Exposure to risk of injury and ergonomic load during beef cattle handling in open areas

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Abstract
Working with beef cattle in open areas has been shown to expose workers to a high risk of musculoskeletal injuries and/or over exertion. The aim of this presentation are to identify and review the data on injuries to workers when working with beef cattle in open areas, and summarize critical livestock handling practices that would enhance worker safety. The study was based on work carried out as field studies on seven Swedish beef farms, where the risk factors in connection with farmers' work with cattle on pasture were investigated. Duration and sequence for the identified tasks were observed and registered during the farmer’s driving, sorting, transporting and relocating cattle. The risk of injuries were assessed for the tasks observed using Working Environment Screening Tool in Agriculture (WEST-Ag). This tool is a modified version of the WEST, which was designed to assess the work environment. The results from the findings of this work will be used in the development of educational resources that target small beef producers. It is anticipated that adoption of the recommended practices will reduce the risk of injury. Cattle handling activities in open areas present a significant level of risk of injury and over exertion to the farmers. Practices implemented to reduce the farmer’s exposure to the aggressive behaviour of the cattle and other related hazards have been effective on some beef farms. Inexpensive animal handling technology could be incorporated to enhance the safety of the farmer and the welfare of the cattle.

Keywords: animal handling, livestock safety, working environment

Introduction
Working with beef cattle in open areas, such as pasture and open feedlots, exposes workers to a high risk for traumatic and musculoskeletal injuries or over exertion. The most serious hazards are associated with the direct exposure between the worker and the animal. In Sweden, five fatalities were documented during cattle handling activities in open areas during 2010 and 2011 (LRF, 2010; LRF, 2011). Sheldon et. al. (2009) reported on 287 bull-related attack of which over half (57%) were fatal and nearly 14 % took place in a pasture setting. Field (2011) noted that small and part-time beef farmers account for a disproportionate percentage of both fatal and serious farm-related injuries. Cattle that are not restrained or contained in pens or feedlots, as with beef rose on pasture, are unpredictable in their behaviour and have the capacity to act in aggressive ways if approached or sense that their territory or their young are being threatened. These defensive behaviours can lead to a worker being butted, gored, kicked or mauled due to the superior strength, size
and quickness of the animal (AFS, 2008:17; Hendricks and Aderoya, 2001; Geng and Salomon, 2010; Geng and Salomon, 2011). The severities of injuries that can be caused by cattle have been reported by others (Reiling1997; Drudi, 2000; Sheldon et. al., 2009; Health and Safety Authority, 2011). Field (2011) also identified other beef handling-related hazards, including: use of tractors without protective cab or ROPS to herd beef cattle on pastures; falls associated with rough terrain, slippery surfaces and while climbing across fences; needle sticks occurring during animal treatment; the use of all-terrain vehicles; and vehicle collisions with cattle that enter public roadways.

In addition to traumatic injuries, beef producers are also at risk from other cattle handling operations. It has been well documented that livestock handling, in general, involves high physical demands that increase the risk of musculoskeletal injuries or exertion (Vingård et al., 1992; Stiernström et al., 1998; Holmberg et al., 2005; Hartmann et al., 2005; Sheldon et. al., 2009; Geng and Salomon, 2010; Geng and Salomon, 2011).

The aims of this presentation are to identify and review the currently available data on injuries to workers when working with beef cattle in open areas, and to summarize critical livestock handling practices that have a high potential for enhancing worker safety.

