The Old School, Brewhouse Hill, Wheathampstead,
Hertfordshire AL4 8AN, UK
www.ufaw.org.uk

Animal Welfare 2012, 21: 547-558
ISSN 0962-7286
doi: 10.7120/09627286.21.4.547

Human-animal relationships in the Norwegian dairy goat industry: assessment of pain and provision of veterinary treatment (Part II)

K Muri*† and PS Valle†‡

† Norwegian School of Veterinary Science, Department of Production Animal Clinical Sciences, PO Box 8146 Dep, 0033 Oslo, Norway
‡ Molde University College, Head Office, PO Box 2110, 6402 Molde, Norway
* Contact for correspondence and requests for reprints: e-mail: karianne.muri@nvh.no

Abstract

Stockpeoples' ability to recognise pain in their livestock, and to respond appropriately, is of utmost importance for animal welfare. Assessment of pain is complex, and attitudes and empathy are thought to play a role in peoples' responses to the sight of pain. In a separate paper we investigated the dimensionality of Norwegian dairy goat stockpeoples' goat-oriented attitudes and empathy. This paper investigates how the stockpeople assess and manage pain and disease in goats. The interrelationships between pain perception and provision of veterinary attention were explored, as well as how these two measures are associated with demographics, attitudes and empathy. Pain assessment scores for individual conditions ranged across most of the picture-based pain assessment scale. Dystocia, gangrenous mastitis and the neurological form of caprine arthritis encephalitis were considered most painful. Linear regression showed that one attitude dimension was positively associated with mean pain assessment score (mPAS), while growing up on a goat farm, having farming as main income and having seen a large number of the conditions were negatively associated with mPAS. Cluster analysis on reported frequency of contacting veterinary surgeons for ten conditions revealed two distinct groups of stockpeople. Logistic regression showed that females, older stockpeople and stockpeople who grew up in a rural district were significantly more likely to be in the group that more frequently contacted veterinary surgeons. We conclude that training of stockpeople needs to focus on evaluation and management of pain to ensure a high standard of animal welfare.

Keywords: *animal welfare, dairy goats, human-animal relationships, pain assessment, pain management, veterinary treatment*

Introduction

Stockpeoples' ability to recognise pain in their livestock, and to respond appropriately, is of utmost importance for animal welfare. Pain has been defined by the International Association for the Study of Pain (IASP) as "the unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" (Loeser & Treede 2008). The 'Five Freedoms' and the accompanying provisions (FAWC 1993) are widely accepted as a solid framework for evaluation of the welfare of farm animals, and the actions required to safeguard animal welfare. The third freedom states that animals should have "freedom from pain, injury and disease — by prevention or rapid diagnosis and treatment" (FAWC 1993). All animals will inevitably experience some pain at times, as it is an inherent part of living. However, high welfare standards require that steps are taken to prevent unnecessary pain and rapidly alleviate unavoidable pain. In the livestock industries pain may result from injuries, diseases, management practices and poor handling techniques. Examples from the dairy goat industry include the routine disbudding of goat kids (albeit with local anaesthesia and long-acting pain relief according to Norwegian legislation [Norwegian Ministry of Agriculture and Food 2005]), mastitis, chronic infectious diseases and lameness. Research applying objective methods to evaluate pain involved in any condition in goats is lacking, with the exception of pain related to disbudding (Alvarez *et al* 2009; Alvarez & Gutiérrez 2010). Physiological measures may be useful in prey species that are unlikely to display overt signs of pain unless there are advanced injuries or disease, but the technical requirements render these methods less feasible for on-farm assessment (Anil *et al* 2005; Weary *et al* 2006). This underlines the importance of the stockpeoples' skills in identifying and quantifying pain based on qualitative observations of subtle behavioural changes, but also based on clinical symptoms, as the severity of lesions may be related to pain severity (Gregory 2010). Thus, early identification and accurate assessment of pain requires knowledge about health and natural behaviour of the species and a good knowledge of the individual animal (Molony & Kent 1997; Rutherford 2002).

Research on attitudes towards pain in animals has mostly addressed the perspectives of veterinary surgeons (Price

et al 2002; Raekallio *et al* 2003; Huxley & Whay 2006; Whay *et al* 2008; Fajt *et al* 2011), veterinary nurses (Coleman & Slingsby 2007) or veterinary students (Kielland *et al* 2009). Knowledge about how stockpeople perceive pain in farm animals, and how psychological constructs and background variables may influence that perception is scarce. However, Kielland *et al* (2010) used 21 photographs of dairy cattle suffering from a variety of conditions and asked dairy farmers to grade the pain. They found the median pain score to be positively associated with a statement reflecting attitudes about animals' experience of pain (Kielland *et al* 2010).

Research on the management of pain in farm animals has not received the same attention as that of companion animals (Anil *et al* 2005). Moreover, there are little empirical data on stockpeoples' decision-making related to contacting veterinary surgeons. In a British study, only 2.2% of sheep suffering from locomotor disorders received veterinary attention (Clements *et al* 2002), but national differences in the regulation of medical treatment suggests that this may not be representative for countries with stricter regulations. According to Norwegian legislation, medical treatment of animals must be initiated by veterinary surgeons (Norwegian Parliament 2001). Although there may be alternative ways of managing animal pain, initiating appropriate medical treatment is an obvious example of helping behaviour towards animals suffering from disease, injury or other sources of pain. Evidence suggests that negative attitudes towards an individual in pain reduce the likelihood of helping behaviour (Hein *et al* 2010). Research has also indicated that helping behaviour is a function of empathy (Mehrabian & Epstein 1972), and empathic responses to seeing targets suffering has been shown to predict helping behaviour (Hein *et al* 2010). On the other hand, some authors have suggested that empathy in itself does not suffice to induce helping behaviour, but must be turned into sympathy to motivate helping (de Vignemont & Singer 2006). Accordingly, empathy and helping behaviour are at least conceptually linked, as the initial affect sharing must be followed by an understanding of the target's feelings, which motivates concern for the target, and eventually helping behaviour (Singer & Lamm 2009). We have previously described the dimensionality of stockpeoples' goat-oriented attitudes and empathy (Muri *et al* 2012, this issue). In this study, we used variables representing these dimensions to investigate their relationships with the stockpeoples' perception of pain in goats and their tendency to seek veterinary treatment for specific conditions goats may suffer from.

Thus, the aim of this study was firstly to investigate how Norwegian dairy goat stockpeople assess pain in goats, and to explore their opinions pertaining to pain and animal welfare in the goat industry. Secondly, the aim was to examine how they manage cases of disease and suffering, in particular how frequently they request veterinary attention for specific conditions. Finally, we wished to explore the interrelationships between pain perception and provision of veterinary attention, and investigate how these two measures are associated with demographic variables and dimensions of attitudes and empathy.

Materials and methods

Questionnaire

The description of the questionnaire will be limited to the parts pertaining to the results presented in this paper. The entire questionnaire is available from the authors upon request. The questionnaire was developed in two formats; one internet-based version (QuestBack™) to the farmers we could reach by an email address, and one paper-version to be distributed in the post for the rest of the farmers (Muri *et al* 2012).

Part 1 — Demographics

Details about the demographics are presented in part 1 of this study (Muri *et al* 2012).

