Study on Hoof Growth Pattern in Sheep to find Proper Indices of Hoof Trimming

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Abstract

Hoof trimming of sheep is a relatively skill based practice that have been done in some sheep in case of indoor housing or hoof diseases. Proper knowledge of the hoof growth pattern in mature and young sheep could make valuable clues for doing hoof trimming. This current anatomic study on ovine hoof was done to find growth pattern and weight bearing surfaces of the ovine hoof.

Fore and hindlimbs of 15, two years old slaughtered ewes were selected. Hooves were incised saggitally by an electric saw and toe height to ground and to the solar surface, heel height, sole length, toe length, toe length to the sensitive tissue, sole thickness in toe and heel region (mm) were measured. Toe angle mathematically measured from toe height and toe length, and toe to heel height were measured as well. Results were compared by t-test in different limbs and digits. Toe angle were significantly different in forelimbs (55.09 ± 8.1) and hindlimbs (50.43 ± 6.9) and heel height was significantly different (30.2 ± 3.3, 23.6 ± 4.4) in the fore and hind limbs respectively. Hoof growth makes an edge in the abaxial walls that is slightly longer in hindlimbs. Sole thickness in toe and heel regions of fore and hindlimb recorded as (4.1 ± 1.2, 8.2 ± 1.8 and 3.7 ± 1.3, 6.8 ± 1.7) respectively, that was significantly higher in hindlimbs. Toe angle in fore and hindlimb is slightly higher than cows. Lateral wall growth in solar region makes weight bearing surface of the hoof different from cows

Introduction

Lameness is not only a major economic problem, but also a major welfare issue for animals. There are few conditions which regularly produce as much pain and distress as lameness for the animals and few conditions where the herdsman has to spend as much time and effort as lameness (Blowey, 2004). Cattle hoof trimming is an important factor to restore normal function of the hoof and preventing one of the most important economical losses in dairy industry (Mohamadnia & Mohamadpour, 2004).

Sheep is one of the most important species among farm animals and by improving methods of housing and intensive animal production some changes especially in growth and shearing of the hooves happened. Proper hoof trimming is the most important factor to provide hoof health and function (Beigi, 2004). Hoof trimming means to cut and pare the claw in order to make them function as well as possible and it was described completely in other species, especially cattle and horse (Toussaint Raven, 1989).

Finding proper indices of hoof trimming needs a proper knowledge of growth pattern. As in cattle functional hoof trimming medial digit of the hindlimb and lateral digit of the forelimb consider as normal digit and recommended to be the first digits to be trimmed, and continue the trimming by pairing contra digits for determination of the toe length (Mohamadnia & Mohamadpour, 2004).

In sheep and goats an overall study to standardize hoof trimming method had not be done, that maybe a result of variety of breeds with different live body weight and obviously different hoof size and pattern. However most references emphasize on importance of hoof care and its methods. In this species as well as cow over trimming leads to sole hemorrhage and decrease in sole diameter, and it can make the hooves susceptible for more diseases (Blowey, 1992).

This current anatomic study on ovine hoof was done to find growth pattern and weight bearing surfaces of the ovine hoof to look for a standard ovine hoof trimming method.

Materials and methods

Fore and hindlimbs of 15, two years old slaughtered ewes from a local breed were selected. The average weight of adult ewes in this breed recorded as 60 kg. Hooves were cut saggitally by an electric saw, and all following measurements were done in eight digits of fore and hindlimbs.

Distance from coronary band to the end of the hoof in toe region recorded as TL1, and the distance between coronary band to a diagonal line to the point of sensitive tissue were recorded as TL2. Since the sole of the hooves stands slightly higher than ground level, two measures were used as toe height, the first one is a height from coronary band at the toe region to the ground and recorded as TH1, the second one is the length of the coronary band to the solar level and recorded as TH2. Heel height (HH) measured from the coronary band in heel region to the ground level. Sole length (SL) measured from the tip on the hoof at the solar region to the end of the weight bearing part of the hoof at the heel region. Sole thickness after saggital section was measured in toe (ST1) and heel region (ST2) (Figure 1).

Toe angle mathematically measured from toe height and toe length, and toe to heel height were measured as well. Results were compared statistically by t-test in Sigmastat (Jandel scientific) software in different limbs and digits.

Results

Toe angle were significantly different in forelimbs (55.09 ± 8.1) and hindlimbs (50.43 ± 6.9) (Graph 1) and heel height was significantly different (30.2 ± 3.3, 23.6 ± 4.4) in the fore and hind limbs respectively (Graph 2). Although no statistical difference were recorded in the other results but some descriptive changes is recorded. Hoof growth makes an edge in the abaxial walls that is slightly longer in hindlimbs. Sole thickness in toe and heel regions of fore and hindlimb recorded as (4.1 ± 1.2, 8.2 ± 1.8 and 3.7 ± 1.3, 6.8 ± 1.7) respectively, that was significantly higher in hindlimbs (Graph 3). Toe angle in fore and hindlimb is slightly higher than cows. Lateral wall growth in solar region makes weight bearing surface of the hoof different from cow. Hoof growth pattern in sheep is different from cow. 12 mm of horny tissue of the hoof protects from sensitive underlying tissue that can make a satisfactory hoof trimming (Graph 4). Results show that the height of hoof wall edges in foreclaws is 4.2 mm and in hindclaws is 4.7 mm but there is no significant difference between them and it is related to more weight bearing to hindlimb.

