**Study on ovine hypocalcemia in ewes in central Ethiopia**

*M. WOLDEMESKEL*, **M. ENEYEW** and **T. KASSA**

SUMMARY

A study on ovine hypocalcemia was made on a total of 437 local ewes. The clinical signs, blood serum analysis and response to treatment with calcium borogluconate were used to diagnose the hypocalcemia. The disease was confirmed in 71 (16.3 %) of the examined 437 ewes. This is the first report on the disease in ewes from Ethiopia. The disease was observed in good to fatty body conditioned mature ewes house-fed on concentrate ration at late gestation (84.5 %) and with multiple births (80 %). The mean ± standard deviation (SD) of serum calcium in hypocalcemic ewes (0.92 ± 0.19 mmol/l) was significantly lower (P < 0.01) than that of the normal ewes (2.49 ± 0.28, and 2.28 ± 0.22 mmol/l in normal pregnant and non-pregnant ewes, respectively). There was no significant difference (P > 0.01) between the serum phosphorus and magnesium levels of the hypocalcemic and clinically normal pregnant and non pregnant ewes. However, there was a significant rise (P < 0.01) in serum glucose levels in sick (6.00 ± 1.14 mmol/l) than in clinically normal (3.21 ± 0.12 and 3.06 ± 0.22 mmol/l in pregnant and non pregnant ewes, respectively) ones. Factors that influenced the disease occurrence were discussed. The results of this study indicate that not only infectious but also metabolic diseases may be important under certain conditions in Africa and merit attention.

KEY-WORDS : hypocalcemia - study - ewes - central Ethiopia.

Introduction

Hypocalcemia, an acute metabolic disease of sheep, characterised by tetany, incoordination, paralysis and coma is caused by an inadequate supply of metabolisable calcium [9]. There are several reports about the occurrence and outbreaks of hypocalcemia in intensively housed ewes and those fed on quality concentrate ration [21, 22, 24].

The estimated 2.4 million Tropical Livestock Unit (TLU) for steep and 17 TLU for goats in Ethiopia places it second in Africa and sixth in the world [5]. They provide more than 30 % of all domestic meat consumption and generate income from exports of meat, mainly as live animals and skin [6].

In urban areas where farm size decreases with population pressure, sheep are assuming a greater importance than cattle in livestock production [8]. Furthermore, an increase in sheep...
production is needed both to meet the protein needs of explo-
ding human population particularly in urban areas and
increase export earnings. In line with this there is an increase
in smallholder sheep farms oriented towards increased pro-
duction.

Although hypocalcemia was known to occur sporadically
in ewes in Ethiopia, now it occurs in increasing frequency in
smallholder farms imparting a serious problem. However,
there is no study and published report on the extent of the
disease and factors that influence its occurrence. This study
reports the prevalence rate, describes the clinical features of
the disease and related management factors in ewes in central
Ethiopia.

Materials and methods

STUDY AREA

The study was conducted in Eastern Shoa, central Ethiopia,
a region located between 8°9’ and 9°45’ N and 38°45’ and
40°18’ E with an area of 12,754 sq. km.[19]. The altitude of
the region ranges between 700 m and 3100 m above sea level.
The respective average annual temperature and rainfall are
25°C and 700 mm in the lowland and 16°C and 1500 mm in
the highland. The study area is in the lowland which covers
about 48 % of the area and is totally part of the Rift Valley.
The livestock population in the region comprises of 809,465
cattle, 216,815 sheep, 370,528 goats, 125,137 equines and
18, 282 camels [4].

STUDY ANIMALS

A total of 437 local ewes were considered in this study.
These were brought from different areas in Eastern Shoa and
kept under smallholder farms in Nazareth. They were fed on
wheat bran, Teff (Eragrostis teff) and barley straw as basic
feed and supplemented with linseed (240 ewes) or Noug
(Guizotia abyssinica) seed cake (197 ewes) cakes (Tables I and II).
The study was conducted in Nazareth Veterinary Clinic and
smallholder sheep farms in and around Nazareth. The sheep
farms were regularly visited and a thorough clinical exami-
nation of suspected recumbent and comatose ewes was made.
Diagnosis was based on clinical examination, response to
treatment with calcium borogluconate and analysis of serum
samples.

