

# Major causes of lamb mortality at Ebinat woreda, Amhara National Regional State, North-western Ethiopia

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## Abstract

A year-round (from September 2008 to August 2009) study was conducted to investigate causes of lamb mortality at Ebinat woreda, Amhara National Regional State, northwestern Ethiopia. Two hundred and forty one lambs under the age of six months were exploited for analysis of this study. Out of the 241 lambs observed, 96 were found dead giving the overall mortality of 40.0% (96/241). Most of the mortalities were due to diarrhea 49 (51.0%), pneumonia 37 (38.5%) and others 10 (10.4%). Result of this study showed that there was a significant variation ( $\chi^2 = 3.847$ ;  $df = 1$ ;  $P = 0.050$ ) in mortality between the two sexes. Season as a variable had a significant ( $\chi^2 = 9.963$ ;  $df = 1$ ;  $P = 0.002$ ) influence on lamb mortality. Our study indicated that there was a strong association ( $\chi^2 = 40.432$ ;  $df = 3$ ;  $P = 0.000$ ) between body condition scoring and mortality of lambs. There was significant variation ( $t = 27.61$ ;  $df = 75$ ;  $P = 0.00$ ) in birth weight between single-born lambs and multiples. Sex and dam parity, as factors, had shown no specialized features against specific variation seen on birth type basis. Result of faecal egg counts indicated that highest values were recorded in wet season especially in July and August during the higher rainfall. Result of t-test of mean PCV significantly varies ( $t = -1.13$ ;  $df = 165$ ;  $CI = -3.00 - 0.80$ ) between the two seasons showed that higher value was recorded in dry season ( $29.33 \pm 5.12$ ) than in wet season ( $28.23 \pm 5.88$ ). This study has found that mortality in lambs born alive is likely to be above 40 per cent and may represent high loss of deaths in sheep husbandry practices of the area. Mortality from diarrhea and pneumonia could be minimized by timing of mating to ensure that lambing occurs in the dry/hot season (January/February) so that lambs are weaned at the beginning of the rainy season (June/July). Mortality of lambs can also be reduced by improving flock health, nutritional management, and housing.

**Key words:** diarrhoea, diseases, lamb, mortality, pneumonia, season.

## **Introduction**

In smallholder production systems, goats and sheep are important because they require low initial capital and maintenance costs, are able to use marginal land and crop residues, produce milk and meat in readily usable quantities, and are easily cared for by most family members. Small ruminants are prolific and need only short periods to increase flock sizes after catastrophies or in periods of high prices and thus off take rate can respond to price increases (Winrock International, 1983). Ethiopia is second in Africa and sixth in the world in terms of sheep population. The sheep enterprise in the Ethiopian highland crop and livestock system is the most important form of investment and source of cash income and provides social security in bad crop years (Getachew Asamenew et al, 1988). The country has, however, benefited little from this enormous resource owing to a multitude of problems, disease being the most important. Lamb mortality accounts for serious losses in sheep production and is thus a major factor reducing profitability of sheep farming (Markos Tibbo, 2006).

Studies in Ethiopia indicate a perinatal lamb mortality of 18% (Njau et al, 1988). Early sheep losses have been attributed to infertility and embryonic mortality and to neonatal mortality including starvation/exposure to cold stress, abortion/stillbirth, infectious diseases, accidental death or loss, predators and congenital defects (Eales et al, 1983). Wilson et al. (1985) gave a mortality rate of 12.6% of all lambs born, with 48% of the deaths occurring due to liver fluke, pneumonia, diarrhea and the starvation-mismothering exposure (SME) complex, while the causes of 42% of the deaths were undetermined.

The Amhara National Regional State has a ruminant population of 5.3 million sheep and 4.8 million goats (CSA, 2008) kept by resource poor farmers as a sole or supplementary source of cash income. Due to traditional type of rearing and marketing inefficiencies, the small-scale stock producers are not optimally benefiting from this source of income. Despite the production potential for small stock to provide food security for sheep and goat producers this opportunity has not been fully utilized. Lamb mortality is one of the most obvious constraints to profitability of sheep producers in the Amhara Regional State sheep flocks.

