

Attitudes of beef producers to disbudding and perception of pain in cattle

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Abstract

Pain is an indicator of welfare status in livestock, and attitudes play a key role in the assessment and treatment of pain in animals. Veterinarians' and dairy producers' perceptions of cattle pain are affected by gender, age and work experience. The aim of this paper was to study beef producers' attitudes regarding disbudding as well as the painfulness of certain cattle diseases. A questionnaire was sent out to 1,000 Finnish beef producers and the response rate was 44%, representing 19% of all Finnish beef producers. Producers graded their attitudes on a five-point Likert scale and perception about pain on an eleven-point numerical scale. Factor analysis was used and four factors were established. These factors described producers' assessment of disbudding-related pain, their sensitivity to pain in cattle, their willingness to self-medicate disbudded calves and their perceived importance of horns. Factor scores were tested for differences between genders and the use of disbudding on farms with Mann Whitney U-tests. Kruskal-Wallis tests were used to assess differences among producers' age, work experience and herd size. Female beef producers assessed animal pain higher than male beef producers. Older and more experienced beef producers showed more positive attitudes towards cattle with horns than younger or less-experienced ones. Older beef producers were more sensitive to cattle pain than younger producers and beef producers with a smaller herd size took disbudding pain more seriously and were more sensitive to cattle pain than the producers with larger herds. Producers who did not use disbudding valued horns more than producers using disbudding.

Keywords: animal welfare, attitude, beef producer, cattle pain, disbudding, human-animal relationship

Introduction

Beef cows (also often referred to as suckler cows) are kept for beef production and, in suckler herds, calves are usually kept with their dams up to six months of age. In 2011, there were 57,000 beef cows in Finland (LUKE, Natural Resources Institute Finland 2015). Finnish beef production is mainly based on dairy breeds as only 20% of all beef originates from actual beef breeds. Finnish beef farms tend to be family operated with very versatile housing systems, from warm tie-stalls to light, shelter-based winter pastures. Supplement feeding is needed and all-year-round pasture-based systems do not exist as pasture time is very short, only 120–150 days a year (Tiilikainen *et al* 2003). Since many of the most common beef breeds in Finland (ie Charolais, Hereford, Limousin, Aberdeen Angus and Simmental) are at least partly polled, the usage of disbudding in Finnish beef farms may be rare, but is yet to be studied.

Disbudding entails destroying the horn buds in young calves up to 8–12 weeks of age prior to any horn material becoming visible (ALCASDE 2009). The term 'dehorning' refers to amputation of the horns once they grow longer and become

attached to the underlying frontal sinus. This is common in beef cattle around weaning worldwide, but is not performed in Finland (ALCASDE 2009). Tipping is practiced as an alternative to dehorning cattle of various ages and the procedure can range from light tipping (2 cm cut off the end of the horn with no bleeding, ie blunting the horn) to heavy tipping (reducing the length of the horn to around 10 cm with bleeding and exposed cavities) (Prayaga 2007).

In the literature, use of the terms 'disbudding' and 'dehorning' varies and can cause confusion. It is often the case that 'dehorning' is used when 'disbudding' is meant. Hot-iron disbudding (the only legal method for disbudding in Finland), means that calf horn bud tissue is destroyed by burning with a heated metal bar with a concave tip. The very hot (approximately 600°C) metal burns the horn bud and surrounding tissue. The procedure is extremely painful to the calves (Graf & Senn 1999; Grøndahl-Nielsen *et al* 1999; Heinrich *et al* 2010) and the pain can persist for several days (Theurer *et al* 2012).

Pain impacts substantially on animal welfare: the greater the pain the poorer the welfare (Broom 1991). Pain has been

defined by the International Association for the Study of Pain as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage” (IASP 1979). Assessing pain in farm animals is crucial for its prevention, alleviation and improved animal welfare, and the producer plays a key role in everyday pain assessment (Muri & Valle 2012; Prunier *et al* 2013). Furthermore, cattle are a prey species and have had an evolutionary advantage in showing no clear behavioural signs of pain, sickness and weakness (Underwood 2002; Whay & Huxley 2005; Huxley & Whay 2006; Viñuela-Fernández *et al* 2007). It is, therefore, a challenge recognising signs of pain in cattle. Treatment decisions of both producers and veterinarians are affected by economic considerations (Whay & Huxley 2005; Weary *et al* 2006; Viñuela-Fernández *et al* 2007).