Part 2 — Pain assessment scale (PAS)

Twenty-three colour photographs presented the recipients with a wide range of acute and chronic conditions, including management procedures, infectious diseases, metabolic diseases and traumatic injuries, in both young and adult goats. The photographs were labelled with the name of the condition, and the recipients were instructed to score the pain experienced by the animal in each photograph on a Visual Analogue Scale (VAS), ranging from 'No pain' to 'Unbearable pain'. For the paper-based format the response was requested by drawing a mark on a standard 10-cm VAS. In the web-based format, the VAS was divided into 20 clickable areas, each representing 5% of the scale, but these divisions were not visible. Otherwise, the VAS was of the same colour and appearance as in the paper format.

Part 3 — Attitudes related to pain in goats

There were seven statements pertaining to pain and pain management, with responses requested on a seven-point rating scale from 'Totally disagree' to 'Totally agree'. The recipients were also asked an open question about what they consider the biggest animal welfare challenge in the goat industry. This part also comprised the attitude and empathy scales, which have been described elsewhere in this issue (Muri *et al* 2012).

Part 4 — Management of pain and health issues

This part included questions about whether the stockpeople had seen goats affected by 20 specific conditions, which were a subset of the 23 depicted conditions. The sum of conditions seen by each respondent made up a new variable. A veterinary treatment scale asked the stockpeople how often they provide veterinary attention for goats suffering from ten specific conditions, on a seven-point rating scale from 'Never' to 'Always'. 'Not applicable/I don't know' was included as an additional response choice. There were seven statements regarding alternatives for the management of disease in general, and finally there were three statements pertaining to the motivation to learn more about goat diseases, pain and welfare. Responses to these statements were also requested on seven-point rating scales.

For all the rating scales, the values between the extremes were numbered, but had no descriptors. A middle option (4) was interpreted as neutral, and was included to avoid forced choice.

https://doi.org/10.7120/09627286.21.4.547 Published online by Cambridge University Press

Subjects

The reference population was all Norwegian dairy goat farmers and the target population was formed from two original lists collected from the Goat Health Service and the Goat Milk Recording System, respectively. Eighty-nine percent of the dairy goat producers were enrolled in the Goat Milk Recording System in 2009. From these lists we accessed contact information for 480 dairy goat farms. The web-based questionnaire was successfully distributed by email to 217 farmers. The paper-based questionnaire was sent to the remaining 263 farmers. Non-responders were sent a reminder after three weeks and a second reminder five weeks after the first. We obtained 260 responses, and after adjusting for feedback from retired farmers the calculated response rate was 54%. However, according to Statistics Norway (2009), there were only 430 registered dairy goat herds in Norway at the time the data were collected, which suggests that the accurate response rate is somewhat higher.

Ethical considerations and confidentiality

The confidentiality issues were approved by the Norwegian Social Science Data Services (NSD, project number 19208) and communicated to the recipients in a cover letter. To safeguard anonymity, all the farms were given a four-digit code which replaced their identity in the response datasets. The paper questionnaires were pre-coded with this number, so the respondents did not need to supply any information regarding their identity. Only the first author had access to the database where these codes are linked to the identity of the farms.

Data management and statistical analysis

Data management and statistical analysis were performed in Microsoft Office Excel 2003 and Stata/SE 11.0 (StataCorp, College Station, TX, USA). Detailed descriptions of the initial data management and the Principal Component Factor Analysis (PCFA) of the attitude and empathy scales are presented in part 1 of this study (Muri *et al* 2012). The new ordinal grouped continuous index variables, based on the sub-scales from the PCFA, were used as independent variables in regression analyses in the present study.

The alpha coefficient (Cronbach 1951) was used to assess the internal consistencies of the pain assessment scale and the veterinary treatment scale. To assess whether there were any differences between groups of respondents we performed *t*-tests on equality of means. We generated a new variable (mPAS) representing the mean pain assessment score assigned by each respondent.

Cluster analysis

To explore the natural grouping of responses in the veterinary treatment scale, we conducted complete-linkage agglomerative hierarchical cluster analysis with the Manhattan (L1) distance measure. Prior to this analysis, the response category 'Not applicable/I don't know' was recoded to missing, to avoid biased means. This left the analysis with 103 observations. We generated a grouping variable at the level of two clusters. A new dataset was formed based on the means of the observations in the two clusters, and these data were transferred to Microsoft Office Excel 2003, where a radar chart was generated.

Regression analysis

The index variables representing attitude and empathy dimensions and the demographics variables were screened as predictors in the regression analyses. For the analyses with the veterinary treatment grouping variable as the outcome, mPAS was also screened. Prior to the model building, every predictor was screened by unconditional regression analysis, and the variables that were associated with the outcome variable at the level of $P \leq 0.2$ were selected for further analysis. This liberal *P*-value in the initial screening was chosen to avoid excluding predictors of which the effect becomes evident only when a confounder is controlled (Dohoo *et al* 2009). Significant predictors ($P < 0.05$) were kept in the final, multivariable regression model. For categorical independent variables with more than two categories, the overall significance was tested with multiple Wald's test. The ordinal attitude and empathy variables were screened in the reversed form to avoid having independent variables with few observations in the baseline category.

Robust linear regression was chosen to deal with concerns about failures to meet assumptions in the model with mPAS as the dependent variable. Q-Q plots, histograms of residuals and scatter plots for fitted values against residuals were used to assess the major assumptions of normal distribution of residuals and homoscedasticity (Dohoo *et al* 2009). To get an approximate estimate of how much of the variance the robust linear model explained we used the rregfit-command. To provide an estimate of the effect size of individual dichotomous independent variables, we calculated Cohen's *d* (Cohen 1992).

Logistic regression analysis was conducted with the veterinary treatment grouping variable from the cluster analysis as the dependent variable. A ROC curve was used to assess the predictive ability, and the Pearson's X^2 and Hosmer-Lemenshow tests were used to assess goodness-of-fit of the model (Dohoo *et al* 2009).

