Survivability of lambs under village management condition: The case around Jimma, Ethiopia

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Abstract

The influence of non-genetic factors on lamb survivability at various ages up to 360 days was studied under village management condition in Jimma, Ethiopia. The overall least squares means of lamb survival rate was 89.0 at 0-60, 81.5 at 0-120 and 50.0 % up to 360 days. The survival rate of lambs up to weaning (120 days) was 81.5 %. Season of birth consistently exerted a significant effect ($p<0.05$)) on lamb survival. Lambs born during the post rain and dry periods showed a higher survival rate than lambs born during the wet season. Districts showed a significant effect ($p<0.05$)) on survival rates of lambs. Lambs born in land scarce areas (Dedo) had a low survival rate than lambs born in Seka (land available area). Type of birth did not exert an influence ($p>0.05$) on lamb survival. Sex had a significant effect ($p<0.05$) on survivability of lambs at later stages and the females showed higher survivability rate than males. Mortality tended to decrease with an increase with birth weight and decreased as parity increased. The birth weight showed a significant effect ($p<0.05$) on survival rate of lambs. The lambs with birth weight of 2 kg and above were showing higher survival rate. The lambs with 1.5 kg and lower birth weight showed high mortality rate. The study revealed that, adequate measures to be taken to curb mortality of lambs. The selection of heavier weight and larger litter at birth coupled with improved management could be a means to improve lamb productivity in the villages.

Key words: non-genetic factors, production system, sheep

Introduction

Jimma area is characterized by cash crop, cereal and livestock integrated farming systems. The area is predominantly rich in coffee and chat cash crops. The livestock plays a key role in income generation and food security. Sheep are the components of the livestock production system.

The sheep management situation in the region is characterized by a tethering practice during the wet season to control crop damage and as a mechanism of controlling animals. A preliminary survey in South Western part of Ethiopia showed that more than 70% of farmers practice tethering of sheep during cropping season (Berhanu 1998). A significant weight lose has been observed during this period due to tethering of sheep in a fixed peg for a long period. This was attributed to restricted selective grazing; poor feed intake and higher infestation by parasites (Romney et al 1996). During the dry season the main feed resources is an after math of cropland and the quality of feed available during the dry period is poor.

The flock size recorded in the region is the lowest as compared to high land cool areas of Ethiopia (Berhanu 1998). It is speculated that the smaller population size leads to inbreeding. The farmers also practice selling of sheep for slaughter, which have a better growth

performance and body condition score to secure better prices in the market. This may lead into negative selection of lambs. The unthrifty animals with poor body condition score remains in a flock, as breeding rams and this will in turn contribute to poor productivity sheep. As a result, the sheep in the traditional sector are alleged to be poor in productivity. Given this allegations, they are vital in farming community in income generation and food security. The extent of the productivity of sheep in terms of production indicators such as survivability is not recorded in the region in the traditional sector. The present study is an attempt to show the degree of variability of survivability of lambs at various ages and demonstrate the factors that exert effect on lamb survivability at various age intervals under village management condition.

The degree to which lambs survive to marketable age is one of the key indicators of the efficiency of sheep production. Low survival rate may be signs of very low standard of husbandry. Lamb survivability in the village condition is one of the main factors that adversely affecting lamb production and it will remains the major form of productive wastage resulting into sizable economic loses in sheep farming unless there is an intervention to curb the problems (Abassa 1995). In the traditional flocks an estimated 10 to 50% of lambs die annually before weaning (Mukasa Mugerewa et al 1994).

Higher survival rates are essential for replacement of stock and efficiency of selection. The causes of lamb mortality are directly associated to the production and the management system. Factors, which can affect lamb mortality, include genetic group, birth weight, type of birth, season and year of birth. They are aggravated by poor management practices such as lamb exposure to predators, naval infection as they are unattended during lambing, dehydration, as they are allowed to join the dam by traveling long distance without water, heat stress, and lack of veterinary services (Mukasa Mugerewa et al1994).

Knowledge on factors affecting survivability of lambs under village conditions can help in devising economically efficient and sound management scheme and breeding strategies. It is a prerequisite for good understanding of the production system of interest and to an adequately diagnose the constraints associated to the sheep production system. Therefore, the objective of this report is to show the survivability of lambs under village management condition and explore the factors that affect lamb survival at various ages for improvement.