In the Theory of Planned Behaviour, a person’s intention to behave in a certain way is shaped through attitudes that predict their behaviour (Ajzen 2002). Studying the attitudes of the producers is important in predicting their behaviour. A positive attitude to cattle (Hemsworth *et al* 2000; Boivin *et al* 2003; Raussi 2003) is associated with better handling and a positive human-animal relationship (Grandin 2000; Boivin *et al* 2007), while negative handling of cattle (eg hitting and shouting at them) is associated with fear of humans and a negative human-animal relationship (Breuer *et al* 2000, 2003; Hemsworth *et al* 2000). Previous research into human-animal relationships has concentrated on producer attitudes and their behaviour and farm management (Seabrook & Wilkinson 2000; Hemsworth *et al* 2000, 2002), animal welfare (Waiblinger *et al* 2002; Coleman *et al* 2003; Hemsworth 2003) and production figures (Hemsworth *et al* 2000; Hanna *et al* 2009; Kauppinen *et al* 2012).

In a previous study, we found that dairy producers who perceived disbudding-related pain to be high, and who thus found it important to treat disbudding-related pain, were generally more sensitive to cattle pain overall (Wikman *et al* 2013). Furthermore, the producers’ attitudes to disbudding practices affected their attitudes towards cattle pain, their willingness to medicate calves they were disbudding themselves and their attitude towards keeping cattle with horns (Wikman *et al* 2013). We have also reported a positive correlation between producers’ perceptions of disbudding-related pain and their willingness to use pain alleviation for calves (Hokkanen *et al* 2015). These findings are in line with a study conducted among Canadian veterinarians: those veterinarians who perceived dehorning without analgesia to be painful were more likely to use analgesics (Hewson *et al* 2007). Little is known about beef producers’ perceptions of cattle pain and their attitudes towards disbudding.

The gender of the veterinarian has been found to affect pain assessment in animals (Capner *et al* 1999; Raekallio *et al* 2003; Huxley & Whay 2006) and also among veterinary students (Kielland *et al* 2009). Those Finnish female dairy producers who ranked disbudding pain higher, were more sensitive to cattle pain and more willing to treat the disbudding pain than male producers (Wikman *et al* 2013). Studies have also shown females in the veterinary profession to be

more empathic than their male counterparts towards animals (Paul & Podbersceck 2000; Hazel *et al* 2011) and that the empathy skills of veterinarians influences their pain scoring (Norrington *et al* 2014).

Age and work experience may also affect pain assessment. Previously, it was shown that older dairy producers were more sensitive to cattle pain than middle-aged and younger producers (Wikman *et al* 2013). Similarly, Kielland *et al* (2010) found that dairy producers’ personal experience with cattle sickness resulted in higher pain assessment, and a similar pattern of higher pain assessment and personal experience with animals has been noted among cattle veterinarians (Huxley & Whay 2006) and veterinary nurses (Coleman & Slingsby 2007).

In smaller dairy herds, the producer has a closer relationship with the animals and more frequent human-animal interactions than in larger dairy herds and pays more attention to the individual animals (Dockès & Kling-Eveillard 2006). Amongst part-time producers with smaller herds, the human-animal relationship might be stronger compared to those with bigger herds (Wilkie 2005). In a recent study on pigs, the producers on larger farms perceived treating animals humanely as being more difficult than on smaller farms (Kauppinen *et al* 2012). Herd sizes in Finnish beef farms tend to be relatively small, the average herd size being 27 dams (LUKE, Natural Resources Institute Finland 2015), and beef cattle are often kept in connection with other types of farming, such as dairy or crop farming.

Our aim was to study beef producer attitudes to the painfulness of different cattle diseases and disbudding practices, and also establish the background factors associated with such attitudes. We hypothesised that producers’ attitudes towards pain during disbudding would have an effect on their attitudes to cattle pain in general. We also expected that females would rank pain higher than males and that herd size and work experience would have some influence on producers’ estimation of pain during disbudding.

Materials and methods

Study design and subjects

In January 2011, a four-page, postage-paid questionnaire was sent out to 1,000 Finnish beef producers (see supplementary material to papers published in *Animal Welfare* on the UFAW website: <http://www.ufaw.org.uk/the-ufaw-journal/supplementary-material>). The research protocol was approved by the Finnish Agency for Rural Affairs. Producers were selected randomly from a geographically balanced list of all 2,264 beef producers in Finland (TIKE, Information Center of the Ministry of Agriculture and Forestry 2010). The questionnaire was sent to producers in both Finnish and Swedish, enabling all beef producers to respond in their mother tongue. The questionnaire was tested on ten beef producers prior to being mailed out to ensure it was appropriate and valid. All data from the questionnaires were analysed without identifying the respondents or their farms. This is part of a larger study and the methods are described in detail in Wikman *et al* (2013).

