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Sonographic imaging of digital fat cushions in the first three lactations of dairy cows

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Introduction:

Lameness is one of the most significant problems for dairy farms all over the world. Often changes in the digital fat cushions are associated with hoof diseases which cause decreased performance, high veterinary costs and even culling of animals. Early diagnostic options for hoof diseases or even reliable predictive capabilities are still rare. However, diagnostic ultrasonographic examination has become a routine diagnostic technique in buiatrics. Therefore, ultrasound will be tested as a method in this study in order to detect changes in the fat pads as early as possible. Emphasis is placed on the examination of the subcutaneous digital fat cushion and measurement of its thickness. Furthermore, correlations between fat cushion thickness, body condition and changes in blood values will be investigated as well as relations of these measurements with pathologic changes leading to hoof diseases.

Material and methods:

80 cows from three different dairy farms in Thuringia and Lower Saxony were examined at specified intervals over the first three lactations. The hooves of all animals are regularly trimmed according to the principles of functional hoof trimming.

Examination procedure:

- estimation of physical condition using the body condition score
- measurement of body weight
- evaluation of gait pattern (locomotion score)
- ultrasound measurement of back fat thickness
- ultrasound images of the digital cushion (right hind lateral hoof, right front medial hoof)

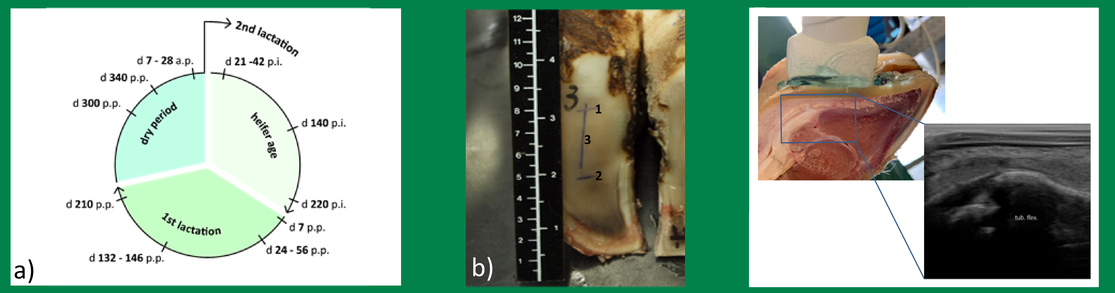
Standardized points of measurement for the ultrasound images (images were taken both in longitudinal direction and cross-section):

- thinnest dimension of the fat cushion next to the flexor tubercle
- thickest dimension of the fat cushion at the point of maximum concave solear curvature of the distal phalanx

Preliminary results:

Visualization of the fat body by ultrasonographic examination is possible in principle, though the quality varies from individual to individual. The part of the fat pad immediately below the flexor tubercle is the most suitable for thickness measurement. The thickness of the digital cushion shows a dynamic course over the period of a lactation with extreme values shortly before calving (highest) and between one to eight weeks after calving (lowest). A correlation between a thin fat cushion at some point during the lactation and the occurrence of hoof diseases such as sole ulcer or sole haemorrhages is already becoming evident (not yet statistically confirmed). A correlation between the fat cushion, body weight and back fat thickness is becoming apparent.

Figure 1

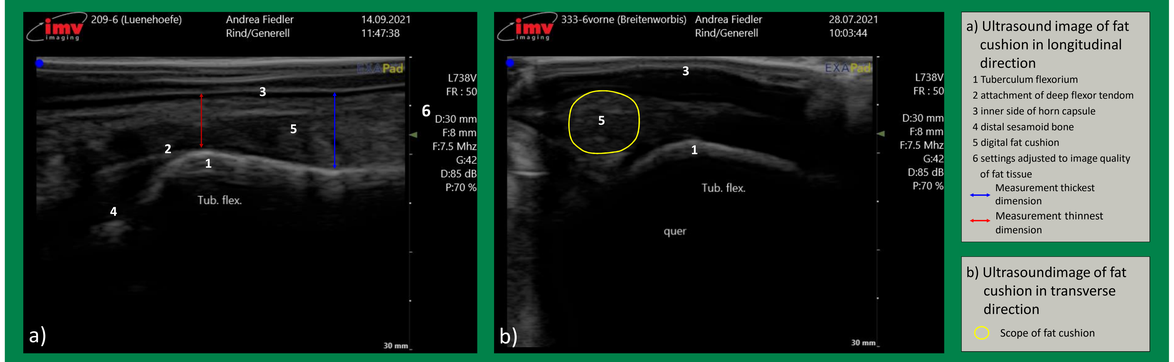


a) Dates of examination

b) Position of ultrasonic probe
1 marking tuberculum flexorium
2 marking tip of fat cushion
3 measuring line for fat cushion length

c) Position of ultrasonic probe and corresponding ultrsound image

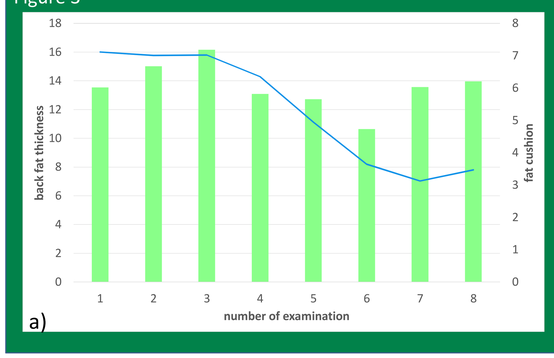
Figure 2



a) Ultrasound image of fat cushion in longitudinal direction
1 Tuberculum flexorium
2 attachment of deep flexor tendom
3 inner side of horn capsule
4 distal sesamoid bone
5 digital fat cushion
6 settings adjusted to image quality of fat tissue
Measurement thickest dimension
Measurement thinnest dimension

b) Ultrasoundimage of fat cushion in transverse direction
Scope of fat cushion

Figure 3



a) Development of thickness of fat cushion and back fat over time (first eight examinations)
fat cushion
back fat

Further information about the project partner EIP

References:
- Räber M, Lischer Ch J, Geyer H, Ossent P. The bovine digital cushion- a descriptive anatomical study. Veterinary journal (London, England : 1997). 2004;167(3):258-64.
- Further sources on request

Landwirtschaftliches Bildungszentrum Echem.