426
No	17.5		7.5		7.5		12.5			
Reason for culling	(33)		(37)		(37)		(35)			
Old cock or hen	51.5		56.8		48.7		48.6			
Poor brooding hen	33.3		35.1		13.5		17.1		16.16	0.0129
Poor egg laying	15.2		8.1		37.8		34.3			
Fate of culled chickens	(33)		(37)		(37)		(35)			
Consumed in number	36.4		29.7		8.1		5.7		20.3	0.0024
Sold	27.2		18.9		18.9		20			
Sold or consumed	36.4		51.4		73		74.3			
Culling age of cocks (Least sq mean ± SE)										
Average culling age of cocks in year	3.1±0.11		2.4±0.11		2.6±0.11		2.4±0.11			<0.0001

n= number of respondents, MHH = Male Headed Households, FHH = Female Headed Households.

Some of the major reasons mentioned by the farmers were lack of information about veterinary service of chickens by 55% and 60% of the households in lowland and midland areas, inadequate veterinary service by 20% and 26% of the households in lowland and midland areas and giving less attention to chicken production by 25% and 13.75% of the households in lowland and midland areas, respectively.

4. Discussion

Farmers provided daily their chickens with supplementary feed though the amount of feed supplemented was very small. This shows traditional poultry production is the main source of chickens for consumption, replacement and other purposes in the area. Similarly Tesfu (2006) stated that all chicken keeper farmers around Diredawa provided supplementary feed to their chickens. In addition, Halima et al (2007) in North-west Ethiopia, Mekonen (2007) in Southern Ethiopia and Fisseha et al (2010) in Bure wereda, reported that 99.28%, 98.1% and 97.5% of the farmers provided supplementary feed to their chickens, respectively. The tradition of providing

supplementary feeds reported in this study is, however, in sharp contrast with the report that only 0.2% of the respondents in Zimbabwe provided supplementary feed to their chickens (Mapiye and Sibanda 2005). This might be due to the difference in amount of scavengable feed resource in these two contrasting environments (Tadelle et al 2002) and/or due to the difference in the production system (van Eekeren et al 2006).

Table 6
Different methods of treating sick chickens practiced in lowland and midland agroecolgy of central Tigray.

Variables	Lowland		Midland		X2 value	P value
	MHH (%) (n=40)	FHH (%) (n=40)	MHH (%) (n=40)	FHH (%) (n=40)		
Vaccination of chickens						
yes	7.5	22.5	10	7.5	5.34	0.1488
no	92.5	77.5	90	92.5		
Farmer's action when chickens sick						
-Treat him self	75	50	72.5	65		
-Take to clinic (only for exotic birds)	12.5	22.5	5	7.5	13.99	0.1228
-Slaughtered the bird	12.5	20	17.5	20		
-No action	0	7.5	5	7.5		
Types of traditional treatment methods	(35)	(29)	(31)	(29)		
-Tetracycline powder	20	10.4	29	20.7		
-Juice of ere plant, shinfae and garlic with water	17.2	27.6	32.3	48.3	92.03	<0.0001
-Mixture of neam leaf, shinfae, chenaadam, lemon, oil and salt with water	51.4	44.8	0	0		
-Holy water	0	0	38.7	31		
-Cutting beneath the wing	11.4	17.2	0	0		
Reason for lack of vet service						
-Lack of information	47.5	62.5	52.5	67.5		
-Lack of attention	37.5	12.5	17.5	10		
-Inadequate veterinary service	15	25	30	22.5	10.56	0.1030

n= number of respondents, MHH = Male Headed Households, FHH = Female Headed Households.

In Central highland of Ethiopia the housewife provided a preferential feed supply for chicks in most case boiled grains or water socked Enjera until they started to scavenge with the mother hen Dessie and Ogle (2001). With regard to watering all households provide water for their chickens. This is in line with the report of Mekonen (2007) in Southern Ethiopia, Tesfu (2006) in villages of Dire Dawa town, Fisseha et al (2010) in Bure wereda, both stated that regardless of watering frequency, all farmers provide water to their chickens. But water supplementation in the study area is better than the report of Benabdeljelil et al (2001) and Swaston et al (2001b) who reported that only 94% of the farmers in Morocco and 73% in the Vhembe district of the South Africa provided water to their chickens, respectively.

Since the production system is traditional the constructed poultry house was not appropriate to chickens. In general very short and confined type of house constructed by the farmers was in agreement with the report of Dessie and Ogle (2001) in central highlands of Ethiopia who stated that usually, there was no special housing provided for the birds, a few households had constructed a small enclosure outside the house. Similarly, Benabdeljelil et al (2001) reported that poultry house made of local materials such as bamboo, wood, stones, plastic screens were used in small unpaved; windowless compounds in 79% of the households in Morocco. Kondombo et al (2003) also reported that, poultry housing in Burkina Faso was always built of straw and was too small. Similar housing system was reported by Faouzi et al (2002) in Morocco whereby different types of housings

such as baskets, cages made out of wire mesh and wooden sticks/plastic roof, little squared house made out of stone and plastic or even old cars.