Questionnaire

The questionnaire comprised five parts and included 66 questions. In the first part, we included ten background information questions about the respondent and their farm, including gender, barn type, number of years employed as a beef producer, herd size and breed. The second part included six questions about disbudding calves, such as those about on-farm disbudding and the association of horns with dangerous situations, and on the prevalence of polled, tipped adult cows and horned.

The third part included eleven questions about disbudding practices and was intended only for producers performing disbudding, and the questions were related to how disbudding was performed on the farm, eg who disbudded on the farm, whether pain medication and analgesia were used, and at what age disbudding occurred.

Part four included statements about disbudding and was intended for all producers, regardless of whether disbudding was carried out on the farm or not. Respondents were asked to rate their agreement with 25 disbudding animal-welfare-related statements on a five-point Likert scale (Raekallio *et al* 2003). The scores ranged from 1–5, in which 1 corresponded to complete disagreement and 5 to complete agreement.

In part five, we asked for opinions about cattle diseases and practices that caused pain to cattle, using statements about pain in beef cattle. The evaluation of pain included 14 statements and was made using an eleven-point numerical rating scale (NRS) (Whay & Huxley 2005; Huxley & Whay 2006; Hudson *et al* 2008; Kielland *et al* 2009). The scores ranged from 0–10, where 0 represented no pain and 10 the highest degree of pain. In this paper we just report relevant results from parts 1–2, 4–5 and just one question from part 3 because the focus is mainly on the attitudes of the beef producer.

Statistical analysis

In total, 436 (44%) of the 1,000 producers responded to the questionnaire, of which seven respondents did not reply to the statements in parts 4 and 5 and were therefore excluded from the analysis. Ultimately, answers from a total of 429 respondents (19% of all Finnish beef producers at the time) were analysed.

Factor analysis with Principal Components Method using Promax rotation was used to establish summary variables in the data to be used in further analyses. The 25 different statements concerning disbudding (part 4) and 14 statements concerning cattle pain (part 5) were used in the factor analysis. Eigenvalues over one were extracted and variables with communalities below 0.3 omitted (Zhan & Shen 1994; Knapp & Brown 1995; Vaartio *et al* 2009). Missing values (4.3% of all 16,008 values) were replaced with means (Newman 2014). The factor loadings gave a total of 12 different factors. If the Cronbach's alpha value calculated from absolute value of factor loadings was under 0.6 the factor was omitted (Knapp & Brown 1995; Wikman *et al* 2013). Factor scores were calculated from the rotated factor loadings using the regression method (DiStefano *et al* 2009).

Table 1 Beef producer profiles and farm factors in percentages.

| Profile of the questionnaire respondents | Respondents (%) | |
|--|-----------------|----|
| Gender | Male | 68 |
| | Female | 32 |
| Age (years) | ≥ 55 | 23 |
| | 40–54 | 51 |
| | ≤ 39 | 26 |
| Working experience | 0–5 | 36 |
| | 6–10 | 25 |
| | 11–20 | 21 |
| | > 20 | 18 |
| Herd size (number of cows per farm) | 1–20 | 42 |
| | 21–40 | 32 |
| | 41–60 | 15 |
| | > 61 | 11 |
| Barn type | Tie-stall | 15 |
| | Free-stall | 58 |
| | Data missing | 27 |
| Herd healthcare agreement | | 58 |

Respondents; n = 429.

Before analyses, the herd size was categorised as 1–20, 21–40, 41–60 and > 61 cows. The classification was utilised in order to correspond with the relatively small size of Finnish cattle farms. Many of the factors were non-normally distributed and, thus, we chose to use non-parametric univariate tests. The differences in factor scores between genders were tested with Mann-Whitney *U*-tests. The differences in factor scores among producers with differing herd sizes (1–20, 21–40, 41–60 and > 61) and producers of different ages (≥ 55 years, 40–54 years and ≤ 39 years) and with different work experience (0–5 years, 6–10 years, 11–20 years and > 20 years) were tested first with a Kruskal-Wallis test and, if significant, the pair-wise comparisons were carried out via a Mann-Whitney *U*-test using Bonferroni corrections. Mann-Whitney *U*-tests were used to analyse differences in factor scores between the producers performing disbudding and not doing so. The correlations between the factor scores were analysed with Spearman Rank tests and only correlations with coefficients over 0.25 are reported here. Results are presented as medians (interquartile range, IQR) or proportions of respondents. IBM SPSS Statistics 22 (IBM Corp, Armonk, NY, USA) was used for the statistical analyses.

