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Human-animal relationships in the Norwegian dairy goat industry: attitudes and empathy towards goats (Part I)

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Abstract

The quality of human-animal relationships in the livestock industries has been increasingly recognised as an important determinant of animal welfare. Attitudes and empathy are multi-dimensional traits that may be associated with the stockpersons' behaviour. The aim of this study was to determine the dimensionality of the goat-oriented attitudes and empathy of stockpeople in the Norwegian dairy goat industry. We also explored how empathic and attitudinal dimensions are interrelated, and how the demographic background variables may predict empathy and attitudes. A total of 260 dairy goat farmers participated in the study, by the means of either postal or internet-based questionnaire formats. Multi-item rating scales were developed specifically for the assessment of attitudes and empathy towards goats, and Principal Component Factor Analysis was conducted to determine the dimensionality of the farmers' goat-oriented attitudes and empathy. Subsequently, linear and ordinal regression analyses were performed to explore the interrelationships. The analyses revealed dimensions of empathy that can be recognised from studies of human-oriented empathy, and attitude dimensions that can be interpreted similarly as dimensions described in studies from other livestock industries. Our results show that different dimensions of attitudes and empathy were associated with different demographic variables, and that each empathy dimension was associated with a different attitude factor.

Keywords: *animal welfare, attitudes, dairy goats, demographics, empathy, human-animal relationships*

Introduction

Stockpeople have a fundamental role in safeguarding the welfare of the animals in their care. Competency, motivation, attitudes and certain personality traits have been identified as job-related prerequisites for ensuring high farm animal welfare standards (Hemsworth & Coleman 2011). Human communication with or towards animals, particularly vocal communication, can be an indication of the human's attitudes towards animals (Boivin *et al* 2003). Attitude has been defined as "a psychological tendency that is expressed by evaluating a particular entity with some degree of favour or disfavour" (Eagly & Chaiken 2007). According to the Theory of Planned Behaviour, the intention to perform a behaviour is stronger the more favourable the attitude with respect to that behaviour is (Ajzen 1991). Attitudes are learned dispositions (Hemsworth & Coleman 2011) that can change depending on context, and the person holding the attitude may or may not be aware of it (Eagly & Chaiken 2007). Attitudes are based on cognitive, affective and behavioural information and can differ in both valence and strength (Maio & Haddock 2009). Cognition refers to what a person believes to be true about an object, while affect refers to the emotional response towards the object (Hemsworth & Coleman 2011). The behavioural component refers to tendencies to behave in a particular way, which may reflect underlying attitudes (Hemsworth & Coleman 2011). The attitudes and behaviour of stockpersons will be affected by their initial experiences in the livestock industry (Hemsworth 2007), and stockpersons with positive behaviour towards animals have positive attitudes both towards the animals and towards the conditions under which the animals are kept (Boivin *et al* 2003).

It is also important for a stockperson to recognise positive and negative emotions in animals. Empathy is a dispositional characteristic, but it has been debated whether it is an innate or a learned trait (Hemsworth & Coleman 2011). It is believed to be a complex, multi-dimensional concept consisting of both cognitive and affective components. The cognitive components refer to the ability to interpret and

understand the experience of others (perspective-taking) and the affective components refer to an appropriate emotional reactivity, which may be other-oriented or self-oriented (Davis 1980; Baron-Cohen & Wheelwright 2004). By the use of factor analysis, Davis (1980) identified four dimensions of human-oriented empathy: 'Fantasy', 'Perspective-taking', 'Empathic concern' and 'Personal distress'. Empathy is also subject to contextual appraisal and modulation. Affective link, familiarity, similarity and the target's need for care or protection may be important modulatory factors, together with the characteristics of the empathisers (de Vignemont & Singer 2006). Neuro-imaging studies have provided evidence to suggest that humans' ability to empathise can generalise towards non-human animals, and more so if the animals are phylogenetically more similar to humans (Westbury & Neumann 2008).

A number of studies have provided evidence for a sequential relationship between stockpersons' attitudes and behaviour, and the subsequent behavioural response and performance of the animals (Hemsworth & Coleman 2011). As an example, Hemsworth *et al* (2000) found that more positive attitudes were associated with more positive interactions and less negative interactions, and in turn that positive interactions were negatively correlated with the cows' fear of humans, measured as flight distance. Waiblinger *et al* (2002) found that behavioural attitudes were the most consistent predictors of stockpeoples' behaviour, but factors of general attitudes towards cows were also significantly correlated with stockperson behaviour. These attitude factors were also associated with milk yield. The authors suggested that general attitudes influence the formation of behavioural attitudes (Waiblinger *et al* 2002).

The importance of empathy in stock-keeping is less clear as there are limited empirical data, but empathy has been reported to be associated with positive attitudes and positive behaviour towards animals (Hemsworth & Coleman 2011).