Materials and methods

This study was a continuation of the previous study that recorded the sheep husbandry practices of the region and constraints associated to sheep production (Berhanu 1998). In the previous study individual small holder sheep flock size and structure was established. Following the initial survey, a monitoring study was conducted to document the performance of sheep under village management condition from 1995 to 1997

The study was conducted in Jimma zone of Oromia region, Ethiopia. The Jimma zone is located 335 km southwestern of Addis Ababa. Jimma is situated at 1710 m above sea level, $36^{o}37'$ E longitude and $7^{o}55'$ N altitude. The minimum temperature is 11.8 ^{o}C and the maximum temperature was 28 ^{o}C. The rainfall averages about 1500 mm per year. The season is divided into three and main rainy season covers (June, July, August, and September); Cool dry season

extends (October, November, December, January and February) and early rainy season covers (March, April, May). There was an extended period of rains for about eight months. The seasonal distribution of rainfall was 17.5 % in cool dry season (October to February), 56.3% in the rainy season (June to September) and 26.2 % in early rains (March, April and May). The average relative humidity was amounted to 68 %.

Two districts were selected namely Dedo and Seka from the Jimma Zone. The distinction between the Dedo and Seka district is mainly land holdings per house hold, where in Seka district the average land holding per house hold is 2.5 hectare and for Dedo district the land holding was 1.2 hectare. The Seka district is a livestock-coffee/Khat- cereal based farming system and Dedo is livestock- Khat/cereal based production system. The sheep found in Seka had more access to Khat left over and crop residues as feed sources on the top of communal grazing. Khat (Catha edulis) is a flowering shrub native to northeast Africa and the Arabian Peninsula. Framers chew khat leaves because of the stimulant effects and the left over from Khat is consumed by sheep.

Three Peasant Associations were identified for each district in consultation with the Ministry of Agriculture livestock experts and development agents. Peasant association is the smallest administrative institution in Ethiopia. These sites were selected on the basis that, they are potential areas for sheep production and are the main suppliers of sheep for Jimma town. In each peasant association the farmers who have sheep in their yard and volunteered to cooperate in the research undertaking were listed from the peasant association list book and 30-50 farmers holding sheep were randomly selected and participated in the monitoring study. A total of 150 small holder farmers and 1000 sheep of different age groups were involved in the monitoring study. The sheep were ear tagged using plastic ear tag and the monitoring work lasted for three years (1995-1997). The experimental units in the present study were the sheep which were identified using ear tags and registered under monitoring study. Farmers were involved to recall the date of lamb died, survived and sold in their flock. A field technician who was staying in the villages was trained to record the data by rotating house to house every day to take record on deaths that are happening in the flock. The farmers were providing information on lamb mortality when it is occurred. They were also forwarding the reasons of death of lambs from their close observation. No post mortem investigation was made in this study, to ascertain the causes of lamb mortality. Concurrently to lamb survival the production indicators such us off take, weight, body measurement, dentition status data were collected and put in an appropriate format.

The management system followed was characterized us village management condition. The management of sheep was in such a way that during the wet and cropping season they were tethered for 6- 8 hours in a day (Berhanu 1998). During the dry season they were freely grazing communal grazing area and crop after math. Animals were provided shelter during the night. The house was not separated from the main family house. The sheep are enclosed in the evening time without feed and watering. Children and women are mainly involved in feeding, sheltering and watering of sheep

The data collected by the data collectors were checked and screened for completeness and correctness. The data were coded and stored in Dbase IV program for data input. The data was

coded for various age intervals and it was given zero when the animal has died at specific age interval and one if it has survived for that age interval.

The traits under investigation were survival of lambs at the interval of (0- 60, 0-120 and 0-360 days). Least squares procedure was used to analyze the survival rates at different age intervals (SAS 2000). The factors assessed were; District (Dedo, Seka); season of birth (main rainy season; June - September; post rain; October - February; and dry season; March - May); year of birth (1995, 1996, 1997); parity (1- ≥6); Type of birth (single, twin); and birth weight of the lamb (≤1.5, 1.5-2.0, 2.0- 2.5, ≥3.0) and Sex (male, female). The statistical model was explained as follows.

$Y_{ijklmnop} = \mu + D_i + S_j + R_k + P_l + L_m + B_n + X_o + e_{ijklmnop,}$ where *Yijklmnop is survival rate at different age intervals,* μ= overall mean; D*i* is the fixed effect of the *i*th District (Dedo; Seka) ; S*j* is the fixed effect of *j*th season (*j* = post rain, dry season and wet season); R*k* is the fixed effect of *k*th Year of birth (*k* = 1995; 1996; 1997); P*l* is the fixed effect of *l*th Parity (*l* =1,2,3,4,5, ≥6); Lm is the fixed effect of m*th* type of birth (single, twin); and B*n* fixed effect of n*th* birth weight of the lamb (≤1.5, 1.5-2.0, 2.0- 2.5, ≥3.0) Xo is the fixed effect of o*th* sex (o = male, female); e*ijklmnop* is the random error attributed to the p^{th} lamb.