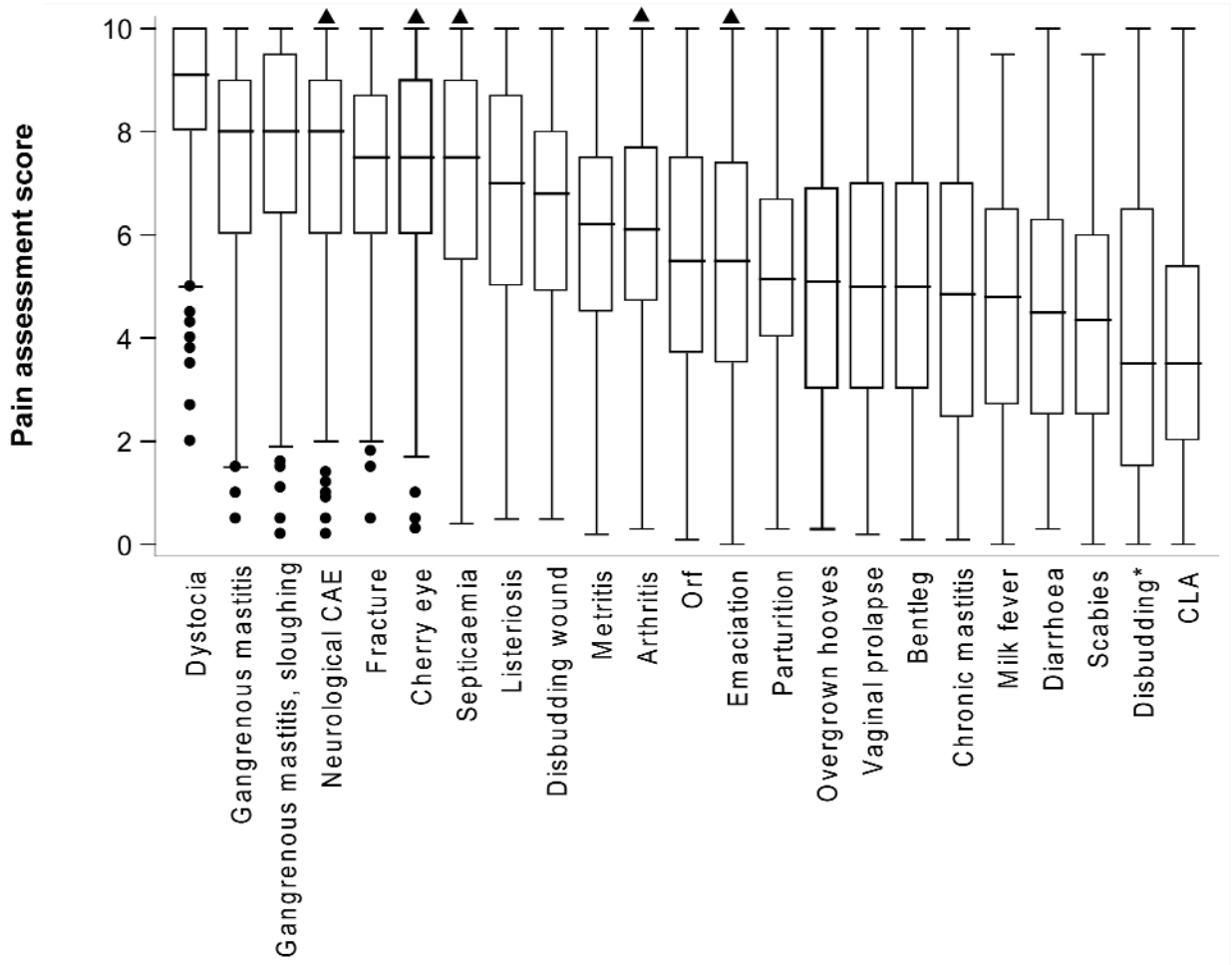
Results

Pain assessment

The internal consistency of the pain assessment scale was high in both questionnaire formats, with an overall $\alpha = 0.89$ (paper: $\alpha = 0.90$, web: $\alpha = 0.89$). The pain assessment scores assigned to neurological caprine arthritis encephalitis (CAE), cherry eye, septicaemia (young kid), arthritis and emaciation differed significantly ($P < 0.05$) between the two questionnaire formats, with higher pain scores assigned in the web format.

The median pain scores for all conditions are presented graphically in Figure 1. Overall, dystocia (Figure 2) was considered the most painful condition, followed by two examples of gangrenous mastitis (with and without sloughing of mammary tissue) and neurological CAE. Caseous lymphadenitis (CLA) (Figure 2), disbudding and scabies were assigned the lowest pain scores.

Figure 1



Boxplot with median pain scores. ▲ Significantly different mean pain assessment score ($P < 0.05$) between the two questionnaire formats. * With sedation and local anaesthesia.

Statements pertaining to pain

The distributions of the stockpeoples' responses to the statements pertaining to pain and pain alleviation are presented in Figure 3.

Farmers' perception of welfare challenges related to veterinary treatment

One hundred and ninety-six respondents gave a comment to this open question, but only the responses that specifically pertain to veterinary and medical treatment will be reported here. Thirty of them (15.3%) specifically mentioned that the value of goats is low compared to the cost of veterinary treatment. Ten respondents mentioned late access to veterinary services as a welfare problem, some specifying that the reason was long travel distances for the veterinary surgeons. Inadequate competence in goat health and medicine by veterinary surgeons was mentioned by six respondents, and eight respondents wrote that not having the opportunity to keep medication on the farm was an important welfare challenge.

Experience with painful conditions in goats

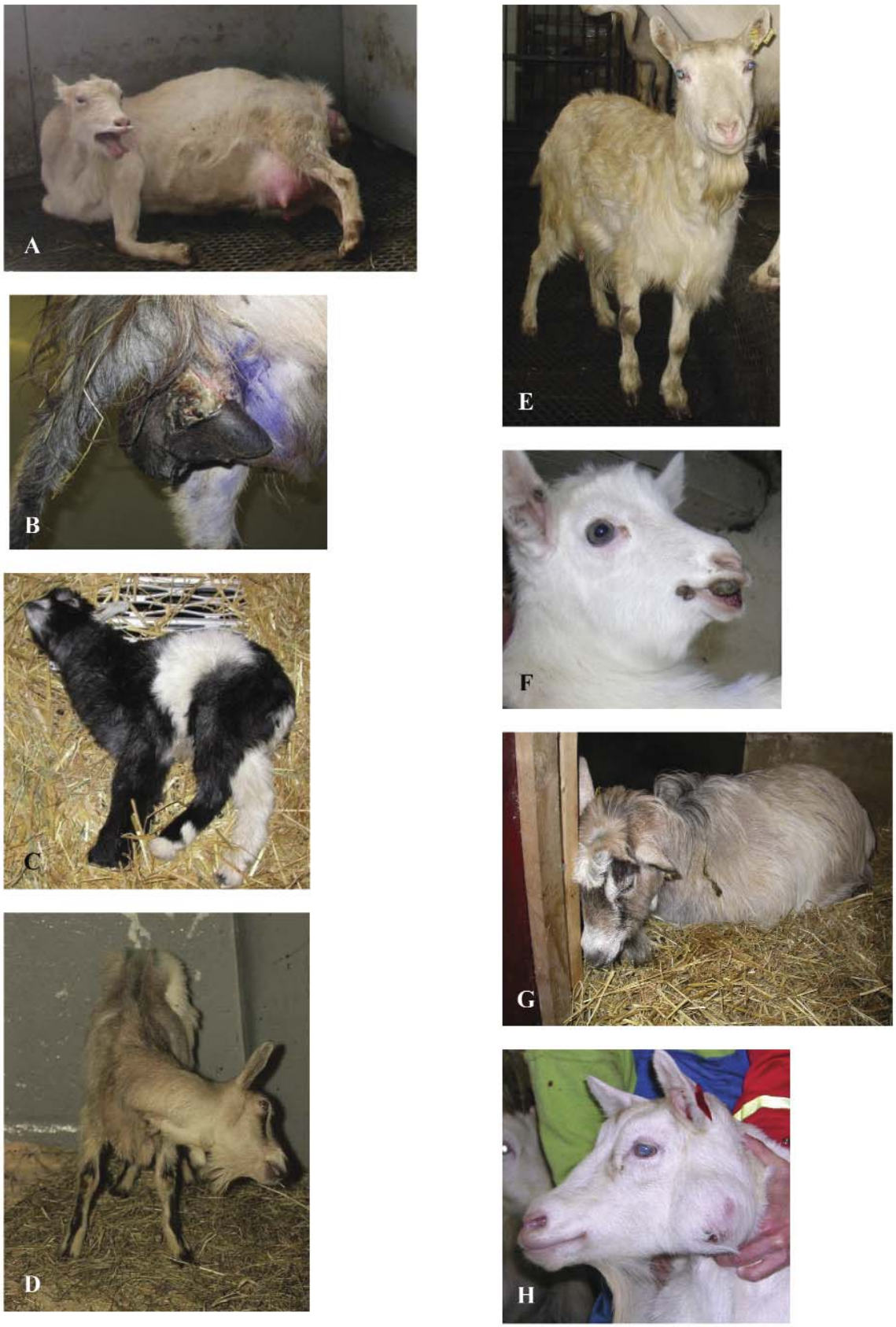
The number of conditions the respondents had seen ranged from one to 20, and the mean (± SD) was 15 (± 3) conditions. Five of the conditions were seen by more than 90% of the respondents; diarrhoea (98.8%), dystocia (98.1%), gangrenous mastitis (96.9%), disbudding (95.3%) and caseous lymphadenitis (92.3%). The least commonly seen conditions were neurological CAE (45.1%), bentleg (31.1 %) and septicaemia in kids (16.8 %).