Materials and methods

Findings are include data gathered during a pilot field assessment of work environment carried out on seven Swedish farms during the pasture season, where the risk factors in connection with farmers' work with cattle in open areas were observed and documented. The sample farms and participants as well as the tasks observed are described in table 1. Four of the farms had cattle on pasture all year, and the other three only pastured during summer season (between May-September). The size of the herds varied from 53 to 225 cattle (numbers of bull per farm are from 1 to 5). The areas of pasture per farm are from 30 to 130 hectares. The farmers performing the tasks and working conditions were observed during driving, transporting and relocating cattle in the pastures. At each farm, most of the tasks observed were carried out by at least 2 persons. Six of the farms utilized temporary collecting pens with foddering built on the pasture (1-15 days) before the day of cattle handling. Also, a detailed interview was carried out with the seven male farm owners. The ages of the participators were between 29 to 63 years. Their working experiences with animals were from 11 to 45 years. Traumatic injuries during cattle handling were reported at four of the farms.
Table 1. Information about the farms, participants and their tasks studied

<table>
<thead>
<tr>
<th>Farm code</th>
<th>No. of cattle/(bull)</th>
<th>Pasture area (ha)</th>
<th>Pasturing period</th>
<th>Farmer age (year)</th>
<th>Farmer experience (year)</th>
<th>Tasks studied</th>
<th>Worker (no.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm 1</td>
<td>71 (1)</td>
<td>35</td>
<td>Whole year</td>
<td>48</td>
<td>30</td>
<td>moving, sorting, separating 11 suckle cows</td>
<td>2</td>
</tr>
<tr>
<td>Farm 2</td>
<td>53 (1)</td>
<td>35</td>
<td>Whole year</td>
<td>57</td>
<td>11</td>
<td>moving, sorting, separating 13 young bulls &amp; 3 heifers</td>
<td>4</td>
</tr>
<tr>
<td>Farm 3</td>
<td>63 (1)</td>
<td>30</td>
<td>Whole year</td>
<td>56</td>
<td>40</td>
<td>moving, sorting, separating 13 young bulls &amp; 15 heifers</td>
<td>2</td>
</tr>
<tr>
<td>Farm 4</td>
<td>61 (3)</td>
<td>33</td>
<td>Whole year</td>
<td>63</td>
<td>30</td>
<td>transporting 18 cows &amp; 18 calves to barn from two pasturelands</td>
<td>2</td>
</tr>
<tr>
<td>Farm 5</td>
<td>124 (4)</td>
<td>70</td>
<td>May-Sept.</td>
<td>29</td>
<td>18</td>
<td>transporting 19 cows &amp; 19 calves to another pastureland</td>
<td>2</td>
</tr>
<tr>
<td>Farm 6</td>
<td>225 (5)</td>
<td>180</td>
<td>May-Sept.</td>
<td>40</td>
<td>25</td>
<td>moving, sorting, transporting 27 cows &amp; 24 calves to barn</td>
<td>3</td>
</tr>
<tr>
<td>Farm 7</td>
<td>204 (4)</td>
<td>130</td>
<td>May-Sept.</td>
<td>47</td>
<td>30</td>
<td>moving, transporting 17 cattle to barn</td>
<td>2</td>
</tr>
</tbody>
</table>

*Years of working experiences with animals

The risks of injuries at each site were assessed for the current tasks using the Working Environment Screening Tool in Agriculture (WEST-AG, Torén et al., 2004). The WEST-AG is a modified version of a WEST method (Karling and Brohammer, 2002). The method transposes the exposure in the working environment into an effect on human health in economic terms in Swedish Krona per thousand working hours (SEK/th). With the WEST-AG, seven factors can be screened, i.e., risk for injury, ergonomic load, psychosocial factors, noise, vibrations, chemically health hazards and work environment in general. For each factor, there is a model for the exposure to the factor and a method to translate this exposure into health effects. Each work situation gives positive or negative contributions to the factor of interest. Thereby, a representation of the working environment is obtained, showing which factors should give negative or positive contributions. The exposure from the factor into health effects are expressed as the effect on productivity for the farm screened. In this study, the working environment was screened for two factors, i.e., risk for injury and ergonomic load.