Data from the field of psychology and from research on human-animal relationships in relation to other species have shown interrelationships between dimensions of attitudes and empathy, and associations between these dimensions and demographic variables. For example, higher levels of empathy and positive attitudes have been found in female respondents than males, and this seems to be a consistent finding across studies (Mathews & Herzog 1997; Furnham *et al* 2003; Baron-Cohen & Wheelwright 2004; Taylor & Signal 2005; Signal & Taylor 2007; Ellingsen *et al* 2010). To our knowledge, no studies have explored these aspects of human-animal relationships in the dairy goat industry. Thus, the primary aim of the present study was to investigate different dimensions of empathy and attitudes towards goats. Secondly, we aimed at exploring how empathic and attitudinal dimensions are interrelated, and finally how the demographic background variables may predict the different dimensions of empathy and attitudes.

Materials and methods

Questionnaire

The questionnaire was developed in two formats; one internet-based version (QuestBack™), which was distributed as a link in an email, and one paper version which was distributed in the post to recipients without an email address. In connection with the development of the questionnaire, people with expertise in goat health and management were involved. Seven dairy goat farmers were interviewed about welfare, pain and diseases and were asked to complete an early version of the questionnaire. Their comments were used to improve the final version. The questionnaire had four parts. Only the parts of the questionnaire from which data are presented in this paper will be described in detail. The entire questionnaire can be provided by the authors upon request.

Part 1 — Demographics

This part included questions about age, sex, marital status, the number of children, education level, where they grew up and what level of experience they had with animals in childhood, adolescence and through work.

Part 2 — Pain assessment scale (PAS)

The pain assessment scale is described in the companion paper to this study (Muri & Valle 2012, this issue).

Part 3 — Attitude and empathy scales

The different dimensions of multi-dimensional traits must be measured separately in order to assess their individual effects on behaviour (Davis 1980; Feshbach & Feshbach 2009). Multi-item rating scales, such as the Interpersonal Reactivity Index (IRI) (Davis 1980), are not direct measures of attitudes or empathy, but the responses can be used to infer the underlying attitudes and empathic capacities. For this purpose, multi-item rating scales concerning goat-oriented attitudes and empathy were developed. The attitude scale was based on the 25 statements used by Hemsworth *et al* (2000). The empathy scale was an adaptation of the Animal Empathy Scale (AES) developed by Paul (2000), which in turn was based on the Questionnaire for the Measurement of Emotional Empathy (QMEE) (Mehrabian & Epstein 1972). Although the QMEE was originally considered a measure of emotional empathy, it has been argued that some of the statements assess cognitive aspects (Davis 1980). The adapted statements from these scales were modified and restructured to pertain to dairy goats and represent experiences that were considered relevant for dairy goat farmers in Norway. In addition, original statements were developed to replace statements that were considered irrelevant, and the final scales each consisted of 20 statements. Half of the statements were negatively worded in order to avoid response bias. Responses to the attitude and empathy scales were requested using a seven-point rating scale from 'totally agree' to 'totally disagree'. The values between the extremes only had numbers and no descriptors. A middle option (4) was interpreted as neutral, and was included to avoid forced choice.

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In addition to the attitude and empathy scales, there were seven statements specifically addressing pain. They will be presented in part 2 of the study, together with questions about the stockpeoples' experience and management of health and pain issues (Muri & Valle 2012).

Subjects

The reference population in the study 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. The Goat Milk Recording System is owned by TINE SA, the only dairy company that collects goat milk in Norway, and 89.8% of the dairy goat producers were enrolled in 2009. The web-based questionnaire was successfully distributed by email to 217 farmers. The paper-based questionnaire was sent to the remaining 263 farmers (in total, n = 480). Non-responders were sent a reminder after three weeks and a second reminder five weeks after the first.

From the web-based questionnaire, 130 responses were obtained and information about retirement was received from one recipient, resulting in a response rate of 60%. Leaving out incorrectly completed questionnaires, 130 valid responses were obtained from the paper-based questionnaire. Information about retirement was provided by a total of 12 farmers, resulting in a response rate of 52%. Based on these figures, the overall response rate was 54%. However, the number of dairy goat herds in Norway has declined over the past decades and, according to Statistics Norway (2009), there were 430 registered dairy goat herds in Norway at the time the data were collected. The mailing lists had not been updated according to this decline, suggesting that the accurate response rate was 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 were linked to the identity of the farms.

Data management and statistical analysis

Data management and statistical analysis was performed with Stata/SE 11.0 (StataCorp, College Station, TX, USA). Negatively worded statements from the attitude and empathy scales were reverse coded before subsequent analyses, so that high scores indicated positive attitudes or high levels of empathy regardless of the original wording. Some demographic variables had few observations in one or more of the categories, in which case categories were combined where appropriate. Marital status was converted to a dichotomous variable; in a relationship (married/partners and cohabitants) or not in a relationship (separated/divorced, widows/widowers and singles). The number of years of experience was also changed to a dichotomous variable (less or more than 20 years), as a majority of respondents had more than 20 years of experience. Few respondents had higher education, so the categories for college and university education were aggregated. Only ten respondents had no siblings, rendering that category unsuitable as the baseline in regression analyses, so the scale was reversed. The variable for age had eleven categories representing five-year intervals and was treated as a continuous variable.