Veterinary treatment for specific conditions

The internal consistency of the veterinary treatment scale was consistently high in both questionnaire formats (overall $\alpha = 0.83$). The farmers most frequently reported to provide veterinary treatment for goats with milk fever or acute mastitis with fever, while they least frequently reported to call the veterinarian for orf or emaciation (Table 1). Cluster analysis revealed two distinctly different groups of farmers in terms of responses to the veterinary treatment scale (Figure 4). *T*-tests on equality of means showed that group 1 (n = 19) scored significantly lower than group 2 (n = 84) on the veterinary treatment scale for all ten conditions ($P < 0.01$ for orf, $P < 0.001$ for all other conditions).

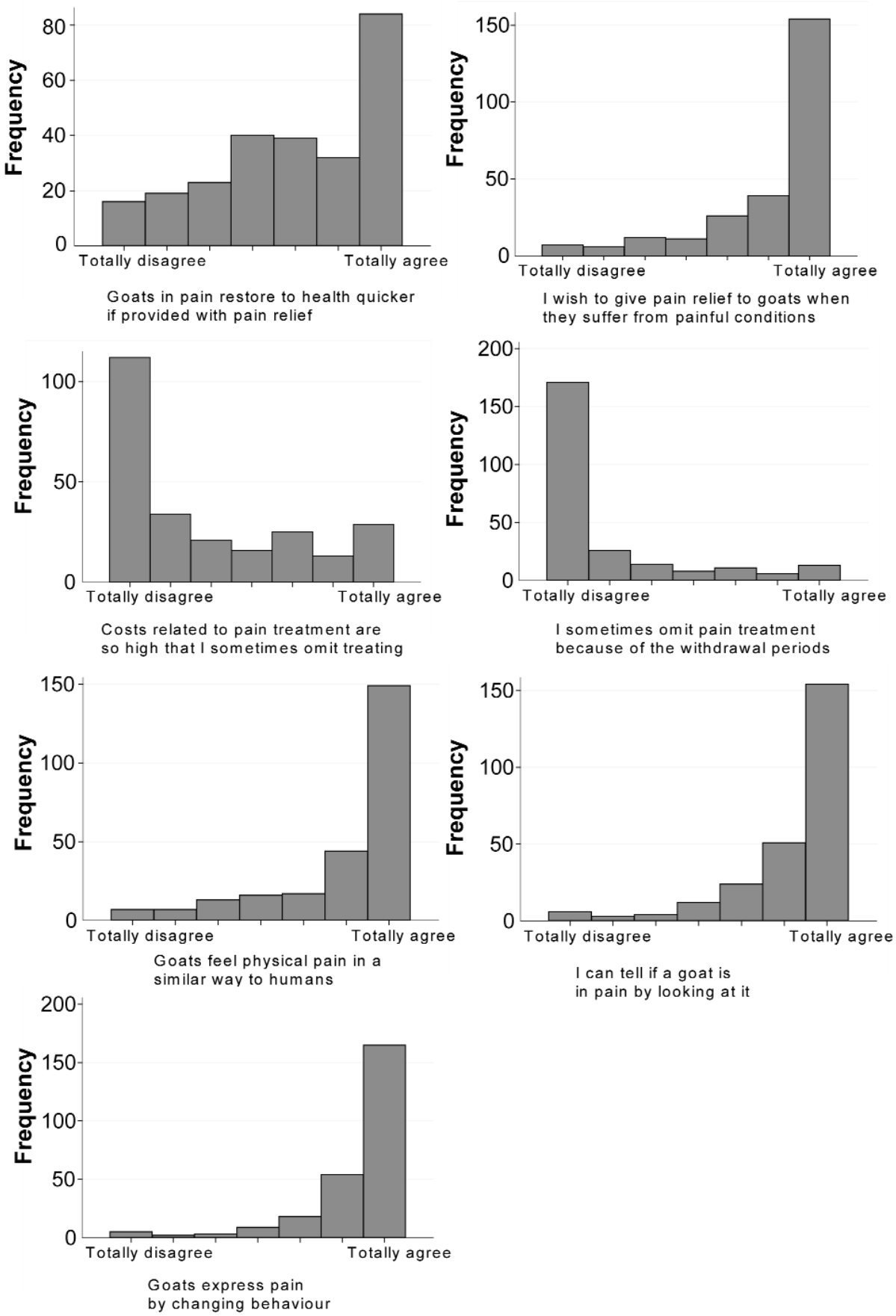
https://doi.org/10.7120/09627286.21.4.547 Published online by Cambridge University Press

Figure 2



Photographs from the pain assessment instrument showing: (A) dystocia, (B) gangrenous mastitis with sloughing, (C) septicaemia, (D) listeriosis, (E) arthritis, (F) orf, (G) milk fever and (H) caseous lymphadenitis.
Photographs courtesy of (A) M Hansen, (B, E) K Muri, (F, H) N Leine and (C, D, G) The Norwegian School of Veterinary Science.

Figure 3



Distribution of responses to statements pertaining to pain.

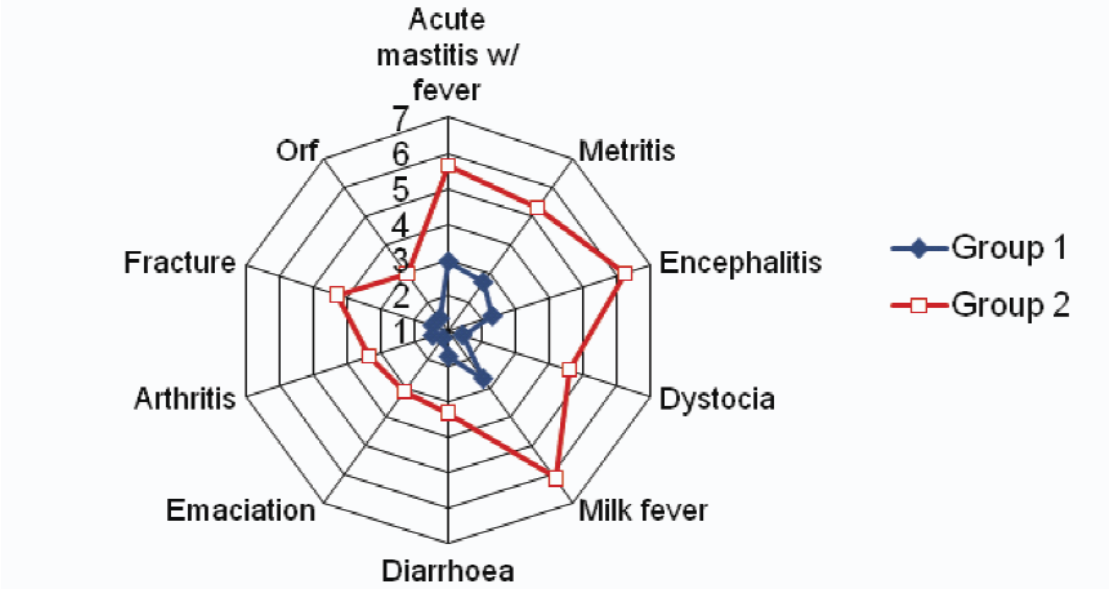
https://doi.org/10.7120/09627286.21.4.547 Published online by Cambridge University Press