Organized works on mortality of lambs especially under extensive system of management in Amhara Regional State have not been well documented.

Even if reports indicated that there is high mortality in lambs and kids in some woredas (Sekota, Farta and Sekela) of the Region, results are underestimating because births and deaths which occur when animals are bush grazing and result in the death of the offspring usually are not recorded and go unnoticed. In addition, further losses due to abortions and stillbirths are also underestimated. This study was aimed to identify the major causes of lamb mortality and investigate host risk factors to lamb mortality in Ebinat woreda of western Amhara Region.

## **Materials and Methods**

### **Study area**

The study was conducted at Ebinat Woreda, South Gondar Zone of Amhara Region from September 2008 to August 2009. Ebinat is located N012.47113 and E0 037.37241 and 110km northeast of Bahir Dar, at an altitude of 2000 meter above sea level. The mean annual rainfall and temperature of the woreda ranges from 500 to 1200mm and from 22- to 30°C, respectively. The production system is mainly mixed farming. Unlike the central highlands of the country where bimodal rains exist, the study area has only one rainy season which starts from June and ends in September.

### **Study animals**

The study animals include local breeds of sheep under extensive grazing system. The main local breed of sheep known as the “Farta” breed is concentrated in the study Woreda. Some indigenous breeds locally known as “Washera” breed/type are also kept by individual farmers.

Sampling units (lambs) were identified individually and monitored throughout the study period. The variable of interest considered as an output variable versus risk factors was lambs health status. The explanatory variables considered were sex, season, birth type, birth weight, dam parity, parasitological status, clinical signs and death.

### **Study methodology**

A combination of multistage and purposive sampling methods was used to select the study areas (Putt et al. 1988). In first stage target administrative zone was chosen on the basis of its livestock potential. In the second stage one

Woreda was selected from the administrative zone, the main criterion being the proximity to a Regional Veterinary Laboratory. In the third stage a list of peasant associations (PAs) within Woreda was made from documents obtained from the Woreda's Agricultural Office and selected two PAs based on accessibility. In the fourth stage villages were selected in collaboration with the respective Woreda's development agents. The selection was done purposively on the basis of previous information on the problem, farmers' cooperation, logistic, share of communal grazing land and accessibility. Then a list of households who had sheep as a sampling frame was taken from office of Kebele Administrative Council and by using simple random sampling technique 36 households were selected from each PA to participate in the study.

By considering individual flock as cluster, the sample size for lambs to be included in the study was determined by adjusting the sample size calculated for simple random sampling. The sample size for random sampling was determined according to Martin et al. (1987) by taking expected prevalence of lamb mortality 25.4% (Bahir Dar Veterinary Laboratory, 2004, unpublished) at 5% required absolute precision and 95% confidence level.

The study was a longitudinal prospective type of study conducted on 241 local breeds of lambs kept under traditional management system. Initially the total number of experimental animals were 306. However, during the trial some lambs were moved to other villages or were sold and some were too difficult to handle. Data from these animals were therefore discarded and only data from 241 animals were analysed.

The study involved monitoring of lamb mortality in selected flocks for one year. For the purpose of the study, lambs were defined as young sheep less than six months of age, and mortality as death of lamb above 12 hours of age. During monitoring all lambs in selected flock, that were under three months of age at the beginning of the follow up period and those born in subsequent nine months were individually identified and monitored. Lambs were dropped from the study when they became above six months of age. Monitoring was carried out through regular and emergency visits.

The observation was done by investigators and potential enumerators who were employed temporarily in close consultation with members of Kebele Administrative Council, development agents as well as representatives of the Woreda Agricultural Office. Recruitment criteria included: formal education

to at least grade 10 level, being a permanent residence in the PA; having a good relation with the farmers, and not already in paid employment. Lambs were visited by investigators on monthly basis. Emergency visits were also made by the investigators in addition to regular visits when there was need of evaluation of lamb health status in response to request from flock owners. Enumerators made the visit every day and record study animals health status with prepared recording format.

