Sjournals
Scientific Journals
Agricultural Advances (2013) 2(7) 206-215
ISSN 2251-7820

Contents lists available at Sjournals

Agricultural Advances

Journal homepage: www.Sjournals.com

Original article

Evaluation of reproductive performances and survival rate of Washera sheep under farm and station management systems in Amhara region, Ethiopia

S. Mekuriaw[a,b], M. Taye[b,*], Z. Mekuriaw[b], G. Mekuriaw[b], H. Mazengia[b], A. Haile[c,d]

[a]*Andassa Livestock Research Center, P.O. Box 27, Bahir Dar, Ethiopia.*
[b]*Bahir Dar University, College of Agriculture and Environmental Sciences, P.O. Box 79, Bahir Dar, Ethiopia.*
[c]*International Livestock Research Institute (ILRI), P.O. Box 5689, Addis Ababa, Ethiopia.*
[d]*International Center for Agricultural Research in the Dry Areas, P.O. Box. 5466, Aleppo, Syria.*

*Corresponding author; Mengistie Taye, Tel: +251918768619, POBOx 79, Bahir Dar, Ethiopia.

A R T I C L E I N F O

Article history:
Received 24 June 2013
Accepted 07 July 2013
Available online 30 July 2013

Keywords:
Farmers management
Reproductive performance
Survival rate
Station management
Washera sheep

A B S T R A C T

Reproductive performance and survival rate of Washera sheep was evaluated in western highlands of Amhara region. Data collected from 2007 to 2010 in Farta and Lay Gaint districts with farmers management system and at Adet Washera sheep breed improvement sub-center were used for the study. The effect of different fixed effects like management system, lamb sex, parity of dam, season of birth/lambing, year of birth/lambing and lamb birth type on reproductive performance and survival rate were analyzed. The effect of management system and birth year on weight at first lambing were significant that Ewes under station management system had lower weight than their farm managed contemporaries (20.03±1.7 kg vs. 23.79±1.4 kg, $p<0.01$). The least squares mean lambing interval and annual reproductive rate of Washera sheep under farm and station management were 303 days & 1.46 and 263 days & 1.40, respectively. Management system, lambing year, lambing season and ewe parity affected lambing interval and annual reproductive rate of Washera sheep. The overall least squares mean survival rate (%) of Washera sheep from birth to one month, three months, six months, nine months and yearling of age were 93, 86, 78, 72 and 67%, respectively. Management system, lambing year, lambing season and ewe parity were found to affect survival of Washera sheep to all ages considered. The lower performances of sheep in most of the traits considered (eg., weight at first lambing, EPPWt and survival), in the station indicated the substandard management level followed in the station which needs great attention by the center. On the other hand, the better performance on the farmer management level shows the wider environmental adaptation of Washera sheep which can be used in similar agro-ecological condition to the study areas. Different fixed effects influenced both reproductive performances and survival rates in the study and needs to be considered whenever there is a need to improve the performances of Washera sheep breeds both under farm and station management system in the highlands of Ethiopia.

1. Introduction

Sheep production is an important agricultural activity in Ethiopia supporting the livelihoods of many poor people providing meat, fibre and manure. They are sources of cash income for the family. There are a large number and breeds of sheep in the country which are maintained under the traditional low-input-low-output system of production. Because native sheep breeds are selected and developed for fitness traits for which natural selection operates for the environmental conditions prevailing in the area, production and productivity is very low (Riggio et al., 2008).

In Ethiopia, there have been different efforts to improve the productivity of indigenous sheep through crossbreeding and within breed selection programs. The crossbreeding program has been started since 1944 using exotic breeds (Tibbo, 2006). However, the efforts were not as such successful for different reasons (Taye et al., 2011). With this regard, the Amhara national regional state Bureau of Agriculture and Rural Development has designed a strategy to use Washera sheep to improve the productivity of other local sheep breeds in the region which are believed to be low performing (BoARD, 2004). Washera sheep is recognized as one of the promising indigenous sheep breed in Ethiopia with an adaptation to a wide range of agro-climatic conditions (Mengistie et al., 2009; Solomon et al., 2010). With this initiative Washera sheep was distributed into different areas of the region including Farta and Lay Gayint districts of south Gonder zone. Along with this a Washera sheep breed improvement center was established by Andasa Livestock Research Center at Adet.

This paper compares the reproductive performances and survival of Washera sheep under the traditional management system of Farta and lay Gaint districts and under station management systems in Adet sheep breeding center.