Table 1 The percentage of farmers responding to each category about frequency of contacting the veterinary surgeon for ten specific conditions.

Condition	1 = never	2	3	4	5	6	7 = always	N/A
Acute mastitis with fever	6.6	5.5	6.2	9.0	11.3	12.5	46.7	2.3
Metritis	10.1	7.0	9.3	10.1	8.2	9.7	33.5	12.1
Encephalitis	10.9	6.2	2.3	5.5	7.0	11.3	42.8	14.0
Dystocia	14.3	15.4	14.3	15.8	12.0	10.8	15.4	1.9
Milk fever	5.8	4.3	3.5	4.3	3.5	7.0	52.3	19.4
Diarrhoea	31.9	17.9	13.6	14.8	11.3	3.1	4.7	2.7
Emaciation	30.2	14.3	6.6	12.0	5.4	2.7	5.0	23.6
Arthritis	25.6	13.4	8.7	9.5	5.5	5.5	5.9	26.0
Fractured limb	26.4	10.2	7.9	8.3	4.7	5.1	20.5	16.9
Orf	41.4	10.9	3.5	7.8	3.5	2.3	10.6	19.9

N/A = I don't know/not applicable (recoded to missing prior to cluster analysis).

Figure 4



Radar graph with mean responses regarding provision of veterinary treatment by the two groups revealed through cluster analysis: (1 = never, 7 = always).

Management of disease in general

The distributions of responses to the statements regarding seven specific management alternatives in relation to sick goats are presented in Figure 5.

Regression analysis

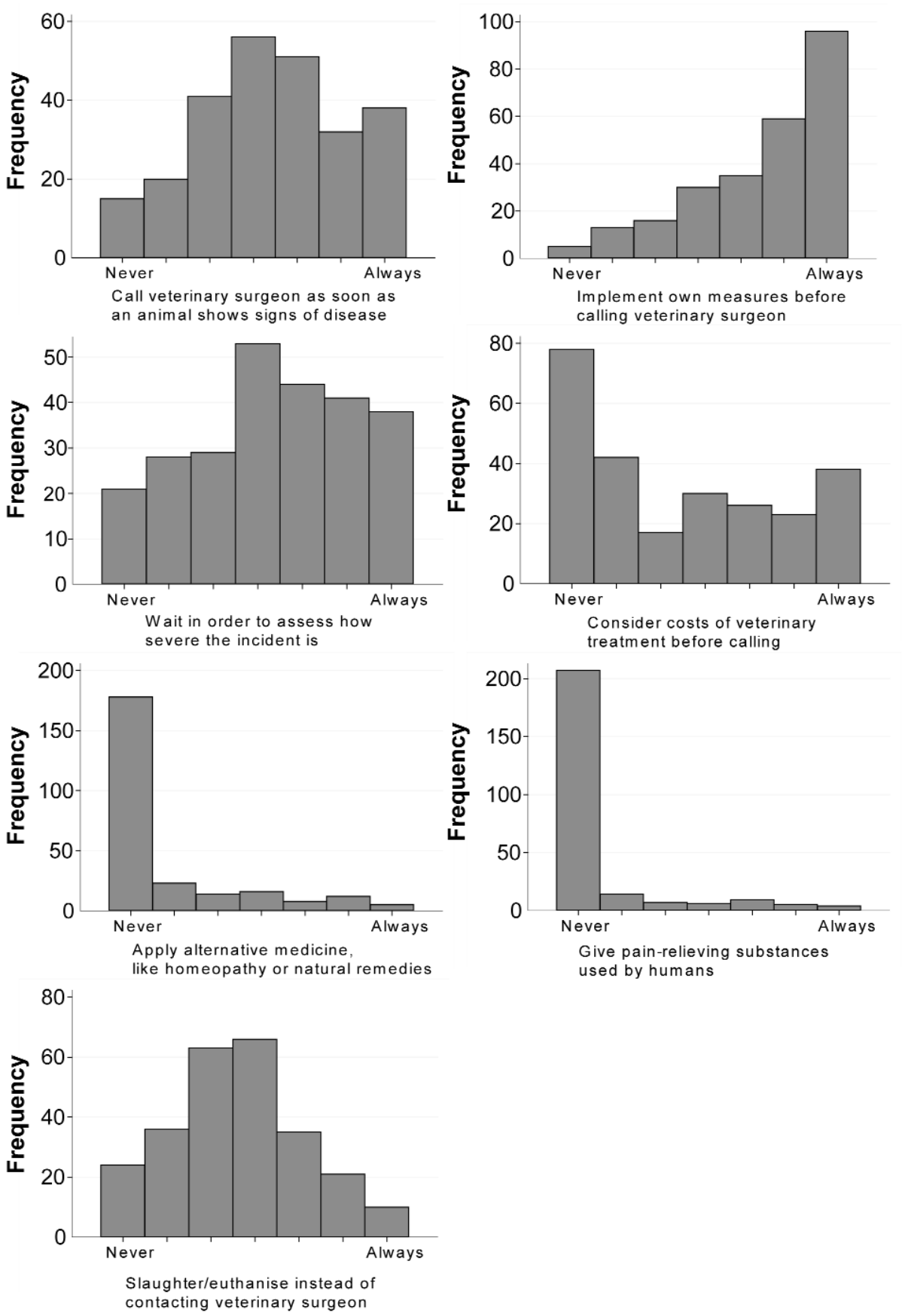
All the coefficients from the final regression models are presented in Table 2.

The final robust linear regression model with mean pain assessment score (mPAS) as the outcome explained 13.4% of the variance. Five covariates were significantly associated with this outcome; the attitude variable labelled 'Pleasant animals', growing up on a goat farm, having farming as the main income, questionnaire format and the number of conditions the respondents had seen in goats. The effect size was small for each of the three dichotomous predictors, with a Cohen's *d* of 0.1.

In the final logistic regression model with the grouping variable from the cluster analysis as the dichotomous outcome, there were three significant covariates; gender, age and growing up in a rural district. The area under the ROC curve was 0.80 for this model.

The proportions of stockpeople that totally agreed with statements pertaining to their wish to learn more were 51% for goat diseases, 48% for pain in goats and 47% for goat welfare in general. The proportions that totally disagreed with these statements were 5–6%.