Principal Component Factor Analysis

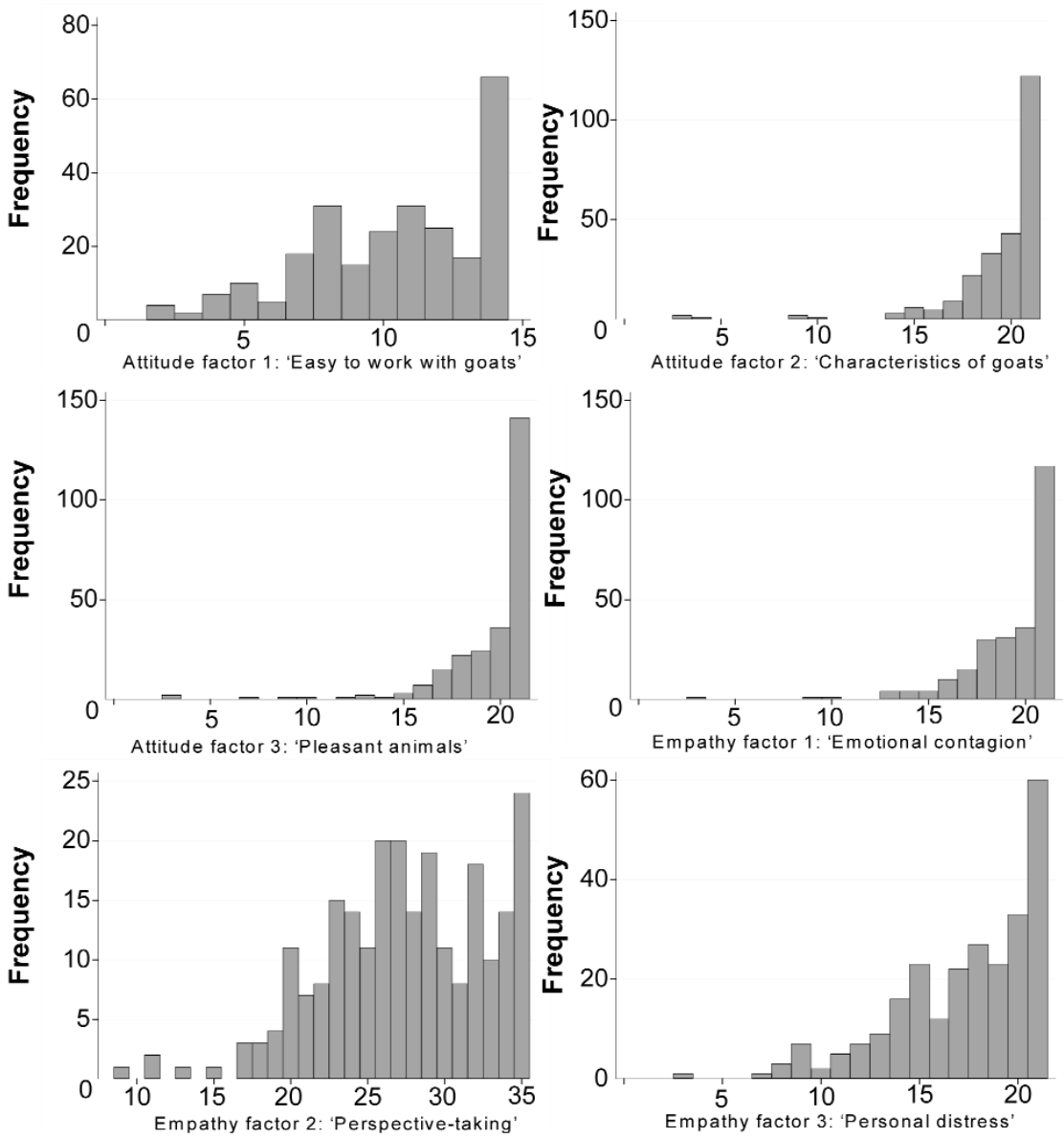
The Kaiser-Meyer-Olkin measure of sampling adequacy indicated that the variables in the attitudes and empathy scales had adequate commonalities to warrant factor analysis (attitudes: 0.62, empathy: 0.76). Exploratory Principal Component Factor Analysis (PCFA) followed by varimax rotation with Kaiser normalisation was conducted on the data from these scales. This method allows reducing a large number of variables (in this case 20 statements) to a few factors reflecting commonalities amongst variables that are highly correlated, and to detect unobservable latent constructs (Sharma 1996). Removals due to missing data resulted in 222 observations of the attitude scale and 224 observations of the empathy scale.