Results

Profile of the respondent and farm factors

The descriptive figures of the respondents and farm factors are shown in Table 1. Two-thirds of the respondents were male producers. Approximately half of the respondents were 40–54 years old and over one-third had been working with beef cattle for less than five years. More than half of the respondents had free-stalls, but there were numerous missing data (27%). More than half of the respondents belonged to the national veterinary herd health management programme.

Table 2 Prevalence of disbudding, the age of calves to be disbudded, the prevalence of polled cattle, tipped cows and cows with horns and dangerous situations caused by horns.

| Question | Category | Prevalence (%) |
|--|-------------------------|----------------|
| Do you disbud on your farm? (n = 427) | Yes, all of the calves | 4% |
| | Yes, some of the calves | 10% |
| At which age are the calves disbudded, on average, on your farm (n = 66) | No | 86% |
| | Less than a week | 3% |
| | 1–2 weeks | 32% |
| | 2–4 weeks | 58% |
| Do you have beef cows with horns? (n = 428) | Over 4 weeks | 7% |
| | Yes | 80% |
| | No | 20% |
| Do you have polled beef cows? (n = 420) | Yes | 82% |
| | No | 18% |
| Do you have tipped (horns sawn) beef cows? (n = 426) | Yes | 23% |
| | No | 77% |
| If you currently have or previously had cows with horns, do horns pose any danger to humans? (n = 403) | Yes | 55% |
| | No | 45% |

Disbudding practices

Most of the respondents (86%) did not disbud calves and, of those that did, over 90% disbudded the calves at younger than four weeks of age. Approximately 80% of the respondents had polled animals in their herd and only 18% of all respondents had no polled beef cows at all. Over half of the respondents with experience of horns reported that horns have been potentially dangerous to stockpeople. These results are presented in Table 2.

Factors in general

We secured all four tested factors with 3–8 loadings and a Cronbach alpha value of 0.68–0.88. The four factors explained 37.9% of the variance in the data. These factors described the producers' assessment of disbudding-related pain, their sensitivity to pain in cattle in general, their willingness to self-medicate disbudded calves and their perceived importance of horns (Factors I–IV, respectively) (Table 3).

Correlation between factor scores

A positive correlation between Factors I ('taking disbudding pain seriously') and II ('sensitivity to pain caused by cattle diseases') was established ($r_s = 0.35$; $P < 0.05$). No other significant correlations between factor scores were found.

Relationship between factor scores and gender

Scores for Factor I ('taking disbudding pain seriously'), Factor II ('sensitivity to pain caused by cattle diseases') and Factor III ('ready to medicate calves myself') differed significantly between male and female respondents ($P < 0.05$ for all): females had higher positive median scores than males (Table 4).

Relationship between factor scores age and work experience

Factor II ('sensitivity to pain caused by cattle diseases') and IV ('pro horns') scores differed between respondents in different age classes ($P < 0.05$) and *post hoc* comparisons showed that producers over 55 years old had higher scores than those aged 39 and younger ($P < 0.05$ for both) (Table 5).

The median (interquartile ranges) scores for Factor IV ('pro horns') also differed among producers within different work experience classes ($P < 0.05$). Producers with over 20 years of work experience had higher scores ($n = 77$, 0.35, 1.20) than those with 0–5 years ($n = 152$, -0.25, 1.34) or 11–20 years of work experience ($n = 88$, -0.18, 1.29) ($P < 0.05$ for both), not differing from the producers with 6–10 years of work experience ($n = 108$, -0.09, 1.32).

Relationship between the factor scores and mean herd size

Scores for Factor I ('taking disbudding pain seriously') and Factor II ('sensitivity to pain caused by cattle diseases') differed between producers with different herd sizes ($P < 0.05$ for both). Scores for the Factor I ('taking disbudding pain seriously') producers with a herd size of 1–20 differed from those of producers with > 61 cows ($P < 0.05$). Scores for Factor II ('sensitivity to pain caused by cattle diseases') differed between producers with herd sizes of 1–20 cows, and those with 21–40 cows and > 61 cows ($P < 0.05$, for both) (Table 6).

Relationship between the factor scores and the use of disbudding on the farm

The use of disbudding on the farm had an effect on how producers favour horns in cattle (Table 7).