2. Materials and methods

2.1. Description of the study area

Data on reproduction and off-take of sheep was collected from farmers' flocks in Farta and Lay Gaint districts and from Adet government sheep research station in Amhara Region, Northwest Ethiopia.

Farta district is situated at 11°40′ N latitude and 38° E longitude and located at about 100 km north-east of Bahir Dar, capital city of the Amhara Region, Ethiopia. It lies within an altitude range of 1920-4135 m a.s.l. The district receives an average annual rain fall of 900-1099 mm and a mean-range temperature of 9-25 OC (Farta District OoARD, Annual report). The district's major socio- economic problem is food insecurity (Alemtsehay and Girma, 2006).

Lay Gayint is situated at 11o43'N latitude and 38o18'E longitude and located at 175 km north-east from Bahir Dar. It lies within an altitude range of 1300-3500 m a.s.l. The district receives a mean annual rainfall of 600-1100 mm and mean range temperatures of 9-19 OC, respectively (Ethiopian National Meteorological Agency, unpublished). It is characterized by drought, sever soil erosion, poor soil fertility, frost and shortage of arable land, crop disease and pest hail damage, landslide and feed shortage (South Gonder Zone BOA, 2008).

Adet Washera sheep improvement sub-center is situated at 11°10′ –11°15′ N latitude and 37°30′ –37°40′ E longitude and found in Yilmanadensa district which is located at about 40km in south-east of Bahir Dar at an altitude of 2,300 m a.s.l. It has a uni-modal type of rainfall receiving a mean annual rainfall of about 1270 mm (1051 to 1488 mm) which occurs from May to October (ENMA, unpublished).

2.2. Flock management

2.2.1. On-farm flock management

In Farta and Lay Gaint districts farmers keep sheep in combination with other livestock species like cattle and equines .The main feed sources for sheep in the study area are natural grazing land, crop residue, improved forage, crop aftermath and concentrates. During crop harvesting times, sheep have access to browse on crop aftermath. Breeding is year-round. Farmers in the study areas house their sheep throughout the year to protect them from sun, rain, wind, theft and wild animals (Shigdaf et al., 2012).

Since the start of data collection, sheep have been de-wormed for internal parasite three times a year; at the end of rainy season, at mid dry season and at the onset of rainy season. Animals have also been sprayed for external parasites when tick infestation is high. Vaccination against pasteurellosis, anthrax and black leg has been given once a year.

2.2.2. On-station flock management

Flocks in the station had on average eight to ten hours grazing time per day depending on the season; during the rainy season, the duration is shorter. Sheep graze on natural grazing land during the day and were supplemented with hay and crop residue. Suckling animals with their lambs had access to concentrate supplementation (200g of maize and nougcake mixture per day). The sheep also had free access to clean water.

Herding is based on age, sex and breeding groups that lambs to weaning, growing lambs, breeding ewes and rams were herded separately during the day and housed in separate houses except suckling ewes and lambs that housed together during the night. Breeding was controlled which was designed to lamb three times in two years. Breeding ewes in a group run with a ram (1 ram to 25 ewes) during the mating season and they were not allowed to mix with each other. All animals were vaccinated, de-wormed for internal parasite and sprayed for external parasite.

2.3. Data collection and management

Data from 118 farm flocks and station flocks collected from 2007 to 2010 was used for the study. Plastic ear tag was used for identification of animals to facilitate recording. On-farm data were collected by trained enumerators supervised monthly by researchers from research station while station data were collected by animal science diploma holders. Reproduction and survival data collected and recorded within 24 hrs of lambing were ewe ID, lambing/birth date, lamb birth weight, ewe postpartum body weight, type of birth, sex of lamb and parity of dam, mortality date, date when sheep is out from the farm for different reasons as sale, gift, loss, death etc.

2.4. Data analysis

Data on reproductive performances and survival rate was analysed using General Linear Model procedures of the Statistical Analysis System (SAS, 2003).

The fixed effects considered were management system, lamb sex, parity of the dam, season of birth/lambing, year of birth/lambing and lamb birth type. Season of birth was defined as dry (November to April) and wet (May to October). Lamb birth weight was classified as heavy (>3 kg), medium (2-3 kg) and light (<2 kg) based on literature used for the same breed (Mengistie et al., 2011). When analysis of variance declared significance, least squares means were separated using Tukey-Kramer test.