Initially, a scree plot was used as a guide to the numbers of factors to extract, and factors with eigenvalues above 1.0 were considered if the scree plot was inconclusive. The statements with factor loadings above 0.3 which also did not load substantially on other factors were treated as potential indicators of new sub-scales. Statements that did not logically belong with the other statements in a sub-scale were discarded from further analysis. The internal consistencies of the sub-scales were estimated with the alpha coefficient (Cronbach 1951), which provides a measure of whether individual items are assessing the same psychological construct (Maio & Haddock 2009). Only the sub-scales with $\alpha > 0.6$ were kept for further interpretation. Two of the identified attitude factors consisted of similar statements, so the factor with the lowest eigenvalue of the two was discarded. The variables that were not included in any of the final sub-scales were discarded, and PCFA was repeated with the remaining variables to confirm the results. Index variables were then created from each sub-scale by summing the response values for each statement in the sub-scale.

Regression analysis

Interrelationships between attitudes and empathy dimensions and their associations with demographics were assessed with the new index variables as outcomes in robust linear and ordinal logistic regression models. 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

Figure 1



Distribution of the attitude and empathy sub-scales.

regression model. For categorical independent variables with more than two categories, the overall significance of the dummy variables was tested with multiple Wald's test.

All but one of the index variables had extreme right-sided distributions (Figure 1). This created problems in terms of the assumptions for linear regression (Dohoo *et al* 2009). A pronounced degree of skew remained in the distribution of the residuals also after log, square, square-root and Box-Cox transformations. This was resolved by converting these variables to ordinal grouped continuous variables and subsequently exploring the associations by the use of ordinal logistic regression analyses. To minimise the amount of information lost, four categories were created, which was the maximum number we considered feasible for the data. The same relative cut-points were used for all index variables. For ease of interpretation, the ordinal scales were used in their original direction as dependent variables, but as independent variables the scales were reversed to avoid having baseline categories with few observations. Ordinal logistic regression analysis is based on a single equation with only one coefficient for each independent variable, and thus assumes proportional odds. To test this assumption, two tests were performed on each model; the Brant Test of Parallel Regression Assumption (Brant 1990) and an approximate likelihood ratio-test (Wolfe & Gould 1998).

The empathy dimension labelled 'Perspective-taking' had a less extreme distribution, and a good fit to the data was obtained with robust linear regression. The assumptions for

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Table 1 Distribution of demographic data for Norwegian dairy goat farmers based on data from the two questionnaire formats (paper and web).

Demographic variable	Paper (n)	Web (n)	Overall %
Gender			
Male	88	87	72
Female	33	36	28
Age (years)			
≤ 20	–	–	–
21–25	1	2	1
26–30	2	3	2
31–35	8	16	10
36–40	5	16	8
41–45	16	19	14
46–50	14	24	15
51–55	19	27	18
56–60	20	16	14
61–65	28	5	13
> 65	12	1	5
Marital status			
Married/partner	88	97	72
Cohabitant	17	16	13
Separated/divorced	8	4	5
Widow/widower	2	1	1
Single	11	10	8
Other	2	1	1
Has children	101	112	85
Number of siblings			
0	5	5	4
1	22	24	18
2	23	45	27
3	32	26	23
4	16	14	12
5 or more	30	15	18
*Where they grew up**			
City	5	2	3
Town	8	10	7
Suburb	1	2	2
Densely populated area	8	13	8
Rural district	116	110	87
*Experience with animals as young**			
None	10	7	7
Grew up on goat farm	71	82	59
Grew up on farm with other livestock	56	28	33
Grew up with pet or horse	19	13	12
Worked on goat farm	9	7	6
Worked on farm with other livestock	14	16	12
Other	3	10	5
Years of experience with animal caring			
0–5 years	2	5	3
6–10 years	4	4	3
11–20 years	13	20	13
> 20 years	109	101	81
Education level			
Primary and secondary school	48	16	25
Upper secondary school	50	64	45
College	10	32	17
University	2	4	2
Other	17	12	11
Farming as main source of income	110	119	93

* Respondents could choose more than one alternative.

linear regression were tested with Q-Q plots, histograms of residuals and scatter plots for fitted values against residuals (Dohoo *et al* 2009). The rregfit-command, which computes *R*-squared for iteratively reweighted least squares models, was used to get an estimate of explained variance. Cohen's *d* (Cohen 1992) was calculated for the dichotomous independent variables to get an estimate of effect sizes.

Results

Demographic description of the population

Details of the demographic distribution across the questionnaire formats and overall can be seen in Table 1. There were 175 (72%) male and 69 (28%) female respondents, and the distribution was consistent between the questionnaire formats. Overall, 87% of the respondents grew up in rural districts, almost 60% of the respondents grew up on a goat farm, and more than 80% of them had more than 20 years of experience with animal husbandry. Ninety-three percent of the respondents had farming as their main income.