Results and discussion

The least squares means and standard errors for survival rates at various ages intervals are presented in Table 1 and 2.

Table 1. Least squares means for survival rates (%) at various age intervals for the effect of district, season and years

Effect	***0 – 60***	***0 – 120***	***0 – 360***
Overall means	89.03 (742)	81.5 (639)	50.0 (296)
R^2	6	12	21
CV	24	26	64
District	*	*	**
Dedo	86.0 (484)	79.1 (433)	49.2 (222)
Seka	90.3 (258)	87.5 (206)	60.0 (74)
Season	**	**	***
Post rain	93.7^{b} (221)	89.9^{b} (180)	74.7^{b} (85)
Dry	86.5^{ab} (165)	82.8^{ab} (135)	56.7^{ab} (79)
Wet	84.0^{a} (356)	77.7^{a} (324)	32.34^{a} (132)
Year	NS	NS	***
1995	90.7 (189)	84.9 (170)	70.7^{b} (98)
1996	88.1 (403)	63.6 (366)	46.5^{a} (168)
1997	85.4	82.0	46.6^{a}

	(150)	(103)	(30)

*Least squares means with different subscripts in the same column indicates significance and subscripts are significantly different at *, P<0.05, * *, P<0.01, * **, P<0.001, NS, not significant*
Figures in the parentheses indicates the number of observations

Table 2. Least squares means for survival rates (%) at various ages' intervals for the effect of parity, birth type, birth weight and sex.

	0 – 60	***0 – 120***	***0 – 360***
Parity	**	*	NS
1)	79.6 [a] (167)	74.4 [a] (152)	52.2 (79)
2)	89.4 [b] (129)	83.8 [ab] (115)	64.3 (59)
3)	82.5[b] (122)	86.4[b] (103)	52.2 (45)
4)	87.8 [b] (119)	81.2 [ab] (105)	47.6 (43)
5)	90.4[b] (86)	84.9.1 [b] (69)	51.6 (32)
≥ 6)	94.6 [b] (119)	89.9 [b] (95)	59.8 (38)
Birth Type	NS	NS	NS
Single	88.6 (390)	86.0 (335)	59.4 (155)
Twines	87.5 (352)	80.9 (304)	49.8 (144)
Birth weight	**	**	NS
< 1.5	76.0 [a] (44)	76.6 [a] (41)	50.9 (28)
1.5- 2.0	88.6 [ab] (86)	81.8 [ab] (209)	48.3 (99)
2.0-3.0	92.5[b] (286)	86.5 [b] (244)	57.1 (110)
> 3	95.2 [b] (174)	89 [b] (145)	62.1 (59)
Sex	*	NS	***
Male	86.7 (381)	82.6 (325)	45.4 (132)
Female	89.4 (361)	84.3 (314)	63.8 (164)

*Least squares means with different subscripts in the same column indicates significance and subscripts are significantly different at *, P<0.05, * *, P<0.01, * **, P<0.001, NS, not significant*
Figures in the parentheses indicates the number of observations

The analyses of variance for various factors affecting lamb survival under village management condition showed a coefficient of variation which was large and fall in the range of 24 % at 0-60 to 64 % at 0-360 days interval and the explanatory power of the model was small in the range of 6 % at interval of 0-60 to 21 % at interval of 0-360. The lower explanatory power of the model may be due to a number of factors not accounted in the model. The lower explanatory power of the model entails the need to include more variables that could influence the survival of lambs under village condition.

The over all least squares means of lamb survivability rate up to 120 days (which is close to weaning) was 81.5 %. The survival rate of lambs up to 360 days ages was 50.0 %. Half of the

lambs born in the villages are lost till the age of one year, which is the highest economic lose for small scale sheep farmers.