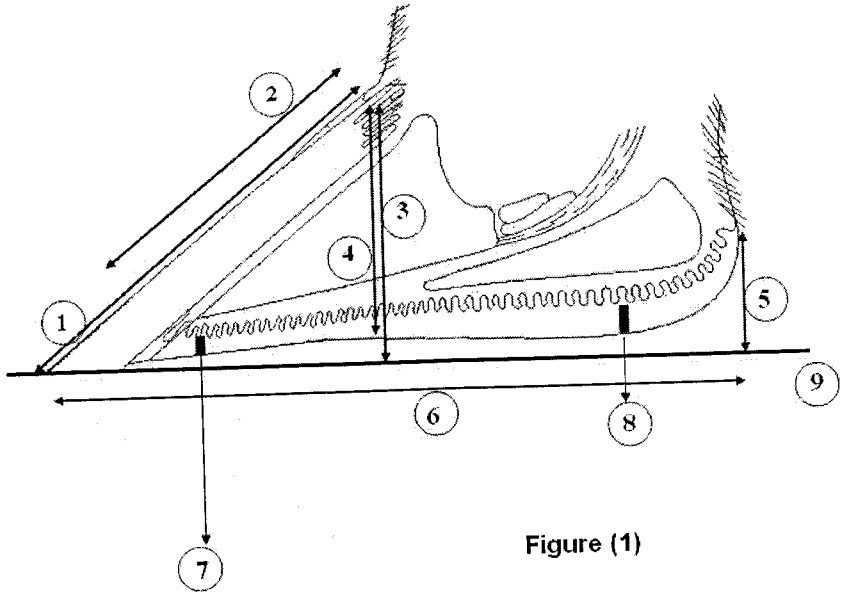
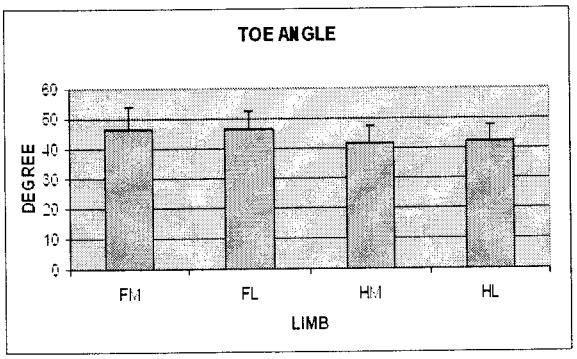


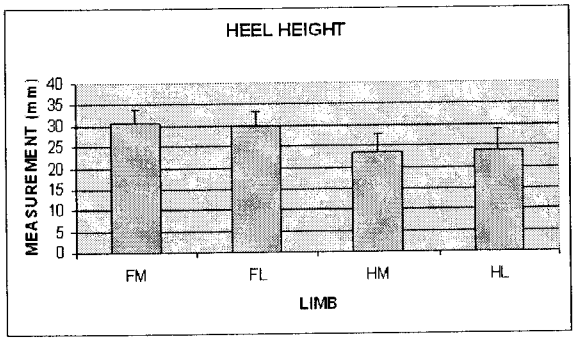
Figure (1)

1: TL1 2: TL2 3: TH1 4: TH2 5: HH

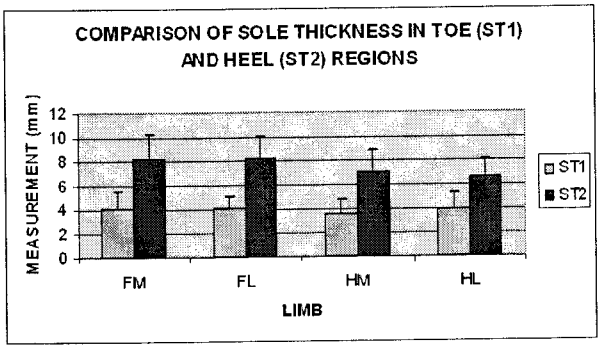
6: SL 7: ST1 8: ST2 9: Ground surface



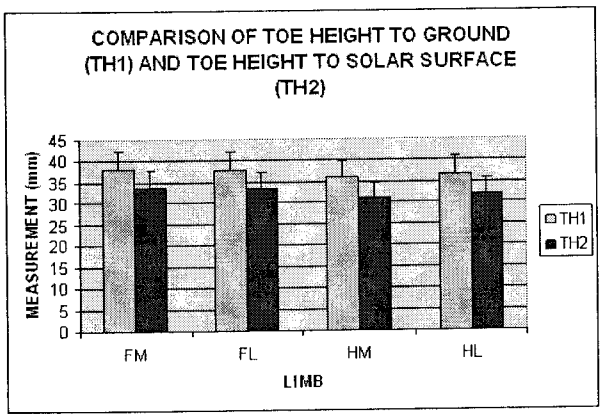
(Graph 1)



(Graph 2)



(Graph 3)



(Graph 4)

Discussion

Lameness, a multifactorial disease, is no doubt one of the most important problems that farm animals producers are facing today. Currently there are many elements contributing to lameness as modern operations, concrete, standing time, comfort, walking distance, nutrition, hygiene, and claw trimming (Shearer & Van Amstel, 2001).