## **Clinical parameters**

### **Microscopy**

Faecal samples were collected at the beginning of the study and continued after every 4 weeks. Collection was made directly from the rectum of each animal in the early morning. Standard Sedimentation Technique and Flootation Technique were applied to identify eggs of helminth parasites. Moreover, McMaster counting technique was used to determine the number of eggs present per gram of faeces (e.p.g). In addition to this, faecal cultures were prepared for differentiation of stongyle group of parasites using a method recommended by Hansen and Perry (1994).

### **Estimation of Packed Cell Volume (PCV)**

Blood from a punctured ear vein was drawn into a heparinized, microhaematocrit capillary tube; the tube was sealed and centrifuged for five minutes at 12000 revolutions per minute. PCV was measured with a microhaematocrit reader (Murray et al., 1983) monthly.

### **Birth weight determination**

Birth weight for experimental groups of lambs was recorded using a spring scale. Each lamb was put on a sack attached to the hook of the scale and then weighed.

### **Body condition score (BCS)**

Condition scoring of individual animal was recorded using ESGPIP technical bulletin No. 8 (2007); thus, scoring was made on feeling the level of muscling and fat deposition over and around the vertebrae in the loin region. Changes in body condition were recorded at four weeks interval.

### Miscellaneous records

Whenever an outbreak of animal disease, especially of small ruminants' had occurred records were made. Simultaneously, clinical cases were treated and further advices were given to the community on how to handle the crisis.

### Data management

Microsoft Excel was used for data management. Statistical software such as SPSS (version 12.0, 2002) for windows was used for data analysis. Data pertaining to mortality were analysed by chi-square (2) test. Birth weight and PCV value data were analysed by using t-test. Difference between dam groups for lamb birth weight was tested over time using analysis of variance (ANOVA). Statistical significance was set at  $p < 0.05$ .

## Results

### Causes of mortality

Out of the 241 lambs observed, 96 were found dead giving the crude mortality of 40.0%. Most of the mortalities were due to infectious conditions like diarrhea (49/96, 51.0%) then followed by pneumonia (37/96, 38.5%) and others (10/96, 10.4%) (Table 1). The Chi-square test result indicated that there was no significant difference ( $\chi^2 = 0.024$ ;  $df = 1$ ;  $p = 0.895$ ) in mortality of lambs between the two PAs.

**Table 1. Main causes of lamb mortality by clinical symptoms, at Ebinat woreda, Amhara National Regional State, Ethiopia.**

Woreda	PA	No. lambs observed	Total no. lambs died	No. of deaths			Mortality (%)
				Diarrhea	Pneumonia	Others	
Ebinat	Jiman	132	52 <sup>a</sup>	23	25	4	39.4 <sup>a</sup>
	Zeha	109	44 <sup>a</sup>	26	12	6	40.3 <sup>a</sup>
	Total	241	96	49	37	10	40.0

Values with a common superscript within the same column are not significantly different ( $P > 0.05$ )

## Risk factors for major causes of mortality

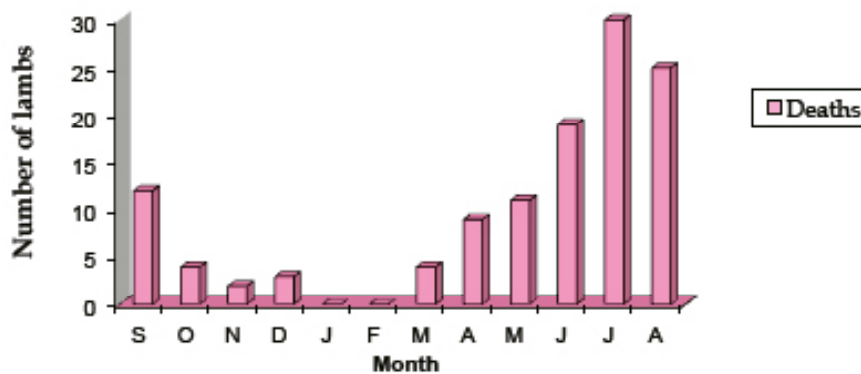
Result of this study showed that sex was one of the risk factors for mortality of lambs. There was a significant difference ( $\chi^2 = 3.847$ ;  $df = 1$ ;  $P = 0.050$ ) in mortality between the two sexes (Table 2).