The screening for risk of injury was performed by risk assessment of 15 components on an 11-degree linear scale and recalculation of the ratings through the model into the WEST-points. The 11-degree linear scale ranged from zero (no/trivial risk) to 10 (extremely high risk), and the 15 components were 1) injury by machine in motion, 2) to be struck by flying object, 3) to be struck by falling object, 4) overexertion of body part, 5) handling injury by hand-tools or other working materials, 6) impact due to disorder, cramped or blocked room, 7) injury with vehicle, 8) fall on the same level, 9) fall to lower level, 10) misstep, 11) contact with chemical, 12) burn or frostbite, 13) electrical injury, 14) explosion or fire, and 15) injury...
by person or animal. Table 2 shows an example of risk assessment with the risk scale for one of the 15-component “injury by person or animal” (Geng, et al., 2009).

**Table 2. Example of risk assessment of component No. 15: injury by person or animal.**

<table>
<thead>
<tr>
<th>Contact with violent person or dangerous animal</th>
<th>Description of the risk</th>
<th>Risk scale</th>
<th>Result</th>
<th>WEST-AG-point SEK/1000h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Injury by person due to wrongly designed workstation.</td>
<td>Extremely high risk</td>
<td>10</td>
<td>-3555</td>
<td></td>
</tr>
<tr>
<td>Injury by animal (e.g. cow/bull with horns, loose bull, etc.).</td>
<td>Intolerable risk</td>
<td>9</td>
<td>-3025</td>
<td></td>
</tr>
<tr>
<td>Physical or psychological injury by person through violence, threat, aggression, etc.</td>
<td>High risk</td>
<td>8</td>
<td>-2533</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Substantial risk</td>
<td>7</td>
<td>-2079</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Increased risk</td>
<td>6</td>
<td>-1664</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Moderate risk</td>
<td>5</td>
<td>-1287</td>
<td></td>
</tr>
<tr>
<td>Comments:</td>
<td>Relatively low risk</td>
<td>4</td>
<td>-949</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low (tolerable) risk[a]</td>
<td>3</td>
<td>-650</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Very low risk</td>
<td>2</td>
<td>-389</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Minimal (trivial) risk</td>
<td>1</td>
<td>-166</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non-risk</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

[a] Acceptable risk level

The screening of ergonomic load is based on judgment of four bases i.e., 1) working posture, 2) repetitive work, 3) weigh/force to be handled and 4) modifying factors. The modifying factors consist of the information about worker’s age, gender, precision task, the task include snatch, local pressure against anatomic structures and work in hot/cold environment. The WEST result of ergonomic load (WEST-erg, SEK/th) is then calculated by:

\[
WEST_{\text{erg}} = (wp + rw) \times \text{weight(\text{force})} \times mf
\]

where \(wp\) is working posture, \(rw\) is repetitive work and \(mf\) is modifying factor.

**Results**

Figure 1 shows the results from screening the risk of injury during working with cattle in the pasture at seven farms. The risk mainly involves potential injury by animal, overexertion of body part and falls on the same level.

Clearly, the risk of injury caused by animal contact was higher during handling of cattle at three farms (Farm 1, Farm 2 and Farm 3) as compared to the other farms. The farmers working on farm 3 also had a higher risk for overexertion of body part. The reason to the high minus score was that the farmers had to lift, carry and move the heavy steel-gates (>40 kg) to build temporary gathering areas.

The result of WEST-point of -2500 SEK/1000hour indicates that the farmers are exposed for risk of injury in the working environment, which corresponds a cost on 2 500 SEK per thousand working hours (or 2.5 SEK/hour) during handling cattle in open pasture.

In addition, the answers on the question about the most stressful activities experienced by the famers were: care and label tagging newborn calves during calving, separating calf from cow, looking for animals escaped from their handling area to another animal group, driving cattle to temporary pens and loading cattle into transporting trailers before slaughtering, etc.
Figure 1. Risk of injury for the seven farmers when working with cattle on the pastures.

Figure 2 WEST-points on ergonomic load on the farmers during working on the cattle handling on the pastures.

Some differences of WEST-point on ergonomic load (-1525 to -2052 SEK/1000h) among the seven farms were assessed. This is because a different weighing factor of weight/force was handled within the farmers’ work at their farms. Also, a different age of worker resulted in a different weighing effect of modifying factor. According to the method, a weighing factor
issues from the modifying factors of age is 40 years = 1.2, 60 years = 1.4. For instance, the farmer at the farm 3 was 56 years (Table 1) and he carried and moved the heavy gates. These higher weight/force and aged elements used to calculate in the WEST-erg (equation 1) caused the higher minus points on ergonomic load than for other farmers.