There was positive correlation (r = 0.48, n=160) between separate housing and flock size. This indicated that farmers with large flock size of chickens might give good attention for construction of chicken house. In line with this Mengesha et al (2008) reported that, sharing of the same roof with human being might be due to the small flock size per household and/or giving low emphasis for their birds or lack of facilities to construct separate houses. Kugonza et al (2008) from Eastern Uganda reported that farmers are more likely to purchase chickens if some housing will be provided, and vice versa.

Farmers living in the midland agro-ecology cleaned chicken house more frequently than farmers living in the lowland agroecology. This could be due to the difference in follow up of the health extension workers in understanding the farmers on the advantage of cleaning poultry house. The study also revealed that male headed households had more frequently cleaned chicken house than female headed households. This might be attributed to the family size and labour availability of the households; hence male headed households have larger family size than female headed households. In line with this Dessie and Ogle (2001) reported that in central highlands of Ethiopia night shelter of chickens was occasionally cleaned by the housewife, depending on her workload.

Farmers use different techniques to manage their broody hens. Some of the methods to break broodiness in hens were like piercing the nostrils with a feather to prevent sitting, physically moving the bird to nearby house for a couple of days, by hanging the bird upside down for about 3-4 consecutive days and disturbing the sitting nest-boxes (Mekonnen 2007). Such practices were implemented to creating stress on the hen, to let it forget broodiness and bring in to production with in short period of time. However, it is documented that some of the practices like, hanging hen upside down and tying the hen's wing up were unrecompensed practices and might harm the hen. Moreover, shifting of hens to another house might be a means for disease transmission.

Selection criteria of the households were varying from agro-ecology to agro-ecology. This is because, low hatchability due to high temperature was prioritized as first problem in the lowland and farmers tried to minimize the problem of hatchability by selecting good broody hen with large size and good sitting-habit for better hatchability. This is in line with the report of Abdelqader et al (2007) in Jordan the most important traits that farmers would like to improve in their flocks were related to productivity and about 51.7% ranked egg production as the first selection criterion. Mengesha et al (2008) also reported that 91% of the households in Jamma wereda (South Wollo) were practicing chicken selection for breeding purpose.

Poultry producers in the study area used different traditional disease prevention methods to cure their chickens. In many cases Garlic was used as traditional medicine even for human beings in addition to its use as food. Garlic has the broadest spectrum of any antimicrobial substance. This property belongs to the garlic constituent allicin (Peter et al 2008). Juice of Neem leaf was also used as insecticide by some innovative farmers. Extracts or crude parts of Neem plant are often mixed with seeds such as maize, grain, rice and beans in storage to protect these seeds against insects (Sara et al 2004) because this plant contain bitter compounds that often have an antifeedant effect and can interfere with hormonal processes in insects (Chawla et al 1995). This indicated that further research activities focusing on identifying the effectiveness of those traditional treatment methods and medications could be important. The bioactive ingredients of Neem were reported to be widely used in fields of public health and agriculture (Tesfu 2006). Mekonnen (2007) also reported that most of the farmers (87.6%) used traditional remedies to treat their sick chickens, which are usually administered through drinking water. Similarly, Swatson et al (2001b) in Vhembe district of South Africa reported that traditional herbal remedies used in an attempt to control disease outbreaks were made from the ground barks or leaves of plants. Benabdeljelil et al (2001) also reported that, people raising Beldi poultry in morocco used several traditional "medicines " locally available such as olive oil, onion, garlic, pepper, paprika and others.

Most of the households in the study area do not vaccinate their chickens due to different reasons. There was significant difference ($P<0.05$) between the reasons mentioned by male headed and female headed households in the study area. Lack of information was largely mentioned by female headed households than male headed households. This might be attributed to the difference in access of training. Most of the time males were more frequently participate in different trainings, workshops and other district level assemblies than females. Similarly, Fikre (2000) stated that most of the poultry extension workers transfer their extension packages to the husband expecting that he will pass the message to his wife. This indicates that, females were hardly visiting the training center of farmers (FTC).

5. Conclusion

The following conclusions are drawn from this study

Poultry production system in the lowland and midland agroecological zones of central Tigray was based on indigenous chicken ecotypes with very small exotic breed (RIR).

Production system and management practices of the households vary with agro-ecology.

Poultry vaccination was very poor whereas, traditional treatment methods were used to treat and prevent chickens from disease.

Diseases, poor veterinary services, poor housing, poor nutrition and neglecting the local chickens in extension packages are the major constraints of the system but the desire of the farmers to promote poultry production and their indigenous knowledge on culling and selection practice could be an opportunity to improve the sector.

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