**Table 2. Mortality of lambs on sex basis at Ebinat woreda, Amhara National Regional State, Ethiopia.**

Sex	Total number of lambs observed	Total number of lambs died	Mortality (%)
Male	109	36	33.0a
Female	132	60	45.5b
Total	241	96	40.0

ab= Values within a column (for each variable) with different superscripts differ significantly ( $p < 0.05$ ).

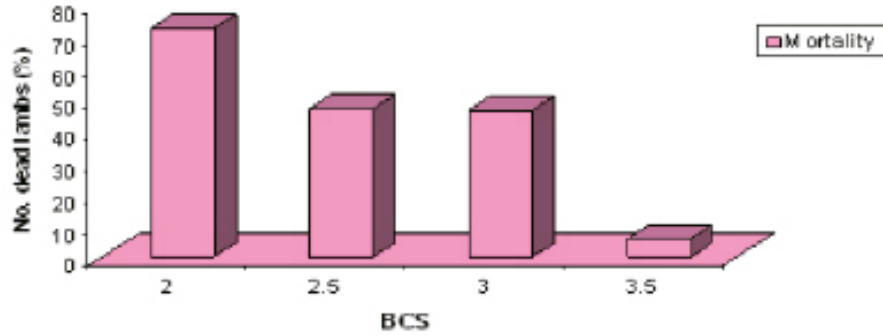
Season as a variable had a significant ( $\chi^2 = 9.963$ ;  $df = 1$ ;  $p = 0.002$ ) influence on lamb mortality. It was observed that low relative values in mortality of lambs were recorded in most dry months (Oct-March), while during wet months (June-September) mortality was higher (Fig.1).



**Figure 1. Mortality of lambs in each month of the year at Ebinat woreda, Amhara National Regional State, Ethiopia.**

The study indicated that there was strong association ( $\chi^2 = 40.432$ ;  $df = 3$ ;  $P = 0.000$ ) between body condition scoring and mortality of lambs. As the body condition of the lambs deteriorates there is high risk of dying from disease conditions. The number of mortality was considerable in animals with poor body

condition (Condition Score 2) as compare to animals with heavy to fat body condition (Condition Score 3+) as indicated in Figure 2.



**Figure 2. Effect of body condition scoring on mortality of lambs at Ebinat woreda, Amhara National Regional State, Ethiopia.**

Analysis results revealed that there was significant difference ( $t = 27.61$ ;  $df = 75$ ;  $P = 0.00$ ) in birth weight between single-born lambs and multiples (Table 3). Sex and dam parity, as factors, had shown no specialize features against specific variation seen on birth type basis (Table 3).

**Table 3- Effect of season, type of birth, sex and dam parity on weight at birth of lambs at Ebinat woreda, Amhara National Regional State, Ethiopia.**

Variable	Birth weight			
	n	Mean	95%CI	
Season	Wet	26	3.44a	3.29 - 3.42
	Dry	50	3.32b	
Birth type	Single	44	3.35a	2.48 - 2.86
	Twins	32	1.73b	
Sex	Female	34	3.41a	-.044 - 0.22
	Male	42	3.32a	
Dam parity	One	16	3.37a	3.23 - 3.51
	Two	29	3.34a	3.22 - 3.46
	Three	28	3.36a	3.24 - 3.47
	Four	3	3.46a	2.89 - 4.04

ab= Means within a column (for each variable) with different superscripts differ significantly ( $P < 0.05$ ).



### Measuring packed cell volume (PCV)

The degree of anaemia was estimated by measuring PCV value and the result indicated that 41.7% (70/167) of the experimental animals showed lower value i.e.  $\leq 27\%$  (Table 4). In addition to this, result of t-test of mean of PCV significantly varies ( $t = -1.13$ ;  $df = 165$ ;  $CI = -3.00 - 0.80$ ) between the two seasons showed that higher value was recorded in dry season ( $29.33 \pm 5.12$ ) than in wet season (July-Sep) ( $26.23 \pm 5.88$ ).