Empathy and attitude dimensions

The statements comprising the attitude and empathy factors identified from PCFA are listed in Table 2, together with the mean scores and standard deviations for the individual statements and the new index variables. The table also presents eigenvalues, factor loadings, coefficients of internal consistency (α) and the range of each category after conversion to ordinal scale. Regression coefficients associated with the models are presented in Table 3.

Three interpretable dimensions were identified from the empathy scale and were given labels according to the dimensions of human-oriented empathy that we propose that they represent. In the regression models with these empathy dimensions as outcomes, only demographics were screened as independent variables.

Table 2 Statements comprising dimensions of empathy and attitudes, with the range of the categories after conversion to ordinal variables. The table also presents mean scores, estimates from the Principal Component Factor Analysis, and internal consistencies (α).

	Low	Medium	High	Max	Mean (± SD)	Eigenvalue	Loading	α
Empathy 1: 'Emotional contagion'	3–12	13–17	18–20	21	19.3 (± 2.4)	3.75		0.67
I find it irritating when goat kids jump up on me to play (–)					6.3 (± 1.2)		0.66	
I will almost always get in a good mood when I see healthy and happy goats					6.6 (± 0.9)		0.68	
I enjoy patting/stroking goats					6.4 (± 1.1)		0.77	
Empathy 2: 'Perspective-taking'	–	–	–	–	27.4 (± 5.3)	2.26		0.60
People often make too much of the feelings of goats (–)					5.0 (± 1.8)		0.57	
It is silly to become attached to a goat (–)					5.7 (± 1.7)		0.58	
It amazes me how upset some farmers become when they have to kill surplus goat kids (–)					4.4 (± 2.1)		0.69	
Farmers that talk to and cuddle their goats annoy me (–)					6.7 (± 0.9)		0.46	
Many farmers are over-affectionate about their animals (–)					5.6 (± 1.7)		0.68	
Empathy 3: 'Personal distress'	3–12	13–17	18–20	21	17.3 (± 3.6)	1.44		0.63
It upsets me to see and hear about goats that have been killed by predators					5.9 (± 1.6)		0.59	
It makes me sad to see goats isolated from the rest of the flock					5.2 (± 1.8)		0.70	
It upsets me to see helpless, sick goats					6.2 (± 1.3)		0.69	
Attitude 1: 'Easy to work with goats'	2–8	9–11	12–13	14	10.4 (± 3.2)	3.16		0.78
Goats are simple animals to work with					5.1 (± 1.7)		0.86	
Goats are easy to care for					5.3 (± 1.8)		0.89	
Attitude 2: 'Characteristics of goats'	3–12	13–17	18–20	21	19.5 (± 2.7)	1.93		0.65
Goats are curious					6.7 (±1.0)		0.70	
Goats are smelly (–)					6.2 (± 1.4)		0.68	
Goats are dirty (–)					6.5 (± 1.0)		0.33	
Attitude 3: 'Pleasant animals'	3–12	13–17	18–20	21	19.6 (± 2.6)	1.71		0.69
It is pleasant to work with goats					6.7 (± 0.9)		0.48	
Goats are entertaining to watch					6.4 (± 1.2)		0.80	
Goats are intelligent animals					6.5 (± 1.2)		0.74	

(–) Negatively worded items that were reversed before Principal Component Factor Analysis. Means are based on values after reversion.

The first empathy factor comprised three statements pertaining to how the respondents respond emotionally to interactions with goats and was labelled 'Emotional contagion'. Respondents who had upper secondary school compared to only comprehensive school up to fifth form were less likely to be in a higher empathy category, and this was the only significant variable in this model (Table 3).

The second empathy factor comprised five statements pertaining to taking the perspective of other people regarding their emotions about goats. This sub-scale was labelled 'Perspective-taking' and is believed to be a cognitive dimension. The robust linear regression model explained 9% of the variance. Female respondents and respondents who had grown up with a pet or a horse scored higher on the continuous scale compared to male respondents. The Cohen's *d* was 0.2 for gender and 0.3 for growing up with a pet or horse. A five-year increase in age was associated with lower scores on this scale (Table 3).

The third empathy factor comprised three statements pertaining to self-oriented emotional reactivity when observing goats in negative circumstances, and was labelled 'Personal distress'. Respondents with between one and four siblings were less likely to be in a higher category of 'Personal distress' compared to respondents with five or more siblings. Respondents who grew up in a rural district, and had upper secondary school or higher education were less likely to be in a higher attitude category (Table 3).

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Table 3 Regression coefficients and significance levels of the variables in the final ordinal logistic (OL) and robust linear (RL) models (odds ratios presented for the OL models).