Figure 5



Distribution of responses to statements regarding management of disease in general.

https://doi.org/10.7120/09627286.21.4.547 Published online by Cambridge University Press

Discussion

The pain scores assigned in this study ranged across almost the entire pain scale for all conditions except dystocia, which had no pain scores below 2. The wide range of pain scores is also reported in other studies (eg Whay *et al* 2008) and supports the notion that it is difficult to assess the pain experienced by animals. Difficulties in recognising pain is a common reason for the lack of treatment of pets in pain by veterinarians (Weary *et al* 2006), and many farm animals in pain may be left untreated for the same reason. Research in empathic accuracy suggests that people are relatively unsuccessful in inferring what others are experiencing, and discrepancies in the estimation of pain between people in pain and observers are usually in the direction of underestimation by the observers (Goubert *et al* 2009). This underestimation may be even greater in evaluation of pain in species of prey. Some of the conditions included in the pain assessment scale were specific to goats or small ruminants, but for other conditions the pain scores obtained in this study are in agreement with research in the dairy cattle industry. Dystocia, mastitis and fractures were also among the conditions considered most painful for dairy cattle among veterinarians (Huxley & Whay 2006) and dairy farmers (Kielland *et al* 2010).

One attitude factor was found to be significantly associated with mean pain assessment score in this study. The positive association with the attitude factor labelled 'Pleasant animals' is in line with our predictions; people who regard goats as pleasant animals are likely to be more concerned about the pain they experience. This is supported by research showing that a positive attitude towards a target is associated with increased empathic concern regarding the target's suffering (Hein *et al* 2010). The lack of associations with empathy dimensions are in contrast to the results reported by Ellingsen *et al* (2010), who found dog owners' animal-oriented empathy to be a better predictor of their pain assessment than attitudes towards animals. We expected the photographs in the pain assessment scale to trigger empathic responses, as a strong correlation has been found between the rating of pain experienced by human targets and the activity in brain areas involved in empathic responses (Jackson *et al* 2005). However, we did not ask for the respondents' affective response to the photographs, but rather their evaluation of the level of pain experienced by the depicted goats.

There were no significant differences between men and women in the mean pain assessment scores in the current study. This is in accordance with the results reported by Kielland *et al* (2010) from their study of dairy farmers, while Ellingsen *et al* (2010) reported that female dog owners assigned higher pain scores on a pain assessment instrument depicting dogs. The diverging results may be related to the utility of the species in question, and may suggest that greater gender differences exist in owners' evaluation of pain in species that humans typically form stronger emotional bonds with.

MPAS was negatively associated with having grown up on a goat farm, having farming as the main income and the number of conditions the farmers had seen in goats. It can be argued that these three variables are measures of expertise or experience, and as such the results are in agreement with the findings of Cheng *et al* (2007), who found that experience in observing painful situations modulates how people perceive the pain experienced by human targets. It is not unlikely that a similar modulation may occur in cross-species pain evaluation. However, the association we found between mPAS and the number of conditions seen is in contrast to the positive association found between similar measures in a study of dairy farmers (Kielland *et al* 2010).

On average, each stockperson had seen 15 of the 20 conditions that were a subset of the 23 depicted conditions. This illustrates that the conditions we included in the questionnaire were highly relevant for Norwegian dairy goat farmers.

The threshold for providing veterinary attention was particularly low for acute mastitis with fever, encephalitis and milk fever. This is in accordance with our expectations, as these conditions require quick medical interventions. Although direct comparison is difficult due to different objectives and methods, the results are partly in agreement with other studies. In one study, both conventional and organic dairy farmers reported to call the veterinarian for most cases of acute mastitis and milk fever (Valle *et al* 2007). In a qualitative study of dairy farmers that use homeopathy, some farmers stated that a veterinary surgeon was contacted very soon if no improvement was seen following homeopathic treatment of cases of mastitis with systemic symptoms, whereas milk fever was reported always to prompt veterinary treatment (Hektoen 2004).

Table 2 List of variables with significant regression coefficients from regression models with mPAS and clusters for veterinary treatment as outcomes.

Model type	Robust linear	Logistic (odds ratio)
Dependent variable	mPAS	Cluster
Explained variance	13.4%	
Gender		20.5*
Age		1.6**
Rural district		16.7*
Lived on goat farm	–0.50**	
Main income	–0.72*	
Number of conditions	–0.10**	
Questionnaire format	0.42*	
Att3 Max (baseline)		
High	–0.38*	
Medium	–0.73**	
Low		

Att3: Attitude factor labelled 'Pleasant animals'.
* $P < 0.05$; ** $P < 0.01$.

Cluster analysis revealed two distinctly different groups of stockpeople in the present study, and regression analysis showed that females, older stockpeople and stockpeople who grew up in a rural district were significantly more likely to contact veterinary surgeons more frequently. The association with gender is in the same direction as gender differences in attitudes and empathy reported in other studies (Mathews & Herzog 1997; Furnham *et al* 2003; Taylor & Signal 2005; Signal & Taylor 2007; Ellingsen *et al* 2010), and may suggest that females also have a stronger propensity for helping behaviour.

The majority of respondents were confident that they recognise when a goat is in pain by looking at it, and agreed that goats change their behaviour when in pain. Behaviour is the most commonly used parameter to assess pain in farm animals (Viñuela-Fernández *et al* 2007). Only one-third of the stockpeople totally agreed that goats restore to health quicker if they are provided with pain relief. Pain can result in changes in haemodynamic, respiratory, metabolic, gastrointestinal, renal and immune functions, and consequently have detrimental effects on tissue healing (Otto & Short 1998), disease outcome, growth and production (Anil *et al* 2005). Our results suggest that these effects of pain are unknown to many stockpeople.

The responses to the statements pertaining to management of disease indicate that many stockpeople wait while considering disease severity and treatment costs before calling the veterinary surgeon, and most of them apply their own interventions in that period. The vast majority of the dairy goat farmers reported that they never apply alternative medicine or pain relieving substances registered for human use, so their own interventions may be more related to management and care. Personal satisfaction related to independent handling of disease problems has been reported as a motivation for attempting alternative treatment before contacting a veterinary surgeon (Hektoen 2004). Most of the stockpeople in this study reported that they never omit treating due to drug withdrawal periods or veterinary costs. However, a considerable proportion of the stockpeople sometimes choose to euthanise goats instead of initiating treatment, and high veterinary costs compared to the value of individual goats was specifically recognised by some stockpeople as an important welfare challenge. This is a known reason for low use of analgesics in farm animals (Viñuela-Fernández *et al* 2007), and in a UK study, only 36% of the cattle practitioners agreed that farmers are happy to pay the costs involved in pain relief (Whay *et al* 2008). Our results suggest that the belief that farmers in general are unwilling to pay may be a misconception, but that it may be true for some. Comments indicated that some delay in veterinary treatment may be caused by the lack of veterinary services locally, or even the veterinary surgeons' priorities. A few respondents were so concerned about their veterinary surgeon's level of knowledge about goat health and medicine that they considered it a major welfare challenge. This is likely to heighten the stockpeoples' threshold for contacting a veterinary surgeon. Some respondents also considered it a welfare problem that the Norwegian legislation prevents veterinary surgeons from dispensing medicines to stockpeople for their own initiation of medical treatment (Norwegian Parliament 2001). In comparison, a study from the UK indicated that approximately 90% of the sheep farmers kept antibiotics on the farm for treatment of lameness (Clements *et al* 2002).