The overall least squares means of pre-weaning survivability rate up to 4 months of age of 81% was within the range of tropical sheep (Traore et al 1985, Upton 1985, Kassahun et al 1991, Wilson et al 1993, Solomon et al 1995 and Rostogi et al 2001). Causes of lamb mortality were not fully investigated using post mortem investigations. It was noted from some of the symptoms before deaths and recalled by sheep owners that, Pneumonia and liver fluke were the major cause of lamb mortality (Berhanu 1998). This calls for the need to under take post mortem examination of the lambs to ascertain the main risk factors in the villages for proper intervention. Earlier studies in Agro-pastoral zones by Maiga (1992), in the Sahelian zones indicated that primary lamb mortality were malnutrition, respiratory diseases and inadequate management practice and predators. These findings are also in agreement with Nidiya (1992) and this report indicated that 40% of mortality rate between birth and 12 months of age in traditionally managed lambs in the humid zones of Senegal. In sensitivity study by Upton (1985) showed that, mortality was identified as the most important factor by which sheep productivity in the traditional village flock in South Nigeria is determined. Lamb loses in South Nigeria was reported to be 48% up to one year of age, in central Nigeria 32% up to 180 days, Northern Nigeria 32% up to 180 days, Northern Nigeria 33% up to weaning, in Kenya and Mali 32% and 28% respectively up to 150 days (Wilson 1976, Sumber and Mack 1985 and Wilson et al 1985). The present study is different from the reports of Yohanes et al (1995) under station management condition, in which lamb mortality was 34.6% up to one year of age. Lamb mortality of 28.1% in the improved flock compared favorably with that of 48.1% in the traditional village flock (Armbruster et al 991). It seems reasonable to argue that the survivability rate under station management condition is better than on-farm management condition. The reports on lamb survival indicated that a tremendous economic loss is recorded in lambs in the station and traditional sector, which will bring economic loses and interfere with the genetic improvement programs of the sector. The high mortality of lambs elucidates the need to identify and monitor the factors and bring interventions to narrow down lamb mortality in the villages.

Effect of district/location

Location (district) had significant effect ($p<0.05$) for lamb survivability. The lambs born in land scarce area (Dedo) were showing high lamb mortality than lambs born Seka district where land holding is better. Low survival rate of lambs in Dedo district might be attributed to low feed supply for both lactating ewes and lambs. The variation in survival rate of lambs might be also attributed to the genetic differences that existed among indigenous sheep kept in different locations.

Effect of season and year

The effect of season of birth had a consistent on survivability rate of lambs. The lambs born during the wet season (June-September) have the lowest survival rate than lambs born at post rains (October to February) and dry season (March to May). The effect of season on survivability of lambs was consistent in both post-weaning and pre-weaning periods. The majority of mortality of lambs occurred in the wet season, which coincides with peak helminthes infestation,

incidence of pneumonia and lower haemocratic level (Fall et al 1983 and Abassa, 1995). This result is also confirmatory to previous studies (Fall et al 1983, Adu et al 1985, Mukasa-Mugerewa et al 1994 and Solomon et al 1995). The highest mortality of lambs during the wet season elucidates the fact that, the rain can aggravate the occurrence of pneumonia. In this regard Fall et al (1983) estimated a 1.3% increase of lamb mortality for each additional 100 mm rain fall for a period from three days of age up to weaning. It is during the wet seasons that disease challenges from infective agents is highest and that deaths attributed to parasitic gastro enteritis, mainly haemonchosis is occurring. The high occurrence of death during the wet season calls an attention in the provision of better housing and feeding packages to lambs to reduce lamb mortality. The present study did not concur with other studies and it was reported that, lambs born in the rainy season exhibit lower mortality than those born during the dry season (Armbruster et al 1991). Lower mortality rate of lambs during the rainy season may be explained by better-feed supply supported with a better shelter while better survival rate during the dry season may be due to reduced disease pressure and cold stresses.

Year had exerted a significant effect ($p<0.05$) at later age intervals of 0-360 days. The loses recorded in lambs varied among years and the higher number of survivors were recorded year 1(1995). The variation in survivability of lambs is among years might be attributed to inconsistency of management and irregularity of rain fall and vegetation for grazing lambs and lactating ewes.

Effect of parity

Parity of the dam was one of the factor, which brought an effect on survivability of lambs at early age up to 120 days. The effect of parity diminished when lambs age advances. The effect of parity on lamb survival did not bring an effect ($p>0.05$) beyond four months. This finding is in accordance with the reports of Mukassa - Mugerewa et al (1994). On the other hand Solomon et al (1995) did not show a significant effect of parity on lamb survival. The present study has also revealed that, the increase in the parity up to the six parity improves the mothering ability of the dam in the provision of milk to young lambs. The ewes that are at early age/parity are not at mature stage and they require nutrients for growth of the ewe and lactation requirement. The mammary development is also not at full stage, this will in turn lead poor mothering ability and again poor survivability of the lambs. Mukasa-Mugerewa et al (1994) reported that, the survival rates of lambs were higher in the fifth and sixth parity with a trend towards increased in survival from first to six parity and the general trend for increasing of survival rate with increased parity may be due to improvement in weight of the dam and subsequently to a large quantity of milk produced with increased parity in ewes. While milk production and mothering ability of the ewe improves with parity of the ewe there is a peak age beyond which the dam loses conditions and the ability to rear the lambs (Mukasa-Mugerewa et al 1994).