	Model type					
	OL	RL	OL	OL	OL	OL
	Dependent variable					
	Emp1	Emp2	Emp3	Att1	Att2	Att3
Gender		1.98*		1.9*		
Age		–0.39*				0.79**
Siblings: 5+ (baseline)						
4			0.36*			
3			0.46*			
2			0.44*			
1			0.45*			
None						
Rural district			0.35**			
Lived on goat farm						0.55*
Had horse/pet		3.08**				
Worked on other farm						2.80*
Primary and secondary school (baseline)						
Upper secondary school	0.39**		0.54*			
Higher education			0.35**			
Other						
Years of experience						2.24*
Emp1 Max (baseline)						
High	×	×	×			0.21***
Medium	×	×	×			0.007***
Low	×	×	×			0.03**
Emp2 (continuous)	×	×	×		1.08**	
Emp3 Max (baseline)						
High	×	×	×	0.33**		
Medium	×	×	×	0.26***		
Low	×	×	×	0.32*		

× Associations not assessed in the regression models. Emp1: 'Emotional contagion'; Emp2: 'Perspective-taking'; Emp3: 'Personal distress'; Att1: 'Easy to work with goats'; Att2: 'Characteristics of goats'; Att3: 'Pleasant animals'.
* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$.

PCFA unveiled three interpretable dimensions from the attitude scale. Demographics and the empathy dimensions were screened as dependent variables in the regression models with these dimensions as outcomes.

The first attitude factor consisted of two statements pertaining to the respondents' perceptions of how easy goats are to manage and care for, and this sub-scale was labelled 'Easy to work with goats'. Ordinal regression analysis showed that female respondents were more likely to be in a higher attitude category, and that the continuous empathy variable 'Personal distress' was positively associated with this attitude factor (Table 3).

The second attitude factor comprised three statements pertaining to the respondents' beliefs about the dispositions and attributes of goats, and was labelled 'Characteristics of goats'. The only significant predictor in the ordinal logistic regression model was 'Perspective-taking', and the association was positive (Table 3).

The third attitude factor comprised three statements pertaining to the respondents' perception of working with goats and was labelled 'Pleasant animals'. Four demographic variables and one empathy factor were significantly associated with this attitude factor. Older respondents, and those who grew up on a goat farm were less likely to be in

or above a higher attitude category. Respondents who had worked on a farm with other species, or had more than 20 years of experience were more likely to be in a higher attitude category. The empathy factor labelled 'Emotional contagion' was positively associated with believing goats are pleasant animals (Table 3).

Discussion

Demographics

Overall, almost 60% of the respondents had grown up on a goat farm, and more than 80% had more than 20 years of experience with animal husbandry. This illustrates the high level of experience this population holds. The two questionnaire modes had some variation in age and educational distribution. Both older age groups and people with lower levels of education are less likely to have access to the internet and be familiar with the use of email, and were therefore less likely to be registered with an email address in the lists we obtained the contact information from.

Empathy and attitude dimensions

The dimensions revealed from the empathy scale in our study correspond to some of the dimensions of human-oriented empathy described by Davis (1980) and Mehrabian and Epstein (1972), although exact comparison is difficult due to inconsistent phrasing of statements. We propose that the factors labelled 'Personal distress' and 'Perspective-taking' correspond to the IRI sub-scales with the same names (Davis 1980). Although the statements that comprised our 'Perspective-taking' sub-scale pertain to animals, the statements actually refer to taking the perspective of other people and their emotions towards animals, and as such should be considered human-oriented cognitive empathy. This may be a relevant measure in the context of animal welfare, but we suggest that future work includes more statements about animal-oriented perspective-taking. Human-oriented perspective-taking is associated with social functioning (Davis 1983). De Vignemont and Singer (2006) argue that perspective-taking does not meet all the criteria for being defined as empathy, as they prefer a narrow definition of empathy that only includes affective states. Nevertheless, the phenomenon is closely related to emotional empathy. If a person never has experienced the emotion of a target it may not be possible to empathise emotionally, and cognitive perspective-taking may provide an alternative route to understand the target's experience (de Vignemont & Singer 2006). Both 'Personal distress' and 'Emotional contagion' are interpreted as different aspects of emotional reactivity. Personal distress is a self-oriented negative emotional response to other's emotions, and is associated with the wish to alleviate one's own distress. It has been argued that tendencies to experience personal distress is caused by an inability to regulate one's emotions, and this form of emotional response is less likely to lead to helping behaviour (Eisenberg & Eggum 2009). We suggest that the 'Emotional contagion' sub-scale corresponds to some degree with the sub-scale labelled 'Susceptibility to emotional contagion' by Mehrabian and Epstein (1972). Emotional contagion is considered a more primitive form of empathy, and reflects people's susceptibility to catch the emotions of others through automatic mimicry and subsequent emotional convergence (Hatfield *et al* 2009). Paul (2000) did not apply any multivariate technique to differentiate between the different dimensions of empathy, so direct comparison with the Animal Empathy Scale, from which we derived our goat empathy scale, is not possible.