Results from the detailed interview with farmer indicated that caring the steel-gates and pushing cattle into the transport vehicles were the most heavy tasks.

Discussion and conclusions
The results demonstrated that the cattle handling activities in open areas can cause a greater level of risk of injury and over exertion to the farmer, especially, gathering and sorting. Therefore good knowledge of the animals’ behaviour is important for animal handling, such as Low Stress Stock handling (LSS-method, Smith, 1998), which would enhance the safety of the farmer and the welfare of the cattle.

Also, it was noticed that all of the farmers interviewed had considerable experience with cattle handling and had developed different practical approaches to reduce the farmer’s exposure to the aggressive behaviour of the cattle and other related hazards, including:

- Setting up temporary collecting pens with feed in pasture areal at least one week before gathering to attract cattle into the pen and let the animals become used to the pen.
- Using a tractor or All-Terrain Vehicles with feed to tempt and lead animals into the gathering pen.
- Loading calves into the wagon first before cows for transporting, as mother animals want to follow their young into the trailer.
- Handling and transporting bulls together with some female cattle to reduce the farmer’s exposure to the aggressive behaviour of the bull.
- Equipment being incorporated for carrying and moving of heavy steel-gates in order to reduce ergonomic load on the farmers and risk for musculoskeletal injuries as well.

Recommendations
Based upon the review of current injury data related to beef cattle handling and the findings of risk assessment by the WEST-AG, the following intervention strategies should be promoted to Swedish beef producers:

1. The level and frequency of direct exposure between the worker and cattle should be kept to a minimum. This includes efforts to construct and maintain suitable fencing, gates, temporary holding pens and loading chutes. The literature and farmer interviews suggested that further work is needed to clarify the engineering aspects of cattle handling facilities to ensure that their capacities are sufficient relative to animal size, weight and strength.

2. When direct contact with cattle is required, such as for medical care, castrating, branding, dehorning and identification tagging, the use of appropriate head gate and squeeze chutes should be recommended practice. Workers should be trained in the proper use of these devices.

3. The use of appropriate all-terrain vehicles by trained workers should be considered as a means of reducing physical contact with cattle in an open setting and to navigate rough terrain to complete fence maintenance, check on herd and pasture condition, and looking for missing cattle. Working alone, on-foot in an open pasture with no ready way for escape is a well recognized hazard that should be avoided. These vehicles however, present a new set of personal hazards that need to be considered.
4. The ergonomic characteristics of current cattle handling facilities and equipment need to be assessed in light of new findings concerning causes of musculoskeletal injuries and advances in technology. Fencing, gate use, and cattle handling equipment required high levels of physical exertion due to the weight of the equipment designed to match animal weight and strength. New technology such as light weight gates, automatic gate openers, high tensile fencing, portable head gates and loading chutes, tractor mounted feeding equipment can play a significant role in reducing the risk for musculoskeletal injury.

5. Beef producers should be encouraged to weed out more aggressive cattle and to breed for higher level of desirable handling qualities. Bulls that become overly aggressive towards workers and cows that are overly protective of their new calves are a high risk of carrying worker injury or damage to facilities. These animals should be sold for slaughter purposes only and not sold or transferred to another farm where they continue to be a threat.

6. Older beef producers who may experience diminishing physical abilities need to be encouraged to use extra caution when exposed to cattle in open spaces. Reduced mobility impaired vision and hearing can increase the risk of a surprised encounter with an animal or make escape more difficult.

7. Opportunities should be provided to all small beef producers to receive training on strategies related to reduced stress livestock handling. This includes discouraging worker behaviours that increase flightiness and facilities that generate unnecessary livestock anxiety.

Acknowledgements
The study was financed by the Royal Swedish Academy of Agriculture (H102-0012-SLO).

References