Discussion

Disbudding is not commonly practiced on Finnish beef farms. By studying the attitudes of producers towards pain during disbudding we can better predict the behaviour of the producers during disbudding-related activities. Beef producers' attitudes towards pain during disbudding were positively associated with their attitudes towards cattle pain in general. Further, there was no difference in these attitudes between farmers that did or did not disbud. Respondents' gender, age, work experience and herd size were associated with their attitudes towards disbudding-related practices.

Disbudding practices

In Finland, disbudding of beef cattle calves is practised in only 14% of beef farms, which is markedly lower than the previously reported value of 72% for dairy cattle in Finland (Hokkanen *et al* 2015) and in other countries (Vasseur *et al* 2010; Gottardo *et al* 2011). We established that 81% of the respondents had polled beef cows, which is much more than the 19% reported among dairy producers in Finland (Hokkanen *et al* 2015) but we did not ask about the proportion of polled cattle in respondents' farms. Breeding polled cattle is a more animal-welfare-friendly alternative to disbudding, which causes many pain-related problems

Table 3 Factor loadings for statements.

| Statements about disbudding (Likert) | Median attitude (interquartile range) | Factor I: Taking disbudding pain seriously | Factor II: Sensitivity to pain caused by cattle diseases | Factor III: Ready to medicate calves myself | Factor IV: Pro horns |
|--|---------------------------------------|--|--|---|----------------------|
| Disbudding without medication causes the calf pain | 5 (2) | 0.80 | | | |
| The calf requires no pain medication for disbudding | 1 (2) | -0.72 | | | |
| The calf may feel pain for as long as three days after the disbudding procedure | 3 (1) | 0.60 | | | |
| It is too expensive to have a veterinarian medicate the calf for disbudding | 4 (3) | -0.74 | | | |
| Sedation causes more problems for the calf than disbudding without medication | 2 (2) | -0.67 | | | |
| Painless disbudding increases the calf's welfare | 5 (1) | 0.36 | | | |
| I could never disbud calves without administering pain medication | 4 (2) | 0.72 | | | |
| Horns pose no risk to the stockperson | 2 (2) | | | | 0.56 |
| Sawing off the animals' horns is a better alternative than disbudding | 2 (2) | | | | 0.76 |
| Disbudding is not one of my favourite jobs | 5 (1) | | | | 0.41 |
| Calves should never be disbudded | 2 (2) | | | | 0.75 |
| Fully grown beef cows need their horns | 1 (2) | | | | 0.60 |
| If I could inject the calf with pain medication myself before disbudding, I would | 5 (1) | | | 0.88 | |
| If I could inject the calf with anaesthetics myself before the disbudding procedure (inject an anaesthetic substance around the horn buds) I would | 5 (1) | | | 0.91 | |
| If I could tranquilise (anaesthetise) the calf myself, I would | 5 (2) | | | 0.90 | |
| Statements about cattle pain (NRS) | Median attitude (interquartile range) | Factor I: Taking disbudding pain seriously | Factor II: Sensitivity to pain caused by cattle diseases | Factor III: Ready to medicate calves myself | Factor IV: Pro horns |
| Disbudding without pain medication (pain during the burning) | 9 (3) | 0.59 | | | |
| Navel infection in a calf (navel is thick and moist, animal is feverish) | 7 (2) | | 0.40 | | |
| Acute mastitis | 7 (3) | | 0.57 | | |
| Uterine prolapse in cattle | 7 (4) | | 0.83 | | |
| Uterine hernias the size of a large apple in a calf | 5 (3) | | 0.67 | | |
| Abomasal displacement in cattle | 8 (3) | | 0.95 | | |
| Severe tympania in cattle | 8 (2) | | 0.92 | | |
| Teat tramping in cow (teat broken at the root) | 8 (3) | | 0.69 | | |
| Eigenvalues of the factors | | 3.39 | 5.98 | 3.20 | 2.21 |
| Variance explained % (total 37.9%) | | 8.69 | 15.33 | 8.20 | 5.68 |
| Cronbach's alpha | | 0.80 | 0.86 | 0.88 | 0.68 |

Statements about disbudding: 1 = completely disagree, 5 = completely agree. Pain in beef cattle, 0 = no pain, 10 most severe pain. N = 429, medians (interquartile ranges).

