Ultrasonographic Thicknesses of Ruminal and Abdominal Wall in High Yielding Holstein Dairy Cows

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Abstract: Ultrasonography has been used as a non-invasive method for examination of gastrointestinal tract of cattle. Rumen status and rumen health are important in high producing dairy herds. In this study the normal values of abdominal and ruminal wall thickness in mid lactation cows were measured and abnormal cases were evaluated with ultrasonography. On ultrasonogram, ruminal wall in all of the cases were constituted by two layers but in some cases such as fluid accumulation or ascite were imaged as three layers. The mean ± standard deviation of abdominal and ruminal wall thickness (two layers) were 17.31 ± 3.08 and 8.01 ± 1.36 milimeters respectively. So, ultrasonographic investigation of left abdomen and their values of the thicknesses could be a part of rumen health evaluation in dairy herds but more researchs should be done for this matter in high producing dairy herds. [Mohsen Ahmadi Roozbahani, Arya Badiei, Mohammad Gholi Nadalian, Abbas Veshkini, Sebastien Buczinski, Mohammad Mashayekhi. Ultrasonographic Thicknesses of Ruminal and Abdominal Wall in High Yielding Holstein Dairy Cows. Life Sci J 2013;10(5s):93-96] (ISSN:1097-8135), http://www.lifesciencesite.com.

Key words: Ultrasonography; Dairy cow; abdominal wall; Ruminal wall; Thickness.

1. Introduction

Ultrasonography is a non-invasive method for examination of body organs in domestic animal (Schroder and Staufenbiel 2006; Braun 2009; Vaughan 2009). It has been used for investigating of diseases and disorders of gastrointestinal tract of cows (Tschuor and Clauss 2008; Braun 2003; Braun 2009). In cattle and especially in high yielding dairy cows diseases of rumen are importance. Rumen diseases such as carbohydrate engorgement, simple indigestion and rumen parakeratosis and rumenitis are most common (Radostitis et al., 2006; Garry 2009; Grunberg and Constable 2009; Kersting et al., 2009). Thickening of the ruminal wall may be seen in cases of rumenitis or secondary to ruminotomy or ruminal trocarization. Abscesses between ruminal and abdominal wall in the left flank region and echogenic strands of fibrin in association with abscesses may be found in ultrasonography examination. Localized or generalized peritonitis may also occur secondary to abscessation (Braun 2009; Vaughan 2009).

The ultrasonographic examination is performed on none sedated, standing cattle by using a 3.5 to 5 MHz linear or convex transducer and ultrasonographic gel. The rumen is visualized in the left flank. The ruminal wall appears echogenic. In the dorsal part of the rumen reverberation artifacts are seen parallel to the ruminal wall. The ingesta in the middle part of the rumen are imaged as echogenic with gaseous inclusion. The fluid in the ventral part is hypoechogenic (Radostitis et al., 2006; Tschuor et al., 2008; Braun 2003; Braun 2009). However to our knowledge, ruminal wall thicknesses have not been reported in high yielding dairy cows with ultrasonography. This study was undertaken to assess normal ruminal and abdominal wall thicknesses because of a few researchs about ruminal ultrasonography especially in high yielding dairy cows.

2. Materials and Methods

The study was carried out on 10 commercial dairy herds located in Tehran and Alborz provinces of Iran. 126 healthy Holstein dairy cows in 60-150 days in milk (DIM) were randomly selected. An area in the ventral left flank below the midline and 20 centimeter (cm) posterior to the last ribs was shaved
and washed. Ultrasonographic investigation of the area of interest was done using a 5 MHz linear probe (Agroscan, ECM, Angouleme, France). Transmission gel was applied to the transducer. The transducer was placed at a point in the ventral left flank 15-20 cm posterior to the last rib on the top of the horizontal line level of the patella. The abdominal wall layers (skin, muscles) and ruminal wall were measured by ultrasonography. Ultrasonographically, the ruminal wall was constituted by three layers which include (from mucosa to serosa); first; a thick hyperechoic layer that was situated adjacent to the ingesta of rumen, second; a thin hypoechoic layer that was situated laterally to the previous layer and the last layer was a thin hyperechoic layer that in most of the cases was attached to the outer (Fig.1). Due to the inconsistency of visualization of the last layer of the ruminal wall, ruminal wall thickness was determined measuring the first two layers. The ultrasonographic images were stored electronically.