The dimensionality of attitudes revealed by PCFA of our 20-item scale is at least partly supported by dimensions reported in other studies. However, previous studies have shown inconsistencies in identified factors, making it difficult to compare findings. Hemsworth *et al* (2000) described five factors from their 25-item scale on general attitudes towards dairy cows (from which we derived our scale). Two factors pertained to ease of management (labelled 'Easy to work with' and 'Easy to manage'). It seems that these two factors tap very similar attitudinal dimensions. Our factor labelled 'Easy to work with goats' had one statement from each of their factors. Panamá Arias and Špinka (2005) did not perform factor analysis to reveal dimensions, but had predefined aspects of attitudes they wished to measure, including ease of handling, which also corresponds to our factor 'Easy to work with goats'. Their scale also measured an attitude aspect they call 'General attitudes', which corresponds somewhat to our factor labelled 'Characteristics of goats'. We propose that 'Characteristics of goats' also corresponds partly with two different factors described by Hemsworth *et al* (2000), namely 'Negative attitudes' and 'Negative characteristics', and also with an attitudinal factor labelled 'Negative beliefs', identified in a study of stockpeoples' attitudes towards pigs (Coleman *et al* 1998). Studies have found consistent relationships between negative attitudes towards pigs and stockperson behaviour (Coleman *et al* 1998). The attitude factor labelled 'Pleasant animals' in the present study corresponds more closely to an identically labelled factor of attitudes towards cows, which was found to be significantly associated with the use of more positive interactions and less negative interactions by dairy cow stockpeople (Hemsworth *et al* 2000).

Associations between attitudes and empathy

In the present study, all the empathy dimensions were significant predictors of attitudes, although each empathy dimension was associated with a different attitude factor. Respondents with higher scores on the 'Emotional contagion' scale had more positive attitudes toward how pleasurable goats are to work with. Respondents that scored higher on the 'Perspective-taking' scale had more positive attitudes towards the general characteristics of goats, while those who scored higher on the 'Personal distress' scale were more positive towards the ease of working with goats. As already mentioned, personal distress is a self-oriented dimension, which may motivate self-related behaviour, like avoidance. If we attempt to interpret the association in terms of this motivation, it could be speculated that being positive about the ease of handling goats brings on better stockman-

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ship, and that this in turn may reduce the stockperson's risk of being exposed to poor welfare, and thus avoiding personal distress. Furnham *et al* (2003) found that the human-oriented 'Emotional concern' and 'Personal distress' sub-scales of the IRI were significant predictors of attitudes towards the use of animals, while the 'Fantasy' and 'Perspective-taking' sub-scales were not associated with attitudes, which suggest a complex relationship between attitudes and empathy. Taylor and Signal (2005) found significant correlations between the 'Empathic concern' sub-scale and the 'Animal attitude' scale among female respondents.

Associations between empathy and attitude dimensions and demographics

Different dimensions of empathy and attitudes were associated with different aspects of demographic background, which is in accordance with what was reported by Furnham *et al* (2003). Men and women have been found to differ in many measures of human-animal interactions, and gender has therefore received particular attention as a predictor of attitudes and empathy. However, for most of the measures, the variation within each gender is larger than the variation between the genders (for a review, see Herzog 2007). This is also the case in the current study, as indicated by low effect size indices. We identified gender differences in the attitude scale 'Easy to work with goats' and the empathy scale 'Perspective-taking', and the differences are in the same direction as have been reported in other studies, with women obtaining higher scores. Signal and Taylor (2007) also found that females scored significantly higher on the 'Perspective-taking' sub-scale of the IRI (Davis 1980), in addition to human-oriented 'Empathic concern' and the overall score on the Animal Attitude Scale (AAS), and the same gender difference has been shown in attitudes towards the treatment of animals (Mathews & Herzog 1997). However, there were no significant differences between men and women in the other attitude or empathy dimensions in the present study. This disparity in the significance of gender in relation to different attitude factors was also reported by Furnham *et al* (2003) who found females to be more negative to animal research than men, whilst there were no differences between men and women in other attitudinal dimensions related to animal use.

Stockpeople who grew up with five or more siblings were more susceptible to personal distress than stockpeople with few to a moderate number of siblings in the present study. Childhood and adolescence is a period of many psychological changes, and it has been suggested that the special facets of sibling relationships can influence pro-social and moral development, but the role of the family in the development of empathy remains largely unclear (Carlo *et al* 1999).