Table 4 The differences in factor scores between producers of different gender.

| Factor | Gender | | |
|---|----------------|------------------|---------|
| | Male (n = 293) | Female (n = 135) | P-value |
| Factor I: Taking disbudding pain seriously | -0.12 (1.46) | 0.60 (1.28) | 0.001 |
| Factor II: Sensitivity to pain caused by cattle diseases | -0.08 (1.39) | 0.36 (1.05) | 0.001 |
| Factor III: Ready to medicate calves myself | 0.09 (1.25) | 0.56 (1.00) | 0.04 |
| Factor IV: Pro horns | -0.11 (1.34) | 0.08 (1.45) | 0.36 |

Results are presented as medians (interquartile ranges in parentheses).

Table 5 The differences in factor scores for producers of different age (n = 424).

| Factors | Age | | | P-value |
|---|--------------------------------|----------------------------|--------------------------|---------|
| | 39 years and younger (n = 111) | 40–54 years (n = 214) | Over 55 years (n = 99) | |
| Factor I: Taking disbudding pain seriously | -0.12 (1.44) ^a | 0.05 (1.51) ^a | 0.19 (1.52) ^a | 0.10 |
| Factor II: Sensitivity to pain caused by cattle diseases | -0.04 (1.46) ^a | 0.09 (1.36) ^{ab} | 0.32 (1.29) ^b | 0.01 |
| Factor III: Ready to medicate calves myself | 0.32 (1.08) ^a | 0.38 (1.11) ^a | 0.01 (1.95) ^a | 0.09 |
| Factor IV: Pro horns | -0.26 (1.28) ^a | -0.06 (1.42) ^{ab} | 0.22 (1.53) ^b | 0.01 |

Results are presented as medians (interquartile ranges in parentheses). Numbers in rows lacking common letters differ statistically ($P < 0.05$).

Table 6 The differences in factor scores for producers with different herd size (n = 421).

| Factors | Herd size | | | | P-value |
|---|--------------------------|----------------------------|---------------------------|---------------------------|---------|
| | 1–20 cows (n = 178) | 21–40 cows (n = 136) | 41–60 cows (n = 63) | > 61 cows (n = 44) | |
| Factor I: Taking disbudding pain seriously | 0.32 (1.43) ^a | -0.04 (1.38) ^{ab} | 0.01 (1.64) ^{ab} | -0.27 (1.47) ^b | 0.01 |
| Factor II: Sensitivity to pain caused by cattle diseases | 0.23 (1.24) ^a | -0.06 (1.55) ^b | 0.04 (1.16) ^{ab} | -0.31 (1.17) ^b | 0.002 |
| Factor III: Ready to medicate calves myself | 0.14 (1.29) ^a | 0.22 (1.08) ^a | 0.58 (1.02) ^a | 0.44 (1.18) ^a | 0.30 |
| Factor IV: Pro horns | 0.08 (1.60) ^a | -0.16 (1.20) ^a | -0.29 (1.32) ^a | -0.15 (1.61) ^a | 0.07 |

Results are presented as medians (interquartile ranges in parentheses). Numbers in rows lacking common letters differ statistically ($P < 0.05$).

(Prayaga 2007; Spurlock *et al* 2014, Kling-Eveillard *et al* 2015). The beef calves are usually disbudded at less than four weeks of age (93%) similar to Finnish dairy calves (95%) (Hokkanen *et al* 2015). Of producers, 23% reported that they kept a number of tipped animals.

Possible reasons for the small disbudding proportion reported in beef farms, in addition to keeping polled beef breeds, include the tradition of keeping horned cattle (also reported in other countries: ALCASDE 2009;

Kling-Eveillard *et al* 2015), the fact that horns are relatively small in the most common beef breeds in Finland and that there are inherent difficulties in disbudding calves kept with their dams. Furthermore, beef cattle with horns seem to be slightly less dangerous to humans compared to horned dairy cattle in Finland (Hokkanen *et al* 2015). Even so, beef producers using disbudding were more critical towards horns than respondents who did not disbud calves on their farms (Table 7).

Table 7 The difference in factor scores for producers who used disbudding on their farms (n = 57) and producers who did not use disbudding (n = 370).

| Factor | Use of disbudding | | P-value |
|---|---------------------------|--------------------------|---------|
| | Yes (n = 57) | No (n = 370) | |
| Factor I: Taking disbudding pain seriously | 0.23 (1.71) ^a | 0.03 (1.49) ^a | 0.46 |
| Factor II: Sensitivity to pain caused by cattle diseases | 0.09 (1.40) ^a | 0.08 (1.35) ^a | 0.62 |
| Factor III: Ready to medicate calves myself | 0.25 (1.59) ^a | 0.22 (1.13) ^a | 0.69 |
| Factor IV: Pro horns | -1.23 (0.72) ^a | 0.08 (1.26) ^b | 0.001 |

Results are presented as medians (interquartile ranges in parentheses). Numbers in rows lacking common letters differ statistically ($P < 0.05$).