3. Results

A total of 126 cows were included in this study. The skin was seen hypoecho and the fascia was imaged as a narrow hyperechoic line. The muscle layers were visualized with mixed echo. The two layers of ruminal wall were imaged as a thick hyperechoic and a thin hypoechoic line. The mean ± standard deviations of the abdominal wall and hyper and hypo and total layers of ruminal wall are recapitulated in table 1. The maximum thicknesses of abdominal wall and hyperechoic layer, hypoechoic layer and total layer of ruminal wall were 24.4 mm, 9.8 mm, 3.6 mm, 12.6 mm respectively. The minimum thicknesses of abdominal wall and hyperechoic layer, hypoechoic layer and total layer of ruminal wall were 10.2 mm, 3.8 mm, 1.2 mm, 5.6 mm respectively. There were some abnormal findings on ultrasonograms of some cows such as hyper echogenicity in peritoneal cavity that were excluded from this study (Fig.2).

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Mean Values a,b</th>
</tr>
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<tbody>
<tr>
<td>Lac</td>
<td>3.48 ± 1.74</td>
</tr>
<tr>
<td>DIM</td>
<td>99.31 ± 27.81</td>
</tr>
<tr>
<td>Abdominal wall</td>
<td>17.31 ± 3.08</td>
</tr>
<tr>
<td>Ruminal wall ( hyperechoic layer )</td>
<td>5.82 ± 1.10</td>
</tr>
<tr>
<td>Ruminal wall ( hypoechoic layer )</td>
<td>2.18 ± 0.56</td>
</tr>
<tr>
<td>Ruminal wall ( hyper + hypo )</td>
<td>8.01 ± 1.36</td>
</tr>
</tbody>
</table>

a,b Data are expressed as the means ± SD
Lac = Lactation
DIM = days in milk

![Figure 1: Ultrasonogram of left ventral abdomen and ruminal wall with three layers. Ventral abdominal wall (1), thin hyperechoic layer of ruminal wall (2), hypoechoic layer of ruminal wall (3), wider hyperechoic layer of ruminal wall (4). Ds, dorsal; Vt, ventral; Lat, lateral; Med, medial.](image1)

![Figure 2: Hyper echogenicity in peritoneal cavity of left ventral abdomen in dairy cow. Skin (1), muscle layers (2), peritoneal cavity with hyper echogenicity (3), ruminal wall (4). Ds, dorsal; Vt, ventral; Lat, lateral; Med, medial.](image2)

![Figure 3: Ultrasonogram ruminal wall with edema in mucosal layer (black arrows) of left ventral abdomen in dairy cow in mid lactation. Skin (1), muscle layer (2), ruminal wall (3). Ds, dorsal; Vt, ventral; Lat, lateral; Med, medial.](image3)
The ruminal wall (two layers) was measured. Braun et al (2011) have measured the thickness of abdominal wall in cows. The abdominal wall thicknesses of their study had a range between 28 to 34 mm while in the present study this range was between 10.2 to 24.4 mm. It seems that differences have originated from the different site and ruminal wall. The authors thank to owners and managers of Majid Hezar jolfa and Afzalian dairy farms for their cooperation during performing of this study.

Acknowledgements
The authors thank to owners and managers of Majid Rezaee, Behdam, Azadeh, poorsate, Laban, Taherloo, Damci, Saberi, Hezar jolfa and Afzalian dairy farms for their cooperation during performing of this study.

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2/22/2013