SERUM ANALYSIS

Blood samples were collected in plane vacutainers from
33 ewes (11 clinically sick ewes showing clinical signs sug-
gestive of hypocalcemia, 11 normal pregnant and 11 normal
non-pregnant) by jugular venopuncture. Serum samples were
harvested and kept in a deep freezer (-20°C) until subsequent
analysis in the laboratory of Clinical Chemistry at the Pasteur
Institute (Ethiopian Health and Nutrition Institute) in Addis
Ababa. Determination of serum biochemical constituents
were made using automated Kem-O-Mat-2 phase 2 of the
Coulter (Electronics Company, France) as follows :

- Calcium was determined using O-Cresolphthalalin com-
plex method (Coulter Electronics Company, France).
- Magnesium was determined by using Colorimetric deter-
mination without depolarisation using calmagate (Bio-
merieux, France).
- Phosphorus was determined by using UV-Method with
direct phosphomolybdnate reaction without deproteinization
(Biomerieux, France).
- Glucose was determined by using Glucose-Oxidase-
 Peroxidase (GOD-POD) method (Biomerieux, France).

Statistical analysis of the results was made using ANOVA
and Student’s ‘t’-tests.

Feed samples (wheat bran, teff, and barley straw, Noug (G.
abyssinica) and linseed cakes were analysed in the
Department of Animal Nutrition of the Debre-Zeit Agricultural
Research Centre to determine its composition, particu-
larly the level of minerals (Table II).

<table>
<thead>
<tr>
<th>FEED TYPES</th>
<th>CALCIUM g/kg</th>
<th>MAGNESIUM g/kg</th>
<th>PHOSPHORUS g/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barley straw</td>
<td>4.6</td>
<td>1.4</td>
<td>1.9</td>
</tr>
<tr>
<td>Teff (Eragrostis teff)</td>
<td>4.3</td>
<td>1.5</td>
<td>1.6</td>
</tr>
<tr>
<td>Wheat straw</td>
<td>1.2</td>
<td>3.2</td>
<td>6.3</td>
</tr>
<tr>
<td>Noug (Guizotia abyssinica) seed cake</td>
<td>3.5</td>
<td>5.3</td>
<td>6.6</td>
</tr>
<tr>
<td>Linseed cake</td>
<td>6.5</td>
<td>4.6</td>
<td>9.0</td>
</tr>
</tbody>
</table>

Table I. — Mineral constituents of feed staff fed to the ewes under study (Department of Animal Nutrition, Debre-Zeit Agricultural Research Centre).
Results

The evidence recorded during the clinical examination, serum biochemical analysis and favourable response to calcium borogluconate therapy strongly suggest and confirm the disturbance to be hypocalcemia. From a total of 437 ewes attended, 71 (16.3 %) were hypocalcemic. Out of these, 14 (19.7 %), 52 (73.2 %), 4 (5.6 %), and 1 (1.4 %) were carrying single, twin, triple and quadruple lambs, respectively, showing the occurrence to be 80 % (57/71) in multiple births.

Furthermore, 4 (5.6 %), 56 (78.9 %) and 11 (15.5 %) of the hypocalcemic ewes were between 3 and 4 months of gestation, above 4 months of gestation and at early lactation (immediately after lambing), respectively.

The common clinical signs observed in 71 cases included depression (100 %), increased respiration (100 %), muscular tremor (87.3 %), muscular weakness (80.2 %), sternal recumbency and extended or twisted head (80.2 %) (Table III). Forty-five ewes had normal rectal temperatures (37.5°C - 42.2°C), while all (100 %) had increased respiration above normal range (16-55 per minute) [7].

The mean serum calcium of the clinically sick (0.92 ± 0.19 mmol/l) ewes was significantly (P < 0.01) lower than the values for clinically normal pregnant (2.49 ± 0.248 mmol/l) and non-pregnant ewes (2.28 ± 0.22 mmol/l). However, the mean serum magnesium (0.94 ± 0.18 mmol/l) and phosphorus (1.77 ± 0.34 mmol/l) were within the normal range. The mean ± standard deviation values of serum calcium, magnesium, phosphorus, and glucose of the clinically sick, clinically normal pregnant and non-pregnant ewes are given in Table IV.

Hyocalcemia was observed in ewes supplemented with Noug-seed cake and linseed cake at prevalence rate of 21 % (43/197) and 11.7 % (28/240) respectively. The feed composition of the feed staff fed to the ewes is given in tables I and II.