Assessment of disbudding-related pain

Respondents were generally well aware that hot-iron disbudding without medication is very painful (Table 3) and the use or otherwise of disbudding on the farm was not associated with beef producers' attitudes towards disbudding-related pain, or to their sensitivity to pain in cattle in general (Table 7). Overall, producers who took disbudding pain seriously were more sensitive to pain in cattle, in general, which was also previously found for Finnish dairy producers (Wikman *et al* 2013). Our findings are similar to previous research in which producers with positive attitudes to animal welfare scored higher for empathy and for perception of animal pain than those with negative attitudes (Kielland *et al* 2010).

Interview-based studies conducted among beef producers in Canada (Spooner 2013) and in European countries (Kling-Eveillard *et al* 2015) show that producers' estimations of the severity of disbudding pain vary and that the majority of interviewed producers perceived pain related to disbudding or dehorning as short term and claimed that no pain alleviation is needed. Furthermore, the respondents in the current study considered it to be rather expensive to call a veterinarian to treat disbudding pain; a finding in line with previous observations on Finnish dairy producers (Wikman *et al* 2013; Hokkanen *et al* 2015).

Overall, using pain relief for cattle to be disbudded or dehorned is not very common worldwide (Fulwider 2008; ALCASDE 2009; Vasseur *et al* 2010; Gottardo *et al* 2011; Spooner 2013). The first obstacle to better pain alleviation during painful procedures is the lack of recognition of pain. This study shows that Finnish beef producers, in keeping with Finnish dairy producers (Hokkanen *et al* 2015), lack a clear opinion regarding the duration of pain in connection with disbudding. However, they did agree that disbudding without medication is painful, and that painless disbudding would increase calf welfare. It has been shown among Finnish dairy producers (Hokkanen *et al* 2015) and among Canadian veterinarians (Hewson *et al* 2007) that there is a positive relationship between a persons' perceptions of pain and willingness to use pain relief in calves before disbudding or dehorning. However,

in this study we cannot conclude whether the perceived price actually prevented beef producers from asking a veterinarian to medicate the calves prior to disbudding.

Finnish beef producers would be willing to medicate calves with sedatives, local anaesthetics and non-steroidal anti-inflammatory drugs (NSAIDs, such as meloxicam), themselves, without veterinary intervention, were it possible in Finland (Table 3). This was not associated with whether or not they practised disbudding on their farms (Table 7). This finding is similar to previous results among Finnish dairy producers (Wikman *et al* 2013) and among interviewed European beef producers (Kling-Eveillard *et al* 2015). In Finland, as is the case in the other Nordic countries, drugs administered to animals are strictly controlled by legislation. In Finland, it is not possible for producers to use local anaesthetics or sedatives to alleviate disbudding-related pain because the drugs are reserved solely for veterinary use. Only NSAIDs can be prescribed for treating post-operative disbudding-related pain under certain circumstances (Finlex; The Act on the Medical Treatment in Animals 387/2014). However, there is, currently, ongoing discussion on disbudding-related legislation in Finland. If future Finnish law requires proper medication of disbudded calves, then it will be necessary to have either obligatory veterinary care, or legislative changes to allow cattle producers to provide sedation and local anaesthesia to their calves.

Gender

Female beef producers took disbudding pain more seriously, were more sensitive to pain caused by cattle diseases and were more willing to medicate calves themselves than their male counterparts. The same results for gender considerations were reported for dairy producers (Wikman *et al* 2013). This corresponds with a number of other studies that showed females rate cattle pain higher than males (Huxley & Whay 2006; Kielland *et al* 2009; Laven *et al* 2009) and, in general, females are more empathic to animals and score animal pain higher and treat animal pain more than males (Capner *et al* 1999; Paul & Podbersceck 2000; Raekallio *et al* 2003; Huxley & Whay 2006). Moreover, no gender effect was established regarding favouring horns. This corresponds with the report on dairy producers (Wikman *et al* 2013).