The response variables analysed were age at first lambing (AFL), weight at first lambing (WFL), lambing interval (LI), litter size (LS), annual reproductive rate (ARR) and survival from birth to different ages. ARR was computed as litter size multiplied by 365 divided by lambing interval (days). Survival traits coded as binary traits were determined by whether or not a lamb survived to the end of each period according to Nguti et al. (2003).

Survival was studied to five different age classes; from birth to 30 days, birth to 90 days, birth to 180 days, birth to 270 days and birth to 365 days. Interaction effects and co-variances were tested and resulted non-significant.

Model 1: Analysis of variance of age and weight at first lambing

$Y_{ij} = \mu + P_i + Y_j + e_{ij}$

Where: Y_{ij} = the observation on age and weight at first lambing

μ = Overall mean

P_i = Management system (i = on-farm, on-station)

Y_j = Fixed effect of ewe birth year (j = 2007, 2008)

e_{ij} = effect of random error

Model 2: Analysis of variance of lambing interval, litter size and annual reproductive rate

$Y_{ijklmn} = \mu + P_i + S_j + T_k + Y_l + Z_m + e_{ijklm}$

Where: Y_{ijklm} = the observation on LI, LS and ARR

μ = Overall mean

P_i = Fixed effect of ewe parity (j = 1, 2, 3, 4, 5, ≥6)

S_j = Fixed effect of lamb birth season (k = dry, wet)

T_k = Fixed effect of lamb birth type (l = single, multiple)

Y_l = Fixed effect of lamb birth year (m = 2007, 2008, 2009, 2010)

Z_m = Management system (n = on-farm, on-station)

e_{ijklm} = effect of random error

The fixed effect birth type was not used for LS (lamb birth type) and ARR

Model 3: Analysis of variance of ewe postpartum body weight

$Y_{ijklmn} = \mu + S_i + T_j + Y_k + Z_l + e_{ijkl}$

Where: Y_{ijklmn} = the observation on ewe postpartum body weight

μ = Overall mean

S_i = Fixed effect of lamb birth season (i = dry, wet)

T_j = Fixed effect of lamb birth type (j = single, multiple)

Y_k = Fixed effect of lamb birth year (k = 2007, 2008, 2009, 2010)

Z_l = Management system (l = on-farm, on-station)

e_{ijkl} = effect of random error

Model 4: For analysis of variance of survival rate

$Y_{ijklmno} = \mu + G_i + P_j + S_k + T_l + Y_m + X_n + Z_o + e_{ijklmno}$

Where: $Y_{ijklmno}$ = the observation on survival to different ages.

μ = Overall mean

G_i = Fixed effect of lamb sex (i = male, female)

P_j = Fixed effect of ewe parity (j = 1, 2, 3, 4, 5 and ≥6)

S_k = Fixed effect of birth season (k = dry, wet)

T_l = Fixed effect of lamb birth type (l = single, multiple)

Y_m = Fixed effect of lamb birth year (m = 2008, 2009, 2010, 2011)

X_n = Fixed effect of birth weight of the lamb (n = light, medium, heavy)

Z_o = Management system (o = on-farm, on-station)

$e_{ijklmno}$ = effect of random error

3. Results and discussion

3.1. Age and weight at first lambing

The least squares mean age and weight at first lambing of Washera sheep under farm and station management systems is presented in Table 1. The effect of management system and birth year on age and weight at first lambing were analyzed and were found to be significant on weight at first lambing. Ewes under station management system had lower weight than their farm managed contemporaries (20.03±1.7 kg vs. 23.79±1.4 kg, p<0.01) which indicates the substandard management level practised in the station.

Birth year also had significant (p<0.05) effect on weight at first lambing so that ewes born in 2008 had heavier weight than ewes born in 2007 (22.2 vs. 19.9kg). This might be as a result of the fluctuation of feed availability because of the variation in the amount and distribution of rain fall between years that has influence on herbage production and performance of ewe (Berhanu and Aynalem, 2009).

Table 1
Least squares means±standard errors of age and weight at first lambing of Washera sheep under on-farm and on-station management systems.

Source of variation	N	Age at First Lambing (days)	Weight at First Lambing (kg)
CV (%)	42	15.50	10.62
Management systems		NS	**
On-station	16	470±8.44	20.0±1.72
On-farm	26	457±4.76	23.8±1.43
Birth year		NS	*
2007	20	463±5.30	19.9±1.61
2008	22	498±3.50	22.2±1.30

NS: Not significant (p>0.05); *p<0.05; **p<0.01.