Out of the 71 hypocalcemic ewes 58 (81.7 %) showed rapid response to calcium borogluconate therapy with a recurrence and additional therapy in 11 (15.5 %) cases. The rest 13 failed to respond and died.

Discussion

This is the first report of hypocalcemia in ewes in Ethiopia. The study showed that severe depression, rapid breathing, muscular tremor, muscular weakness and difficulty to rise and sternal recumbency with the head extended forward or twisted side ways were the most important clinical signs observed. These may be important indicators for sheep bree-
ders and clinicians to strongly suspect hypocalcemia and take
the necessary measures. Similar clinical signs were reported
by several authors [2, 3, 7, 9, 10, 11, 12, 13, 16, 17, 21].

In this observation hypocalcemia was mainly observed in
good to fat body conditioned mature ewes house-fed on
concentrate ration at late gestation (84.5 %) and with mul-
tiple births (80.3 %). It was described not to be the problem
of gimmers (ewe carrying its first lamb) [11]. Previous works
indicated that most cases of hypocalcemia in ewes were
observed at late gestation especially in ewes fed on concen-
trate rations [13, 14, 21, 22] and pronounced in ewes with
twin lambs or multiple births [14, 15, 21]. Late pregnancy
and early lactation may lower the calcium level by 50 % to
60 % and be a factor in causing hypocalcemia [9]. It is pro-
bable that twining/multiple births, concentrate feeding and
fatty body condition as seen in this observation may have a
bearing on the efficiency of the mineral metabolism and pre-
cipitate hypocalcemia during late gestation.

The mean serum calcium level in the clinical cases of
hypocalcemia (0.92 ± 0.19 mmol/l) was significantly
(p < 0.01) lower than the values of clinically normal ewes. A
significant fall in serum calcium level undoubtedly causes
clinical hypocalcemia [9]. The mean serum magnesium and
inorganic phosphorus values were within the normal ranges.
This is in agreement with previous observations made by dif-
erent authors [9, 11, 21, 22].

Several calcium depressing factors, operating singly or
synergetically, coupled with the inability of the animal to

<table>
<thead>
<tr>
<th>Clinical Signs Manifested</th>
<th>No. of ewes showing the sign</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe mental depression</td>
<td>71</td>
<td>100</td>
</tr>
<tr>
<td>Rapid breathing</td>
<td>71</td>
<td>100</td>
</tr>
<tr>
<td>Muscular tremor</td>
<td>62</td>
<td>87.3</td>
</tr>
<tr>
<td>Muscular weakness and difficulty to rise</td>
<td>57</td>
<td>80.2</td>
</tr>
<tr>
<td>Sternal recumbency with head extended foreward or twisted side ways</td>
<td>57</td>
<td>80.2</td>
</tr>
<tr>
<td>Ruminal stasis and tympany</td>
<td>52</td>
<td>73.2</td>
</tr>
<tr>
<td>Suppression of urination and defecation (Constipation)</td>
<td>47</td>
<td>66.2</td>
</tr>
<tr>
<td>Normal temperature</td>
<td>45</td>
<td>63.4</td>
</tr>
<tr>
<td>Grunting at respiration</td>
<td>40</td>
<td>56.3</td>
</tr>
<tr>
<td>Sub normal temperature</td>
<td>26</td>
<td>33.6</td>
</tr>
<tr>
<td>Stiff and uncoordinated movement</td>
<td>14</td>
<td>20</td>
</tr>
</tbody>
</table>

TABLE III. — Frequency distribution of clinical signs observed in 71 hypocalcemic ewes in central Ethiopia.

<table>
<thead>
<tr>
<th>Serum constituents</th>
<th>Clinically sick*</th>
<th>Normal Pregnant*</th>
<th>Normal Non-pregnant*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium (mmol/l)</td>
<td>0.92 ± 0.19a</td>
<td>2.49 ± 0.25b</td>
<td>2.28 ± 0.22b</td>
</tr>
<tr>
<td>Magnesium (mmol/l)</td>
<td>0.94 ± 0.18</td>
<td>0.94 ± 0.19</td>
<td>1.06 ± 0.15</td>
</tr>
<tr>
<td>Phosphorus (mmol/l)</td>
<td>1.77 ± 0.34</td>
<td>1.95 ± 0.30</td>
<td>2.05 ± 0.33</td>
</tr>
<tr>
<td>Glucose (mmol/l)</td>
<td>6.00 ± 1.14a</td>
<td>3.21 ± 0.12b</td>
<td>3.06 ± 0.22b</td>
</tr>
</tbody>
</table>