**Table 4- Frequency of PCV value in experimental animals at Ebinat woreda, Amhara National Regional State, Ethiopia.**

No.	PCV	Frequency	Percent
1.	<27	70	41.7
2.	28-33	64	38.1
3.	34-39	29	17.2
4.	40+	5	3.0

### Discussion

Various clinical signs showed by the lambs suffering from diarrhea included profuse watery diarrhea with often loose but scanty faeces which were occasionally mixed with blood. These animals showed anorexia, weakness, dullness and depression with subnormal temperatures. The other group of lambs that died of pneumonia showed signs of coughing, sneezing, mucus to mucopurulent nasal discharge, sunken eyes, and elevated body temperature.

Diarrhea and pneumonia are most commonly associated with an endemic condition in the area. The causative agents of those diseases could be diverse which could include; Pastuerella, Salmonella, E. coli, Coccidia, Cryptosporidium, clostridial diseases (Clostridium perfringes) Helminths and Rotavirus. Neonatal diarrhea in lambs is considered an important cause of lamb mortality Smith *et al.*, (1975). In this study diarrhea was the main sign accompanying the death in about 51% of lambs' mortalities. The result of the study showed that major causes for diarrhea was salmonellosis and helminthosis which were confirmed on the basis of necropsy (eight lambs) and faecal culture. Similarly, the postmortem examination result of five lambs revealed that there were large numbers of lung worms in the lower respiratory tract and massive haemorrhages in the lungs. The damage of lung tissues may be associated with the

invasion of bacteria normally found in this organ. Thus the combined action of the parasite and bacterium causes the death of the two lambs.

Our study demonstrated that pneumonia is the second important disease which was responsible for the cause of lamb mortality. This result is in agreement with the findings of Mugerwa *et al.* (2000) who reported that respiratory infections represented 54% of causes for neonatal lamb mortality and that of Njau (1988) and Gama *et al.*, (1991). Moreover, a study carried out by Markos Tibbo (2006) indicated that a respiratory disease is the single most important cause of mortality in sheep of central highlands of Ethiopia. In other studies by Tekliye Bekele *et al.*, (1992a), and Tekliye Bekele *et al.*, (1992b), the aetiologies involved were multi-factorial.

The Chi-square test result indicated that there was no significant difference ( $\chi^2 = 0.024$ ;  $df = 1$ ;  $p = 0.895$ ) in mortality of lambs between the two PAs. This might be due to the fact that production management and feeding system of the areas were similar in nature and that the animals in both PAs similar have equal chance of acquiring the disease condition in the area.

High number of deaths was noticed in female lambs rather than in male lambs. This may be due to the husbandry practices of the area where female lambs are kept longer time than males in a flock for the purpose of breeding. Since females are kept for a longer period of time they may have more chance to be exposed to risks that may render them susceptible to diseases. Furthermore, withdrawals of young male lambs (3-6 months of age) for marketing was practiced at early stage making follow up of death recording especially with disease conditions, was difficult.

Highest death occurred in July. High mortality of lambs during wet season could be due to cold stress and favorable conditions in term of humidity and temperature for the spread of communicative diseases such as Salmonellosis, Coccidiosis and respiratory diseases. Moreover cold weather encourages animals to be crowded and creates conducive environment for acquiring respiratory infection easily. Lambs born during the wet season had a higher mortality rate than those lambs born in dry season (Mazumdar *et al.*, 1980; Sarmah *et al.*, 1981; Chawla *et al.*, 1982; Wilson, 1988).

There was significant difference ( $t = 27.61$ ;  $df = 75$ ;  $P = 0.00$ ) in birth weight between single-born lambs and multiples (Table 3). Single-born lambs were born heavier and grew faster than multiples. This result concurs with previous

findings (e.g. Yapi-Gnaoré et al., 1997; Gbangboche *et al.*, 2006). This could be due to the inability of ewes to provide sufficient nourishment for the development of fetuses and extra milk for lambs (Rajab *et al.*, 1992) or competition for resources (reduced milk intake in smaller lambs, particularly litters with low birth weight in the cases of multiples) (Christley *et al.*, 2003). Singletons are the sole users of their dams' milk and their higher weight advantage they had at birth favours their growth in subsequent periods.

Sex and dam parity, as factors, had shown no specialize features against specific variation seen on birth type basis (Table 3). This may be associated with inappropriate receiving information about dam parity from sheep owners. We had chances to met farmers who had no much knowledge of what age were their ewes and dam parity. With regard to sex no effect had shown in birth weight even though male appears to grow faster than respective females in utero (Christley *et al.*, 2003).