3.2. Lambing interval

Management system had significant effect on lambing interval for Washera sheep that ewes under station management had shorter lambing interval than their on-farm managed counterparts (263 vs. 303 days, p<0.01). This difference might be associated with the supplementation of feed for pregnant ewes at the last gestation period under station management system. In addition, there was controlled breeding system in the station which might have effect on lambing interval of ewes.

Lambing year exerted significant (p<0.01) effect on lambing interval that ewes lambed in 2007 had longer lambing interval than ewes lambed in 2008 and 2009. This finding is in line with the findings of Mengistie et al. (2011). Lambing season had significant effect on lambing interval in which ewes which lambed in wet season had shorter lambing interval than those which lambed in dry season (268 vs. 298 days, p<0.01). The effect of season might be associated with the availability of forages, where ewe lambed in wet season might have got sufficient feed and came to heat early after lambing.

Parity had a significant (p<0.05) effect on lambing interval that earlier parity ewes had the longest lambing interval than ewes with later parities. The longer lambing interval for young ewes in this result might be associated to the longer time they take to recover their body condition after lambing for reproduction again.

3.3 Litter size

The litter size obtained for Washera under farmers management in the present study (Table 2) is in agreement with that of Menz and Horro sheep (Mukasa-Mugerwa et al., 2002) and Gumuz sheep (Solomon et al., 2011) but lower than the Horro sheep (Solomon and Gemeda, 2000). This implies that Washera sheep breed is more productive as compared to the Ethiopian better performed sheep breeds.

3.4. Annual reproductive rate (ARR)

ARR is among the productivity measurements using different reproductive parameters. Table 3 presents ARR and the factors affecting it. Management system had significant (p<0.01) effect on ARR in which ewes under station management had higher ARR value than those managed on-farm (1.46 vs. 1.40). This difference might be associated with the controlled breeding followed in the station that lowers lambing interval thereby increase ARR.

Year of lambing exerted significant (p<0.01) effect on ARR in which ewes that lambed in 2009 had high ARR than ewes lambed in the previous years. This might be attributed to the variation in the amount and distribution of rain fall between years that has influence mainly on natural grassland and performance of ewe (Berhanu and Aynalem, 2009).

Ewes that have lambed in dry season had lower ARR than those who lambed in wet season (1.43 vs. 1.45, p<0.01). This variation could be because of fluctuation of feed availability between seasons. Increased parity resulted in increased ARR from 1.18±0.21 at first parity to 1.38±0.22 at six and above parities (p<0.05). The effect of parity on ARR was also reported by Berhanu and Aynalem (2009) that ewes in their early parity showed a smaller ARR than ewes in the middle parities.

3.5. Ewe postpartum body weight

The fixed effects of management system, lambing season and birth type had significant effect (p<0.001) on postpartum ewe body weight.

Table 2
Least squares means ± standard errors of Lambing interval, Litter size, ARR and EPPWt of Washera sheep in Amhara region.

Sources of variations	Lambing interval (days)		Litter size		ARR		EPPWt	
	N	LSM±SE	N	LSM±SE	N	LSM±SE	N	LSM±SE
CV (%)	904	23.38	1853	19.23	904	32.66	566	13.60
Management		**		NS		**		**
On-station	198	263±10.78	364	1.03±0.01	198	1.46± 0.05	355	28.0±0.73
On-farm	706	303±10.21	1489	1.05±0.09	706	1.40±0.04	211	29.2±0.83
Lambing year		**		NS		**		NS
2007	363	308.13±10.54[c]	645	1.02±0.01	363	1.25±0.04[a]	80	27.2±0.90
2008	161	256.01±10.49[a]	708	1.04±0.01	161	1.48±0.04[b]	219	27.4±0.78
2009	380	286.33±11.74[b]	331	1.04±0.01	380	1.54±0.05[c]	212	29.7±0.81
2010		-	169	1.05±0.01		-	115	30.7±0.81
Birth Season		**		NS		**		**
Dry	573	298.05±10.02	876	1.03±0.01	573	1.43±0.04	277	28.3±0.77
Wet	331	268.35±11.21	675	1.04±0.01	331	1.45±0.05	289	26.7±0.81
Parity		*		NS		*		NA
1	131	298.95±15.02[b]	261	1.02±0.01	131	1.18±0.21[a]		
2	222	289.58±13.00[b]	352	1.04±0.02	222	1.21±0.22[a]		
3	239	291.96±12.02[b]	262	1.00±0.03	239	1.30±0.21[b]		
4	174	276.42±11.17[a]	342	1.01±0.01	174	1.34±0.20[b]		
5	96	269.27±12.62[a]	315	1.01±0.02	96	1.35±0.20[b]		
≥6	42	277.12±14.94[a]	321	1.01±0.08	42	1.38±0.22[b]		
Birth type		NS		NA		NA		*
Single	762	284.59±7.92					442	27.0±0.61
Multiple	142	283.81±15.20					124	29.1±1.07
Lamb sex		NS		NA		NA		NA
Female	444	281.43±10.26						
Male	460	285.97±10.64						