TABLE IV. — The mean ± SD values of serum calcium, magnesium, phosphorus and glucose levels (mmol/l) in ewes in central Ethiopia. * Serum from a total of 33 ewes (11 in each group) were examined. a,b Different letters in a row show significant (p < 0.01) difference among the groups.
rapidly mobilise calcium from body deposits result in severe and fatal hypocalcemia. The serum glucose level (6 ± 1.14 mmol/l) was found to be significantly (p < 0.01) higher than that of clinically normal ewes (3.21 ± 0.12 and 3.06 ± 0.22 mmol/l in pregnant and non pregnant ewes, respectively). Increased blood glucose concentration was also reported in parturient paretic cows [18]. This may be due to poor tissue glucose utilisation. SPORLEDER [20] reported that there is decreased glucose turnover during late pregnancy in ewes attributed to increase in insulin resistance. It was further indicated that hypocalcemia augments insulin resistance leading to a high serum glucose level.

Concentrate fed to the hypocalcemic ewes did not contain sufficient amount of calcium but excess magnesium recommended during late gestation and early lactation. The prevalence of hypocalcemia was higher (21.8 %) in Noug seed cake fed ewes than linseed cake fed ones (11.7 %) in which the total daily intake of calcium were 4.13 g and 5.63 g respectively. These were far below the recommended amount for late pregnancy in ewes (11 g) [1]. An outbreak and occurrence of hypocalcemia is usually seen in ewes intensively housed and fed on high quality concentrate ration [9, 14, 21, 22, 24] since unlike leaves and stems of plants grains are deficient of calcium [23]. Furthermore, prolonged feeding on calcium deficient diets and excess magnesium in concentrate feeds may precipitate hypocalcemia during late gestation [9, 10, 14].

The serum magnesium level was within normal range in hypocalcemic ewes while there was excess amount of magnesium in the feed. This agrees with the observation that excess magnesium may limit the absorption of calcium [22, 24]. Milk-fever-like signs, increased faecal calcium excretion, moderate reduction of parathyroid activity and reduced resorption of calcium from bones were related with high magnesium rations as described by different authors [10]. High dietary magnesium, although not a major cause of hypocalcemia, may predispose ewes to the disease.

Sheep in this study were managed under house-feeding based on oil seed cakes (Noug-seed cake and linseed cake). The occurrence of hypocalcemia in intensively house-fed ewes with concentrate ration were reported by several authors [10, 22, 24]. No hypocalcemia was seen in sheep kept under extensive management in the same locality. The animals were not supplemented with concentrates and were generally with poor to fair body condition. Questionnaire to the farmers in this system of management indicated no history of hypocalcemia. Therefore, hypocalcemia was the problem of ewes house-fed in semi-intensive farms on concentrate ration deficient of calcium. It is logical to suggest that the cause of hypocalcemia in ewes in this region is related to calcium deficiency in feed as well as mineral imbalance such as excess magnesium. Proper feeding and management will reduce the loss due to mortality and treatment costs. Animals should be provided with reasonably formulated, locally available feed with recommended dietary allowance during late pregnancy and early lactation.

Calcium deficiency can arise from deficient dietary intake, disturbances in absorption due to diarrhoea, malabsorption, vitamin-D deficiency, excessive excretion from kidneys and parathyroid deficiencies [23]. Therefore any possible predisposing factor in a given area should be considered in drafting a sound control measure. Although several factors influence the level of calcium in the blood, addition of minerals (limestone, dicalcium phosphate) to the diets and allowing ewes to graze on green fodder such as alfalfa which has a high calcium content is advisable to alleviate the deficiency in sheep farms. Sheep owners particularly those rearing animals in semi-intensive and intensive farms for high production should be aware of the problem, take the necessary preventive measures and treat clinical cases with calcium solutions such as calcium borogluconate.

This study has shown for the first time that hypocalcemia is a threat to increased sheep production in a high altitude region in Africa. The results in this study indicate that not only infectious but also metabolic diseases may be important under certain circumstances in Africa and merit attention. As the situation may be a widespread problem, similar studies in various parts of Ethiopia and the tropical Africa are recommended.

References