Parasitic diseases are the major causes of loss in productivity of sheep at Ebinat woreda. The parasitological examination result indicated that most of the study animals were infected with strongyle groups of helminth parasites. Other internal parasites such as liver fluke (*Fasciola*), stomach fluke (*Paramphistoma*) and blood fluke (*Schistosoma*) were rarely detected during the study period. However, these nematodes and trematodes as causes of mortality had limited significance in the present study. Similar observations in Ethiopian highlands were also made by other authors (Njau *et al.*, 1988a; Tekliye Bekele *et al.*, 1992a, Tekliye Bekele *et al.*, 1992b). In the present study, monieziosis has been an important cestode infection in lambs at about 2 months of age, a finding that agrees with works of Markos Tibbo (2006).

The degree of anaemia was estimated by measuring PCV value and the result indicated that 41.7% (70/167) of the experimental animals showed lower value i.e.  $\leq 27\%$  (Table 4). In spite of the fact that the cause of anemia is multifactorial, anemia may be due to the effect of blood sucking nematodes such as strongyle parasites (*Bunostomum*) which are widespread in the study area. In addition to this, result of t-test of mean of PCV significantly varies ( $t = -1.13$ ;  $df = 165$ ;  $CI = -3.00 - 0.80$ ) between the two seasons showed that higher value was recorded in dry season ( $29.33 \pm 5.12$ ) than in wet season (July-Sep) ( $26.23 \pm 5.88$ ). This may be associated with low incidence of diseases during the dry season that animals appeared clinico-pathologically healthy.

Haemonchosis, in its acute form, is associated with severe anaemia. Allonby and Urquhart (1975) observed that in chronic haemonchosis in sheep, haematological values continue to be significantly depressed, although slightly above those seen in acute haemonchosis, and the animals appear clinically normal. Blood losses from *Bunostomum* and *Oesophagostomum* infections may add to the severity of the anaemia (Hansen & Perry, 1994).

## **Conclusions and Recommendations**

This study has indicated that mortality in lambs born alive is likely to be above 40 per cent and may represent high loss in sheep husbandry practices of the area. One of the major causes of lamb mortality at Ebinat woreda was diarrhea characterized by dehydration, feebleness and death. Diarrhea could be associated with inflammation of gastrointestinal (gastroenteritis) tracts as result of *Escherichia coli* (Scours), Salmonellosis, Coccidiosis and gastrointestinal parasites. Pneumonia has also been considered as a second killer of lambs after diarrhea in the study area. Again many organisms implicated for the cause of pneumonia among them *Pasteurella* spp., *Escherichia coli*, *Dictyocaulus viviparus* (lung worm) and sheep pox are the most important ones. Sex, season of the year, body condition and birth type were significant and as risk factors contribute to the occurrence of diseases above all, to the pervasiveness of diarrhea and pneumonia, which in turn contributed to the mortality of lambs.

Based on the results obtained the following recommendations are forwarded; all sick lambs should be isolated for at least three weeks, and those which die should be burned. Mothers of sick or dead lambs usually carry the infection on their teats and udders and should not be used for suckling other lambs. Sheep flocks have to be strategically drenched with anthelmintics to control lungworms. Damp and poorly ventilated quarters should be avoided since this has a tendency to favour the spread of respiratory disorders in sheep. Ewes should be separated into lambing groups which makes management easier (by raddle marking, by single or multiple births, ewe lambs in separate group). It is important to ensure that ewes have milk. It is also important weakly lambs and bad mothers are kept for longer than normal in pens; it is also essential to have plenty of lambing pens which are kept clean. Mortality from diarrhea and pneumonia could be minimised by timing of mating to ensure that lambing occurs in the dry/hot season (January/February) so that lambs are weaned at the beginning of the rainy season (June/July). Further detail investigations of lamb mortality including every component of reproductive losses, particu-

larly prenatal and neonatal mortality must be done at regional level with encompassing different agro-ecological zones. This enables the region to have a complete picture of the problem, develop and implement region wide lamb mortality strategy.

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