Means with different superscript letters (a, b, c) within the same column and class are statistically different at indicated level; NS: Not significant (p>0.05); *p<0.05; **p<0.01; NA= Not applicable; ARR= Annual Reproductive Rate; EPPWt= Ewe post partum weight

Ewes under station management system had heavier ($p<0.01$) weight at lambing than their farm managed counterparts partly because of their shorter lambing interval. Ewes which lambed during the dry season were found to be heavier than those which lambed in wet season (28.3vs 26.7, $p<0.01$). Gbangboche et al. (2006) reported similar results in Djallonke sheep.

Type of birth had significant effect ($p<0.05$) on postpartum ewe body weight that multiple lambed ewes were heavier than single lambed ewes (29.1vs. 27.04±0.61). However, Gbangboche et al. (2006) reported that single bearing ewes were heavier than twin bearing ones. Mengistie et al. (2011) speculated this to be partly related to the positive correlation between ewe body weight and prolificacy as heavier dams produced larger litter size (Mellado et al., 2006).

3.6. Survival rate

Table 3 presents the survival rate of Washera sheep under station and farm management systems in Amhara region. The overall survival rate from birth to 30 days, three months, six months and yearling age were reported to be 93%, 86%, 78% and 67%, respectively.

The results obtained are much lower than the values reported for the same breed by Mengistie et al. (2011) in Quarit and Adet area of the Amhara region. The difference might be because of the difference in production area to which the current research is under ex-situ and station management system, while the report by Mengistie is from the home tract area of Washera sheep. Survival is about adaptation to the production environment. However, the result agrees with the findings of other scholars for other breeds of the country (Kassahun, 2000; Solomon and Gemeda, 2000; Solomon, 2002).

Management system had consistently significant ($p<0.01$) effect on survival rate for Washera sheep in all considered ages in which lambs under farmer management system had high survival rate than lambs under station management (Table 3). This might be because; the incidence of diseases is high in station under confined management system than the farmers' management system to which animals are managed in sparse and small numbers which reduces diseases risks (eg., pneumonia). In addition to this the station where the data were collected is small with very high stocking rate, herding large number of sheep together, deterioration of the grazing area and disease build up with time.

Birth year had significant ($p<0.01$) effect on survival rate for Washera sheep lambs from birth to nine month and yearling ages. Lambs born in 2007 had high survival rate than the other years which might be due to the fluctuation of feed and rain distribution along with the decreasing of grazing land from time to time. In the same scenario, Gemeda et al. (2002), Yibrah (2008) and Berhanu and Aynalem (2011) reported that the survival rate difference between years may be a reflection of differences in feed availability caused by differences in irregularity of rainfall and other climatic factors.

Season of birth had significant ($p<0.01$) effect on survival of lambs at all considered ages. Lambs born during the dry season had higher survival rate than lambs born at wet season in all considered ages. In agreement with the present findings, Mukasa-Mugerwa et al. (2000) reported that lambs born in the dry season had better survival than lambs born in the wet season. Berhanu and Aynalem (2011) also reported that lambs born during the wet season had the lowest survival rate than dry season under farm management. However, this result disagrees with the report by other scholars that lambs born during the wet season had better survival than lambs born in dry season (Kassahun, 2000; Solomon, 2002; Berhan and Van Arendonk, 2006; Mengistie et al., 2011).

Ewe parity had significantly ($p<0.05$) affected survival of lambs to all ages considered. As opposed to the expectation that survival increases from first party to advanced parties and lowers again in older ages, lambs from early parities and old parities had better survival than the medium ones. The effect might be, especially in farm flocks, farmers might give preferential treatment to the animals they think they are unable to nurse their young.