Some studies were done on bovine hoof growth pattern (Mohamadnia et al 2005, Paulus & Nuss 2002, Shearer 2002) and it has been determined that medial claws of forelimb and lateral claws of hindlimb grow more than another claws (Magsa & Kempson 2002, Mohamadnia et al 2005).

The claw of sheep and goats are similar in structure to those of pigs. The horn capsule has a slightly convex outer and somewhat more concave interdigital wall. At the dorsum these two regions meet at an acute angle and form a narrow ridge. The horny wall is highest somewhat caudal to the dorsum. At the point of the toe the surface of the sole is raised so that the wall is shorter in the toe region. The outer wall which covers the whole of the abaxial surface of the distal phalanx decreases only slightly in height towards the palmar (or plantar) region. The interdigital (axial) wall, on the other hand, reduces much more and covers only the cranial two thirds of the interdigital surface (Schummer et al, 1981). In goat lateral claw of forelimb grow more than medial claw, that is in contrast to cattle hoof growth pattern and similar to ovine hoof growth pattern (Beigi, 2004).

Toe length is the most important criteria of hoof growth. In this study there is no significant difference between toe length in all claws and claw growth in hindlimb is more than forelimb (table 1, 2).

In former studies on cattle, sole thickness in lateral claw of forelimb is less than medial claw but it is almost equal in medial and lateral claws of hindlimb and it is almost equal between fore and hindlimb (Mohamadnia & Mohamadpour, 2004). In this current study sole thickness in toe region of hindlimb is less than forelimb (table 1, 2) and sole thickness in heel region of hindlimb is also less than forelimb and it may be related to more closed toe angle in these limbs and more weight bearing on hindlimb. It is no doubt that, like cattle, the best point for beginning of hoof trimming is toe (Mohamadnia et al, 2005), regards to safe limit of sensitive tissue (5 mm) it seems that 40 mm length from coronary band leaves a safe margin for inner sensitive tissues.

Finaly it appears that ovine hoof and its growth pattern is similar to the cattle but differences between

the claws are not significant, so beginning the hoof trimming from a special claw is not necessary and at the end of hoof trimming it is important that claws back to approximately the same size. Of course more studies on another breeds of this species is necessary.

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9 (DEGREE)	8	7	6	5	4	3	2	1	DIRECTION	LIMB
55.5±8.19	8.3±3.7	4±1	35.8±3.7	47±6.4	58.4±6.4	33.7±3.5	37.9±4	30±3.1	LATERAL	FORELIMB
54.68±8.27	8.1±2	4.1±1.4	35.6±3.6	47.1±6.3	57.6±6.3	33.8±4.1	38±4.4	30.4±3.5	MEDIAL	FORELIMB
50.87±6.64	6.6±1.5	3.8±1.4	34.8±3.9	48.1±7.6	58.9±9.5	31.9±3.9	36.7±4.1	23.9±4.6	LATERAL	HINDLIMB
49.99±7.25	6.9±1.9	3.6±1.1	35.1±3.6	48±6.8	56.9±6	31.4±3.6	36.2±4.3	23.4±3.7	MEDIAL	HINDLIMB

1- Heel height 2- Toe height to the solar surface 3- Toe height to ground
4 - Sole length 5- Toe length 6- Toe length to the sensitive tissue
7-Sole thickness in toe region 8- Sole thickness in heel region
9- Toe angle

Table 1: Hoof measurements (mm) in medial and lateral claws of fore and hindlimbs

9(DEGREE)	8	7	6	5	4	3	2	1	LIMB
55.09±8.1	8.2±1.8	4.1±1.2	35.7±3.6	47.1±6.3	58±6.3	33.7±3.8	37.9±4.2	30.2±3.3	FORELIMB
50.43±6.9	6.8±1.7	3.7±1.3	35±3.7	48±7.1	57.9±7.9	31.7±3.7	36.4±3.9	23.6±4.4	HINDLIMB

1- Heel height 2- Toe height to the solar surface 3- Toe height to ground
4 - Sole length 5- Toe length 6- Toe length to the sensitive tissue
7- Sole thickness in toe region 8- Sole thickness in heel region
9- Toe angle

Table 2: Hoof measurements (mm) in fore and hindlimbs