Having a pet or horse during childhood was positively associated with 'Perspective-taking', but none of the attitude factors. This is partially in accordance with other studies, but results are somewhat conflicting. Two studies by Signal and Taylor (Taylor & Signal 2005; Signal & Taylor 2006) showed that attitude scores were not significantly different between those who had companion animals during childhood and those who did not. On the other hand, Paul and Serpell (1993) found that childhood pet-keeping was associated with more positive attitudes to both pets and other animals, including farm animals, and also with human-oriented empathy. Paul (2000) found significant relationships between childhood pet ownership and animal-oriented empathy. Our 'Perspective-taking' scale measures how well respondents can understand and relate to other people's relationships with goats. It is conceivable that attachment to animals during childhood may increase this understanding. Childhood pet owners may therefore differ from those who mainly had contact with farm animals because there is typically greater emotional attachment involved in relationships with companion animals. Although we did not find differences in attitudes between respondents who did or did not grow up with companion animals, the significant difference in 'Perspective-taking' still provides some support for a link between childhood experiences with animals and subsequent adult concerns for animals and people.

Farmers who grew up on goat farms agreed to a lesser extent that goats are pleasant to work with, entertaining and intelligent. Whether these attitudes are formed as a consequence of their background or the positive attitudes towards animals have influenced the career choice of farmers who did not grow up on a farm, is unknown. A possible explanation could be that the respondents who grew up on a goat farm may have become farmers as a result of pressure from parents to take over the family farm, while others made an active decision to become goat farmers as a result of positive attitudes towards goats. However, we have not found any empirical data in support of this, so our proposal remains a mere speculation.

Education level was negatively associated with 'Emotional contagion' and 'Perspective-taking'. Ellingsen *et al* (2010) also found negative associations between education level of dog owners and an overall score of animal-oriented empathy, in addition to pain assessment of depicted dogs and an overall attitude score. Male veterinary students in their final year have been shown to express lower levels of animal-oriented empathy than their peers in lower years (Paul & Podberscek 2000), which could be explained by an emotional hardening due to repeated exposure to animals in pain during the education. But it is not apparent why higher education in general should render people less sensitive to the emotions of animals. Respondents with a university education had the most positive attitudes towards animals in one study, but the differences were not significant (Signal & Taylor 2006).

Our empathy scale included statements pertaining to an appropriate, goat-oriented emotional response, but a factor corresponding to the 'Empathic concern' sub-scale of the IRI (Davis 1980) was not identified through PCFA. A possible explanation could be that the wording made the interpretation of certain statements somewhat unclear.

Studies on animal attitudes and empathy are frequently based on mean or total scores for entire multi-item rating

scales, comprising statements that represent a variety of attitudinal or empathic dimensions. When attitudinal factors have been revealed through multivariate statistics, the attitudes measured have often been specifically related to the use of animals in research and for food (eg Furnham *et al* 2003). These variations in assessment tools and statistical methods may account for some of the disparity of results published (Signal & Taylor 2006), and makes comparison across studies difficult.

Our study illustrates some of the challenges that can arise when analysing data obtained from questionnaires. The extreme right-sided distributions of the index variables created from the PCFA needed to be dealt with in order to avoid biased results and violations of the assumptions of regression analyses. The reason for the extreme distributions in our data could be that farmers in general have very positive attitudes and high levels of empathy with the animals they work with, but some may also have responded in the way they conceived to be expected of them. No direct causal inferences should be made on the basis of the results of this study.

Animal welfare implications

Training stockpeople for the purpose of improving animal welfare involves more than just conveying knowledge and skills, as one also needs to alter existing habits, as well as deep-rooted attitudes and beliefs (Hemsworth & Coleman 2011). Stockpeople in other countries have received such training programmes with appreciation (Boivin *et al* 2003). Some evidence suggests that empathy can be modified by motivation (Duan 2000), and in other scientific fields it is generally acknowledged that people can be trained in perspective-taking and in recognising emotional states in themselves and others, and in that way improve their empathic skills (Feshbach & Feshbach 2009). Given the role of empathy in mediating helping behaviour this could prove to be an additional route to obtaining higher animal welfare standards in the livestock industries. Possible associations between the described attitude and empathy dimensions and on-farm welfare outcomes will be investigated in future studies.

Conclusion

This study revealed attitude factors that can be recognised from studies in other livestock industries, and dimensions of empathy that suggest that animal-oriented empathy may be composed of similar dimensions as human-oriented empathy. Further improvements of methods for measuring animal-oriented empathy are required in order to establish the role of empathy in stockmanship. Our results show that different dimensions of goat-oriented attitudes and empathy were significantly associated with different demographic variables. Moreover, different dimensions of empathy were associated with different attitude factors, suggesting a complex relationship between empathy and attitudes. Future research should aim at increasing knowledge about these aspects of human-livestock relationships. Further analyses have been conducted to explore how these dimensions of attitudes and empathy are associated with stockpeoples' perception of pain in goats and how frequently they contact veterinary surgeons (Muri & Valle 2012).

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