4. Conclusion

The reproductive and survival performances of Washera sheep was evaluated under station and farm management systems in Adet sheep breeding centre and Lai-gaint and Farta districts under farmers' management systems, respectively. The lower performances of sheep in most of the traits considered (eg., weight at first lambing, EPPWt and survival), in the station indicated the substandard management level followed in the station which needs great attention by the center. On the other hand, the better performance on the farmer management level shows the wider environmental adaptation of Washera sheep which can be used in similar agro-ecological condition to the study areas. Different fixed effects influenced both reproductive performances and survival rates in the study and needs to be considered whenever there is a need to improve the performances of Washera sheep breeds both under farm and station management system in the highlands of Ethiopia.

Table 3
Least square means ± standard errors of survival (%) of Washera sheep under on-station and on-farm management systems.

Dependent Variable	N	Survival from birth to				
		30 days	90 days	180 days	270 days	365 days
		LSM±SE	LSM±SE	LSM±SE	LSM±SE	LSM±SE
Overall mean	1646	0.93±0.01	0.86±0.02	0.78±0.02	0.72±0.02	0.67±0.02
Management		***	***	***	***	***
On-station	326	0.90±0.02	0.81±0.02	0.72±0.03	0.65±0.03	0.61±0.04
On-farm	1320	0.97±0.01	0.92±0.01	0.84±0.02	0.79±0.02	0.74±0.02
Year of birth		***	***	***	***	***
2007	437	$0.96±0.02^{b}$	$0.90±0.02^{c}$	$0.87±0.03^{c}$	$0.85±0.03^{c}$	$0.84±0.04^{c}$
2008	512	$0.89±0.01^{a}$	$0.81±0.02^{a}$	$0.69±0.02^{a}$	$0.63±0.03^{a}$	$0.58±0.03^{a}$
2009	425	$0.94±0.02^{b}$	$0.86±0.02^{b}$	$0.77±0.03^{b}$	$0.70±0.03^{b}$	$0.66±0.03^{b}$
2010	272	$0.94±0.02^{b}$	$0.88±0.02^{bc}$	$0.79±0.03^{b}$	$0.68±0.04^{ab}$	$0.61±0.04^{ab}$
Season of birth		***	***	***	***	***
Wet	529	0.91±0.01	0.82±0.02	0.71±0.02	0.66±0.03	0.63±0.03
Dry	1117	0.96±0.01	0.91±0.02	0.84±0.02	0.77±0.03	0.72±0.03
Parity		*	*	**	**	***
1	72	$0.95±0.03^{b}$	$0.91±0.03^{c}$	$0.79±0.05^{ab}$	$0.74±0.05^{abc}$	$0.67±0.05^{ab}$
2	404	$0.91±0.02^{ab}$	$0.84±0.02^{ab}$	$0.74±0.03^{a}$	$0.66±0.03^{ab}$	$0.59±0.03^{a}$
3	414	$0.89±0.01^{a}$	$0.81±0.02^{a}$	$0.72±0.02^{a}$	$0.65±0.03^{a}$	$0.58±0.03^{a}$
4	490	$0.95±0.02^{b}$	$0.87±0.02^{bc}$	$0.78±0.03^{a}$	$0.67±0.03^{ab}$	$0.64±0.03^{a}$
5	198	$0.95±0.02^{b}$	$0.89±0.03^{c}$	$0.87±0.03^{b}$	$0.82±0.04^{c}$	$0.80±0.04^{c}$
≥6	68	$0.96±0.03^{b}$	$0.85±0.04^{abc}$	$0.77±0.05^{a}$	$0.76±0.05^{bc}$	$0.76±0.06^{bc}$
Lamb sex		NS	NS	NS	NS	NS
Female	802	0.94±0.01	0.87±0.02	0.77±0.02	0.72±0.03	0.67±0.03
Male	844	0.93±0.01	0.86±0.02	0.79±0.02	0.72±0.03	0.68±0.03
Type of Birth		NS	NS	NS	NS	NS
Single	1514	0.93±0.01	0.88±0.01	0.79±0.02	0.74±0.02	0.72+0.02
Multiple	132	0.94±0.02	0.85±0.03	0.77±0.03	0.70±0.04	0.63±0.04

NS: Not significant (p>0.05); *P<0.05; **P<0.01; ***p<0.001; Means with different superscripts letters (a, b, c, d) within the same column and class are statistically different..

Acknowledgements

The authors are thankful to the Amhara Regional Agricultural Research Institute (ARARI) and Andassa Livestock Research Center (ALRC) for financing the research. We are also grateful for International Livestock Research Institute (ILRI) for providing logistics support for the researcher.