Age and work experience

There was no effect of age and work experience on beef producers' estimations of the severity of disbudding pain. Beef producers of an older age (over 55 years) were more sensitive to cattle pain caused by disease than producers aged 39 years and younger. These patterns were the same as those noted for Finnish dairy producers (Wikman *et al* 2013). This also corresponds with the findings that older dairy producers with personal experience of different cattle diseases give higher empathy scores (Kielland *et al* 2010). Also, older veterinary nurses give higher pain assessment for animals due to personal experience (Coleman & Slingsby 2007). There was no work experience effect on producers' sensitivity to cattle pain, which corresponded to our research on dairy producers (Wikman *et al* 2013). We did not ask about respondents' history prior to their employment as beef producers. Producers' experience with cattle from childhood might have an effect on their empathy skills and this would be worth studying in the future, especially in countries where cattle are still very often raised in family-operated farms.

Neither age nor working experience affected beef producers willingness to medicate calves. It is possible that farmer-medication of beef cattle calves has, however, failed to become an issue in Finland as disbudding is so seldom performed on Finnish beef farms. These results differ from the finding for dairy producers: younger Finnish dairy producers (under 39 years) were more willing to medicate calves themselves without veterinary intervention than older producers (Wikman *et al* 2013).

Beef producers older than 55 years were more in favour of horns compared with 39-year olds and younger, similarly to dairy producers (Wikman *et al* 2013). However, beef producers with over 20 years working experience had higher scores for the 'pro horn factor' than those who had worked 0–5 and 11–20 years, unlike for dairy cattle (Wikman *et al* 2013). Older and more experienced beef producers were more in favour of horned cattle, perhaps for aesthetic or traditional reasons. Gottardo *et al* (2011) found the main reasons for keeping the horns on dairy cattle were aesthetic, lack of time and tradition. According to the ALCASDE report (2009), tradition and aesthetic reasoning are important for keeping horned beef cattle.

Herd size

Beef producers with small herds (1–20 cows) took disbudding-related pain more seriously than producers with larger herds (> 61 cows) while no herd size effect was recorded among dairy producers (Gottardo *et al* 2011; Wikman *et al* 2013; Hokkanen *et al* 2015). Beef producers with smaller herds (1–20 cows) were more sensitive to pain due to cattle diseases than producers with medium-sized (21–40 cows) or large herds (over 61 cows). This contrasts with our previous research in dairy cattle (Wikman *et al* 2013) where no effect of herd size was found. It has been shown that producers with smaller herds have a stronger human-animal relationship (Wilkie 2005) and it may be that in smaller herds the producer can pay more attention to the individual animal and has a closer human-animal relationship (Dockès & Kling-Eveillard 2006). The reason why this difference is not seen among dairy producers requires further research.

No differences between herds of different size were established regarding the producers' willingness to medicate calves themselves, and this is in line with findings for dairy producers (Wikman *et al* 2013). Also, no differences were found between herds of different size or with respect to the degree of the beef producers' positive attitude towards horned cattle. This result differs from that for dairy producers (Wikman *et al* 2013), where the smallest herd size differed from the other sizes. Disbudding is more common in bigger dairy herds than in smaller ones (Hoe & Ruegg 2006; Vasseur *et al* 2010; Hokkanen *et al* 2015).

Animal welfare implications and conclusion

Disbudding without pain medication is a painful procedure for calves, and a growing concern for the general public. This concern is further reflected in the topic being discussed as part of the ongoing preparation of an update of the Finnish animal protection legislation. Our results show that Finnish beef producers are well aware that disbudding is very painful for calves and those who took disbudding pain seriously were also more sensitive to pain in cattle in general. The manner in which producers, those responsible for the animals in their care every day, assess cattle pain has important implications for animal welfare, and for the use of pain relief in connection with painful procedures, conditions and various diseases. We suggest that increased knowledge among producers about pain, calf pain-related behaviours, and also proper pain management practices could increase the application of pain medication before disbudding, as well as in connection with other painful conditions. On the other hand, some producers despite agreeing that disbudding is a painful procedure for calves, felt that calling a veterinarian to medicate is too expensive. Economic factors may be a restrictive factor for preventing proper care of disbudding pain, but this is a topic that need further investigation.

Female and older beef producers were more sensitive to cattle pain than males and younger persons, a possible reflection of their greater empathy towards cattle. Also, beef producers with smaller herds took disbudding pain more seriously and were more sensitive to cattle pain than those with larger herds, perhaps indicating a closer human-animal relationship. The possible importance of empathy on how producers assess pain supports the need to educate professionals in understanding the relevance of pain for cattle also when aiming at promoting more animal welfare-friendly disbudding practices.

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