Effect of type of birth

Type of birth did not exert effect in any of the age intervals. This is in agreement to the study of Yapi et al (1992) who did not find the effect of types of birth on lamb survivability. However, there was a tendency that, the singles showed higher survival rate than twines. This might be mainly attributed to higher birth weight of single lambs and less competition for milk from their

dams as compared to twines. The present study was not in agreement to earlier finding (Valls 1983, Recardea et al 1990 and Solomon et al 1995) who have reported a significant effect of type of birth on lamb survival in favor of single births.

Effect of birth weight

The average weight of the lambs was 2.43 kg. The birth weight of lambs showed a significant effect ($p<0.05$) on lamb survivability rate up to 0-120 days interval. The lambs weighing l.5 kg and less in birth weight were lowest in survivability and lambs with birth weight of 2 kg or more showed higher survivability. This finding confirms the previous studies of lamb survivability on farm and station management conditions (Hinch et al 1985, Mukassa-Mugerewa et al 1994, Yohanes et al 1995 and Mukassa Mugerewa et al 2000). Mukassa -Mugerewa et al (1994) found that, Ethiopian Menz sheep which weight < 2.0 kg at birth are more likely to die due to starvation, Mis Mothering and Exposure (the SEM syndrome) and the rate of survival increased from 37 % (1 kg birth weight) to 69% (1 to 2 birth weight) and 98% (2-3 kg birth weight) and beyond 3 kg of birth weight, no losses were experienced. The report by Rostagi (2001) showed that, lambs born with equal or below average birth weight for the flock had higher mortality (27.8%) than those with birth weight above the average (8.8%). Birth weight is influenced by ewe prenatal nutrition, litter size, placental size and foetal genotype (Haughey 1991). Factors that contribute to low in birth weight tend to reduce foetal lipid reserve, limit neonatal vigour and restrict ewe milk production (Mellor and Murray 1985 and Rostogi 2001). Lambs born light are more susceptible to SEM complex (Devis et al 1981). These studies indicated that supplementing ewes with extra feed during the second and third trimesters produces heavier lambs with higher chance of survival (Mukassa-Mugerewa et al 1994). There are steps that need to be taken to reduce loses in low weight lamb. Cross fostering or graft light weak orphan or abandoned lambs shortly after parturition might be an option. The rotation of twines during nursing can ensure that each lamb gets enough milk. Increase care of twines might lead to recognizable increase in lamb survival and flock productivity. The farmers in the study did not practice restricting ewes and lambs in homestead for the first few days. This will lead chilly, windy, wet and harsh temperature that needs to be corrected. Lambs ewes that are undernourished often give birth to low weight young that are likely to die of starvation.

Effect of sex

Sex had significant effect ($p<0.05$) on lamb survival at all age intervals except (0-120 days) in favor of females. The higher survival rate of females might be attributed to preferential treatment of females in terms of feed supplementation to ensure the replacement of the flock.

Conclusions

- It was noted that lamb mortality is one of the reproductive wastage that hampers sheep production in the region. The study demonstrated that non-genetic factors exerted a significant influence on lamb survivability and season of birth consistently brought an effect on survivability of lambs. The lambs born during the wet season are victims of lamb mortality.
- The improvement in birth weight could improve the survivability of lambs

Recommendations

- Improvement in survival rate of lambs associated with improvement in birth weight shows the need for ewe supplementations with extra feed during the second and third trimesters to produce heavier lambs with higher chance of survival.
- The lower survival rate of lambs in the studied area calls for improving the management packages in feeding of lambs and house care of lambs to control cold weather and stress of lambs in order to improve the productivity of lambs in villages. It is suggested that on farm improvement on management, housing and nutritional aspect could considerably contribute to reduction of mortality of lambs and increase productivity.
- These measures apart from disease control could considerably increase biological and economic returns from village-managed sheep.
- Close monitoring and laboratory investigation of causes of lamb mortality is suggested for further improvement of lamb survival.

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