References

Ajoy, M., Prasad, H., Ashok, K., Roy, R., Nagendra, S., 2007. Factors associated with lamb mortalities in Muzaffarnagari sheep. Small Rumin. Res, 71, 273–279.

Alemtsehay, A., Girma, H.M., 2006. Terminal evaluation report on Care-Ethiopia's Farta food security and support project (FFSSP) (2002-5), Addis Ababa, Ethiopia.

BoARD, 2004. Sheep improvement breeding strategy and program (*Amharic Version*). Amhara National Regional State Bureau of Agriculture and Rural Development Bahir Dar, Ethiopia. 53 p

Berhan, A., Van Arendonk, J., 2006. Reproductive performance and mortality rate in Menz and Horro sheep following controlled breeding in Ethiopia. Small Rumin. Res., 63, 297–303.

Berhanu, B., Aynalem, H., 2009. Reproductive performance of traditionally managed sheep in the south western part of Ethiopia. Livest. Res. Rural Develop., 21(9).

Berhanu, B., Aynalem, H., 2011. Survivability of lambs under village management condition: The case around Jimma, Ethiopia. Livest. Res. Rural Develop., 23 (4).

Chipman, J., 2003. Observations on the potential of Dangila sheep for mproved food security around Quarit and Adet, West Gojjam, northwestern Ethiopia. A Field Study Hosted by International Livestock Research Institute (ILRI), Addis Ababa, Ethiopia.

Chukwuka, O.K., Okoli, I.C., Okeudo, N.J., Opara, M.N., Herbert, U., Ogbuewu, I.P., Ekenyem, B.U., 2010. Reproductive potential of West Africa Dwarf Sheep and Goat: A Review. Res. J. Vet. Sci., 3(2), 86-100.

Demeke, S., Thwaites, S.C.J., Lemma, S., 1995. Effects of ewe genotype and supplementary feeding on lambing performance of Ethiopian highland sheep. Small Rumin. Res., 15, 149-153.

Fikrte, F., 2008. On-farm characterization of Blackhead Somali sheep breed and its production system in Shinile and Erer districts of Shinile zone. M.Sc Thesis, Hramaya University of Agriculture, Dire Dawa, Ethiopia.

Gbangboche, A.B., Adamou-Ndiaye, A.K.I., Youssao, M., Farnir, F., Detilleux, J., Abiola F.A., Leroy, P.L., 2006. Non-genetic factors affecting the reproduction performance, lamb growth and productivity indices of Djallonke sheep. Small Rumin. Res., 64, 133–142.

Gemeda, D., Schoeman, S.J., Cloete, S.W.P., Jordaan, G.F., 2002. The influence of non-genetic factors on early growth traits in the Tygerhoek Merino lambs. Eth. J. Anim. Prod., 2 (1)127-141.

Gizaw, S., Komen, H., Hanotte, O., van Arendonk J.A.M., 2008. Indigenous sheep resources of Ethiopia: types, production systems and farmers assessments. Anim. Genet. Resour. Inf. 43, 25-40.

Kahsa, T.G., 2009. Estimates of economic values for important traits of two indigenous sheep breeds of Ethiopia. MSc. Thesis, BOKU – University of Natural Resources and Applied Life Sciences,Vienna, Austria.

Kassahun, A., 2000. Comparative performance evaluation of Horro and Menz Sheep of Ethiopia under grazing and intensive feeding condition. PhD Dissertation Humboldt-University.

Markos, T., 2006. Productivity and health of indigenous sheep breeds and crossbreds in the central Ethiopian highlands. PhD dissertation. Department of Animal Breeding and Genetics, Faculty of Veterinary Medicine and Animal Sciences, Swedish University of Agricultural Science (SLU), Uppsala, Sweden.74p.

Mellado, M.R., Valdez, J.E., Garcia, R., Lopez, A., Rodriguez, 2006. Factors affecting the reproductive performance of goats under intensive conditions in a hot arid environment. Small Rumin. Res, 63, 110–118.

Mengistie, T., Girma, A., Sisay, L., Solomon, G., Abebe, M., Markos, T., 2011. Reproductive Performances and Survival of Washera Sheep under Traditional Managment systems at Yilmanadensa and Quarit Districts of the Amhara National Regional State, Ethiopia. J. Anim. Sci. Vet. Adv., 10 (9), 1158-1165.

Mengistie, T., Girma, A., Solomon, G., Sisay, L., Abebe, M., Markos, T., 2009. Growth performances of Washera sheep under smallholder management systems in Yilmanadensa and Quarit districts, Ethiopia. Trop. Anim. Health Prod., DOI 10.1007/s11250-009-9473-x.