Provision of veterinary attention can only be regarded as a crude measure of helping tendencies, as the decision to provide veterinary treatment is affected by a wide range of factors. Issues such as ethics, economics, legislation, scientific knowledge and availability of registered analgesics are relevant in relation to pain alleviation (Anil *et al* 2005), and treatment decisions have been shown to be associated with both animal and herd characteristics (Vaarst *et al* 2002; Mörk *et al* 2009). An in-depth discussion of the role of these factors in relation to veterinary treatment of goats is beyond the scope of this paper. However, we propose that differences in the stockpeoples' inclination for engaging in helping behaviour may contribute to the differences in treatment decisions.

Different formats used to collect data may provide respondents with different stimuli and therefore artificially produce different responses (Dillman & Smyth 2007), which is a likely cause of the significant differences in pain scores between the two formats. We appreciate that there is a need to improve and standardise the methods used for pain assessment studies. Some of the photographs used in this study are close-ups of the affected body part, while others include the whole goat. The latter allows the viewer to assess other aspects than merely the affected part of the goat's anatomy, such as the facial expression, posture and general appearance. Photographs may provide useful information related to pain severity, since features of a lesion may be related to the degree of pain in many conditions (Gregory 2010). However, films would also allow for the assessment of behaviour (including vocalisation) and contextual information, and would therefore give a more realistic picture of stockpeoples' evaluation of pain. No direct causal inferences should be made on the basis of the results of this study.

Animal welfare implications

Accurate pain assessment is a prerequisite for effective pain management (Viñuela-Fernández *et al* 2007), and the initial assessment is usually made by the stockperson. In this study, we gained an indication of how experienced stockpeople perceive the pain in a wide range of conditions goats may suffer from. We expect this contribution to be valuable as guidance for less experienced stakeholders in the goat industry, and as a starting point for much needed research on pain assessment in this species. Furthermore, the study shows that there are significant differences in how frequently farmers provide their sick animals with veterinary attention. This important aspect of human-animal relationships has received little research attention, despite the obvious potential for improving animal welfare if more stockpeople rapidly provide veterinary treatment for animals in pain.

https://doi.org/10.7120/09627286.21.4.547 Published online by Cambridge University Press

Conclusion

Pain management in farm animals continues to be a challenge due to insufficient research, lack of available pain-relieving substances and inadequate knowledge about how to assess pain. The wide range of pain scores assigned to each condition in this study underlines the complexity of pain assessment. Our results suggest that stockpeople differ greatly in how they manage animal pain, but this was unrelated to how they assessed pain in this study. The majority of the stockpeople reported that they are highly motivated to learn more about goat diseases, pain and welfare. In Norway, the agricultural authorities are in the process of making it compulsory for all livestock farmers to attend a course in animal welfare, and thus document their competency in stockmanship (Norwegian Ministry of Agriculture 2002). These courses could serve as important arenas for increasing awareness around pain issues. Targeting people's sympathy and concern may make them more aware of the effects of their behaviour, and may promote helping behaviour (Eisenberg & Eggum 2009). The ultimate goal must be to develop effective ways of promoting animal-directed helping behaviour, such as provision of veterinary attention. Future interdisciplinary research is required to address stockpeoples' propensity for different types of helping behaviour when faced with animals in pain.

Acknowledgements

The authors are especially grateful to all participating stockpeople for their contribution to the study. We thank Professor Adroaldo J Zanella for contributing to the conception of the study, and for revising earlier versions of the manuscript. We thank Dr Camilla Kielland for help with the web-based questionnaire, and Professor Eystein Skjerve and Dr Jon Bohlin for giving statistical advice. We are grateful to Nils Leine, Dr Peter GG Jackson (Cambridge University) and Marianne Hansen (goat farmer) for generously allowing us to use their photographs in the questionnaire, and to Dr Solveig Marie Stubsjøen for revising the manuscript. We would also like to thank the anonymous referees for useful comments and suggestions. The project is supported by a grant from the Research Council of Norway (project nr 179745 NORDAM-SAM).

References

Alvarez L and Gutiérrez J 2010 A first description of the physiological and behavioural responses to disbudding in goat kids. *Animal Welfare 19*: 55-59

Alvarez L, Nava RA, Ramírez A, Ramírez E and Gutiérrez J 2009 Physiological and behavioural alterations in disbudded goat kids with and without local anaesthesia. *Applied Animal Behaviour Science 117*: 190-196

Anil L, Anil SS and Deen J 2005 Pain Detection and Amelioration in Animals on the Farm: Issues and Options. *Journal of Applied Animal Welfare Science 8*: 261-278. http://dx.doi.org/10.1207/s15327604jaws0804_3

Cheng Y, Lin C-P, Liu H-L, Hsu Y-Y, Lim K-E, Hung D and Decety J 2007 Expertise modulates the perception of pain in others. *Current Biology 17*: 1708-1713. http://dx.doi.org/10.1016/j.cub.2007.09.020

Clements ACA, Mellor DJ and Fitzpatrick JL 2002 Reporting of sheep lameness conditions to veterinarians in the Scottish Borders. *Veterinary Record 150*: 815-817. http://dx.doi.org/10.1136/vr.150.26.815

Cohen J 1992 A power primer. *Psychological Bulletin 112*: 155-159. http://dx.doi.org/10.1037/0033-2909.112.1.155

Coleman DL and Slingsby LS 2007 Attitudes of veterinary nurses to the assessment of pain and the use of pain scales. *Veterinary Record 160*: 541-544. http://dx.doi.org/10.1136/vr.160.16.541

Cronbach LJ 1951 Coefficient alpha and the internal structure of tests. *Psychometrika 16*: 297-334. http://dx.doi.org/10.1007/BF02310555

de Vignemont F and Singer T 2006 The empathic brain: how, when and why? *Trends in Cognitive Sciences 10*: 435-441. http://dx.doi.org/10.1016/j.tics.2006.08.008

Dillman DA and Smyth JD 2007 Design effects in the transition to web-based surveys. *American Journal of Preventive Medicine 32*: 90-96. http://dx.doi.org/10.1016/j.amepre.2007.03.008

Dohoo I, Martin W and Stryhn H 2009 *Veterinary Epidemiologic Research, Second Edition.* VER Inc: Prince Edward Island, Canada

Eisenberg N and Eggum ND 2009 Empathic responding: Sympathy and personal distress. In: Decety J and Ickes W (eds) *The Social Neuroscience of Empathy* pp 71-83. Massachusetts Institute of Technology: Cambridge, Massachusetts, USA

Ellingsen K, Zanella AJ, Bjerkås E and Indrebø A 2010 The relationship between empathy, perception of pain and attitudes toward pets among Norwegian dog owners. *Anthrozoös 23*: 231-243

Fajt VR, Wagner SA and Norby B 2011 Analgesic drug administration and attitudes about analgesia in cattle among bovine practitioners in the United States. *Journal of the American Veterinary Medical Association 238*: 755-767. http://dx.doi.org/10.2460/javma.238.6.755

FAWC *1993 Second report on priorities for research and development in farm animal welfare.* Ministry of Agriculture, Fisheries and Food: Tolworth, UK

Furnham A, McManus C and Scott D 2003 Personality, empathy and attitudes to animal welfare. *Anthrozoös 16*: 135-146. http://dx.doi.org/10.2752/089279303786992260