Mirkena, T., Duguma, G., Haile, A., Tibbo, M., Okeyo, A.M., Wurzinger, M., Sölkner J., 2010. Genetics of Adaptation in Domestic Farm Animals: A Review. Livest. Sci., 132, 1-12.

Mukasa-Mugerwa, E., Lahlou-Kassi, A., Anindo, D., Rege, J.E.O., Tembely, S., Markos Tibbo, Baker, R.L., 2000. Between and within breed variation in lamb survival and the risk factors associated with major causes of mortality in indigenous Horro and Menz sheep in Ethiopia. Small Rumin. Res., 37, 1-12.

Mukasa-Mugerwa, E., Anindo, D., Sovani, S., Lahlou-Kassi, A., Tembely, S., Rege J.E.O., Baker, R.L., 2002. Reproductive performance and productivity of Menz and Horro sheep lambing in the wet and dry seasons in the highlands of Ethiopia. Small Rumin. Res., 45, 26-271.

Nguti, R., Janssen, P., Rowlands, G.J., Audho, J.O., Baker, R.L., 2003. Survival of Red Maasai, Dorper and crossbred lambs in the sub humid Tropics. Anim. Sci., 76, 3-17.

Purusothaman, M.R., Thiruvenkadan, A.K., Karunanithi, K., 2008. Seasonal variation in body weight and mortality rate in Mecheri adult sheep. Livest. Res. Rural Develop., 20 (9).

Riggio, V., Finocchiaro, R., Bishop, S.C., 2008. Genetic parameters for early lamb survival and growth in Scottish Blackface sheep. J. Anim. Sci., 86, 1758-1764.

Roberts, J.A., 2000. Frequency of the prolificacy gene in flocks of Indonesian thin tail sheep: a review. Small Rumin. Res., 36, 215-226.

Shigdaf, M., Zeleke, M., Mengistie, T., Asresu, Y., Habtemariam, A., Aynalem, H., 2012. Traditional management system and farmers' perception on local sheep breeds (Washera and Farta) and their crosses in Amhara Region, Ethiopia. Livest. Res. Rural Develop., 24 (01).

Shigdaf, M., 2011. Performance evaluation of Washera, Farta and their crossbred sheep in the Western highland of Amhara Region, Ethiopia. MSc. Thesis. Bahir Dar University, Ethiopia.

Solomon, A.K., Gemeda, D., 2000. Genetic and phenotypic parameters of growth, reproductive and survival performance of Horro sheep at Bako Agricultural Research Center. Research fellowship report. Intern. Livest. Res. Instit., (ILRI), Addis Ababa, Ethiopia.

Solomon, A.K., 2002. Genetic evaluation of production, reproduction and survival in a flock of Ethiopian Horro sheep. PhD. dissertation submitted to the Faculty of Natural and Agricultural Sciences Department of Animal, Wildlife and Grassland Sciences University of the Free State. Bloemfontein. 118p.

Solomon, A., Hegde, B.P., Mengistie, T., 2011. Growth and Physical Body Characteristics of Gumuz Sheep under Traditional Management Systems in Amhara Regional State, Ethiopia. Livest. Res. Rural Develop., 23 (5).

Solomon, G., Aynalem, H., Tadelle, D., 2010. Breeding objectives and breeding plans for subsistence and market-oriented Washera sheep production in Ethiopia. Eth. J. Anim. Prod.. 10(1), 1-18.

SAS, 2003. SAS (Statistical Analysis System) User's Guide: Statistics. Ver.9.1. Cary, NC:Inc.

Taye, M., Yitayew, A., Mekuriaw, S., Bitew, A., 2011. Adaptability and productivity of Washera rams and its crosses with Farta sheep in south Gonder zone of Amhara region, Ethiopia. Online J. Anim. Feed Res., 1(6), 400-406.

Yibrah, Y., 2008. Environmental and genetic parameters of growth, reproductive and survival performance of Afar and Blackhead Somali sheep at Werer Agricultural Research Center, Fellowship report submitted to International Livestock Research Institute (ILRI) and Ethiopian Institute of Agricultural Research (EIAR). Ethiopia.

Yohannes, G., Kassahun, A., Thwaites, C.J., 2005. Factors Influencing Survival and Growth of the Ethiopian Horro Sheep. Ethiop. J. Agric. Sci., 18, 41-51.