Goubert L, Craig KD and Buysse A 2009 Perceiving others in pain: experimental and clinical evidence on the role of empathy. In: Decety J and Ickes W (eds) *The Social Neuroscience of Empathy* pp 153-165. Massachusetts Institute of Technology: Cambridge, Massachusetts, USA

Gregory NG 2010 Relationships between pathology and pain severities: a review. *Animal Welfare 19*: 437-448

Hein G, Silani G, Preuschoff K, Batson CD and Singer T 2010 Neural responses to ingroup and outgroup members' suffering predict individual differences in costly helping. *Neuron 68*: 149-160. http://dx.doi.org/10.1016/j.neuron.2010.09.003

Hektoen L 2004 Investigations of the motivation underlying Norwegian dairy farmers' use of homeopathy. *Veterinary Record 155*: 701-707. http://dx.doi.org/10.1136/vr.155.22.701

Huxley JN and Whay HR 2006 Current attitudes of cattle practitioners to pain and the use of analgesics in cattle. *Veterinary Record 159*: 662-668. http://dx.doi.org/10.1136/vr.159.20.662

Jackson PL, Meltzoff AN and Decety J 2005 How do we perceive the pain of others? A window into the neural processes involved in empathy. *NeuroImage 24*: 771-779. http://dx.doi.org/10.1016/j.neuroimage.2004.09.006

Kielland C, Skjerve E and Zanella AJ 2009 Attitudes of veterinary students to pain in cattle. *Veterinary Record 165*: 254-258. http://dx.doi.org/10.1136/vr.165.9.254

Kielland C, Skjerve E, Østerås O and Zanella AJ 2010 Dairy farmer attitudes and empathy toward animals are associated with animal welfare indicators. *Journal of Dairy Science 93*: 2998-3006. http://dx.doi.org/10.3168/jds.2009-2899

Loeser JD and Treede R-D 2008 The Kyoto protocol of IASP Basic Pain Terminology. *Pain 137*: 473-477. http://dx.doi.org/10.1016/j.pain.2008.04.025

Mathews S and Herzog HA 1997 Personality and attitudes toward the treatment of animals. *Society and Animals 5*: 169-175. http://dx.doi.org/10.1163/156853097X00060

Mehrabian A and Epstein N 1972 A measure of emotional empathy. *Journal of Personality 4*: 525-543. http://dx.doi.org/10.1111/j.1467-6494.1972.tb00078.x

Molony V and Kent JE 1997 Assessment of acute pain in farm animals using behavioral and physiological measurements. *Journal of Animal Science 75*: 266-272

Mörk MJ, Emanuelson U, Lindberg A, Vågsholm I and Egenvall A 2009 Herd and cow characteristics affecting the odds of veterinary treatment for disease - a multilevel analysis. *Acta Veterinaria Scandinavica 51*: 34. http://dx.doi.org/10.1186/1751-0147-51-34

Muri K, Tufte PA, Skjerve E and Valle PS 2012 Human-animal relationships in the Norwegian dairy goat industry: attitudes and empathy towards goats (Part I). *Animal Welfare 21*: 535-545. http://dx.doi.org/10.7120/09627286.21.4.535

Norwegian Ministry of Agriculture and Food 2005 *FOR 2005-02-18 nr 160: Forskrift om velferd for småfe.* The Norwegian Ministry of Agriculture and Food: Oslo, Norway. http://www.lovdata.no/cgi-wift/ldles?doc=/sf/sf/sf-20050218-0160.html. [Title translation: Regulation 2005-02-18 nr 160 Regarding welfare for small ruminants]

Norwegian Parliament 2001 *Lov av 15.06.2001 nr 75: Lov om veterinærer og annet dyrehelsepersonell.* The Norwegian Parliament: Oslo, Norway. http://www.lovdata.no/all/hl-20010615-075.html. [Title translation: Act of 15 June 2001 No. 75 relating to Veterinarians and Other Animal Health Personnel]

Norwegian Ministry of Agriculture 2002 *St meld. nr 12 (2002–2003) Om dyrehold og dyrevelferd.* The Norwegian Ministry of Agriculture: Oslo, Norway. http://www.regjeringen.no/Rpub/STM/20022003/012/PDFS/STM20022003012000DDDPDFS.pdf. [Title translation: Parliamentary Report nr12 Regarding animal husbandry and animal welfare]

Otto KA and Short CE 1998 Pharmaceutical control of pain in large animals. *Applied Animal Behaviour Science 59*: 157-169. http://dx.doi.org/10.1016/S0168-1591(98)00130-0

Price J, Marques JM, Welsh EM and Waran NK 2002 Pilot epidemiological study of attitudes towards pain in horses. *Veterinary Record 151*: 570-575. http://dx.doi.org/10.1136/vr.151.19.570

Raekallio M, Heinonen KM, Kuussaari J and Vainio O 2003 Pain alleviation in animals: Attitudes and practices of Finnish veterinarians. *The Veterinary Journal 165*: 131-135. http://dx.doi.org/10.1016/S1090-0233(02)00186-7

Rutherford KMD 2002 Assessing pain in animals. *Animal Welfare 11*: 31-53

Signal TD and Taylor N 2007 Attitude to animals and empathy: Comparing animal protection and general community samples. *Anthrozoös 20*: 125-130. http://dx.doi.org/10.2752/175303707X207918

Singer T and Lamm C 2009 The social neuroscience of empathy. *Annals of the New York Academy of Sciences 1156*: 81-96. http://dx.doi.org/10.1111/j.1749-6632.2009.04418.x

Statistics Norway Online 2009 Holdings keeping domestic animals of various kinds as per 1 January. *Statistics Norway Online.* http://www.ssb.no/english/subjects/10/04/10/jordhus_en/tab-2011-04-19-01-en.html

Taylor N and Signal TD 2005 Empathy and attitudes to animals. *Anthrozoös 18*: 18-27. http://dx.doi.org/10.2752/089279305785594342

Vaarst M, Paarup-Laursen B, Houe H and Fossing C 2002 Farmers' choice of medical treatment of mastitis in Danish dairy herds based on qualitative research interviews. *Journal of Dairy Science 85*: 992-1001. http://dx.doi.org/10.3168/jds.S0022-0302(02)74159-3

Valle PS, Lien G, Flaten O, Koesling M and Ebbesvik M 2007 Herd health and health management in organic versus conventional dairy herds in Norway. *Livestock Science 112*: 123-132. http://dx.doi.org/10.1016/j.livsci.2007.02.005

Viñuela-Fernández I, Jones E, Welsh EM and Fleetwood-Walker SM 2007 Pain mechanisms and their implication for the management of pain in farm and companion animals. *The Veterinary Journal 174*: 227-239

Weary DM, Niel L, Flower FC and Fraser D 2006 Identifying and preventing pain in animals. *Applied Animal Behaviour Science 100*: 64-76. http://dx.doi.org/10.1016/j.applanim.2006.04.013

Whay HR, Hudson C and Huxley JN 2008 Where are we with pain recognition and management in cattle? *Proceedings, 41st Annual Meeting of the American Association of Bovine Practitioners* pp 54-59. 25-27 September 2008, Charlotte, NC, USA

https://doi.org/10.7120/09627286.21.4.547 Published online by Cambridge University Press