Exploring the relationship between horse-owner attributes and their approach to horse training

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Abstract

The way that horses are trained has implications for equine welfare and training success, yet little is known about the factors that influence horse-owners choice of training approach (TA). Having limited understanding of this area will likely hinder the development and dissemination of evidence-based training advice to owners. Consequently, this study aims to identify demographic and attitudinal factors that influence horse-owner TA selection. A 22-question online survey collected information from 1,593 horse-owners about their demographics, equestrian activities, horse training goals and beliefs. Participants rated how likely they were to use six different horse TAs on a five-point scale. Multinomial regression analysis and Spearman's correlation coefficients were used to identify factors associated with their likelihood of using each TA. Several factors were significantly associated with participants' reported TA use, including their age, gender identity, goals, activities, industry role and whether they had undertaken training in animal behaviour. Beliefs about equine sentience, cognitive ability and whether science should inform horse training correlated with likelihood of applying aversives. Distinct differences in training beliefs were seen between those highly likely to train with food and those more likely to use aversive training methods. This study provides insight for further research and development of educational strategies to reduce the use of training approaches that may compromise equine welfare.

Key words: Equestrian, Horse training, Decision making, Equitation Science, Natural Horsemanship

1.0 Introduction

A range of different horse training approaches (TAs) are used within the equestrian industry to modify horse behaviour, subsequently enabling them to be handled and ridden safely whilst fulfilling a multitude of roles required by humans. Despite many of these TAs sharing roots in the same principles of animal learning (Baragli et al., 2015; McLean & Christensen, 2017) the way in which these methods are applied, described, and marketed often differs. For example, some TAs, such as 'clicker training' which is becoming increasingly recognised in horse training (Carroll et al., 2022; Platzer & Feuerbacher, 2022), place focus on the use of one specific strategy (positive reinforcement) to modify equine behaviour. Others, involve promoting the correct application of multiple learning theory principles to obtain the desired behavioural outcomes (McLean, 2005; McLean & Christensen, 2017). Conversely, some TAs, such as those that fall under the 'natural horsemanship' umbrella, are less frequently discussed in relation to learning theory principles (despite still involving their application (Goodwin et al., 2009; Henshall & McGreevy, 2014)) with emphasis instead placed on the ethos and narrative associated with the approach (e.g. the idea that horse training should be based on how horses are perceived to interact with conspecifics) (Roberts, 2001; Van Der Vaag, 2022).

The type of training employed has been shown to have implications for a range of different human and horse-related factors, including equine welfare (Briefer Freymond et al., 2014; Dai et al., 2019; Innes & McBride, 2008; McLean & McGreevy, 2010; Slater & Dymond, 2011), the horse-human relationship (DeAraugo et al., 2014; Dorey et al., 2014; Larssen & Roth, 2022; Lundberg et al., 2020), and incidence of 'undesirable' behaviour being performed (Danisan & Özbeyaz, 2021; Ferguson & Rosales-Ruiz, 2001; Hockenhull & Creighton, 2012, 2013). Careful selection of TAs that minimise potential harm and maximise training success is therefore vital to improve both equine wellbeing and human safety (Luke et al., 2022). However, despite its relative importance, this decision typically rests solely with horse-owners, who may not necessarily have knowledge of equine learning theory, or an understanding of how different training techniques may impact their horse (Brown & Connor, 2017; Luke, Mcadie, Warren-smith, et al., 2023; Visser & Van Wijk-Jansen, 2012). At present, little is known about how horse-owners make training related decisions, or the factors that influence their choices. This subject has been more widely explored within the dog-owning population, where a range of owner attributes, goals and beliefs were seen to influence the type of dog training employed (Bennett & Rohlf, 2007; Blackwell et al., 2012; Woodward et al., 2021). Given the current paucity of equine-specific research in this area, this study aimed to investigate whether horse owners' likelihood of using specific TAs is associated with their demographic information, equestrian activities, training goals, or beliefs about equine sentience and cognitive capabilities.

2.0 Materials and Methods

Ethical approval for this study was granted by the University of Bristol Faculty of Health Sciences Research Ethics Committee (REF:12094).

An online survey was used to collect information from horse owners or caregivers (i.e. someone who is solely responsible for the care and training of a horse but may not necessarily own them), and formed part of a larger study. The survey *(supplementary file 1)* was created using JISC online surveys (formerly Bristol Online Surveys) and comprised 22-questions, the results from 13 of which will be presented in this article as the remaining questions will be analysed qualitatively and reported elsewhere.

Initially, participants were provided with the following statement to ensure the term 'training' was interpreted consistently, and to differentiate between its use to mean 'physical conditioning/ fitness work':

> *'The term 'training' is being used within this questionnaire to refer to* ***methods used to modify horse behaviour*** *(e.g. teaching a new behaviour or reducing the amount of undesirable behaviour performed).'*

The questionnaire was divided into three sections, the first contained a range of demographic questions asking about the participant's age, education level, role in the industry and the equestrian activities they participate in, as well as gathering information about their horse training goals and intentions. Section two asked participants to rate on a five-point scale (1=*'very unlikely to use'* – 5= '*very likely to use'*) their likelihood of using six different horse training approaches *(see table 1)* that had previously been identified within the scientific literature (Bartlett et al., 2022). Given that previous works suggest equestrians' understanding of learning theory terminology is limited (Brown & Connor, 2017; Luke, Mcadie, Warren-smith, et al., 2023; Warren-Smith & McGreevy, 2008) and to avoid bias that words such as 'punishment' or 'negative' could introduce (McLean & Christensen, 2017) a description and examples, but not the name, of each TA were provided *(table 1).*

Table 1*- Six training approach descriptions presented to survey participants.*

TA name *(not shown to participants)*	**Description provided to participants**
Negative Reinforcement (NR)	*Removing pressure to encourage desirable behaviour (e.g. applying rope or rein pressure and then releasing this when the horse performs the behaviour you want).*
Positive Punishment (PP)	*Adding something your horse won't like to discourage unwanted behaviour (e.g. tapping a horse on the nose, or using the word 'no', if they perform a behaviour you do not want them to).*
Positive Reinforcement (tactile) (PR-T)	*Adding something your horse will like to encourage behaviour you want (e.g. using scratches to reward desirable behaviour)*
Positive Reinforcement (food) (PR-F)	*Using food rewards to encourage behaviour you want (e.g. using treats to reward desirable behaviour)*
Combined Reinforcement (CR)	*Combining 'pressure and release' with something your horse will like to encourage desirable behaviour (e.g. removing pressure AND giving a scratch or food reward when the horse performs a behaviour you want).*

Natural Horsemanship (NH)	*Using training that is based on mimicking how horses communicate with each other with the use of body language and/ or pressure (e.g. natural horsemanship, join-up, Parelli methods)*

The third (final) section aimed to assess participants' beliefs about horse training, equine sentience and pain sensitivity in relation to humans. This involved asking participants to rate their agreement (1='*Strongly disagree'* – 5 = '*Strongly agree'*) with 13 statements *(see fig. 2).* Statement development was informed by existing work in comparable species (e.g. factors shown to influence dog owner training decisions (ref)) and key concepts (e.g. dominance (Hartmann et al., 2017)) referred to within the horse training literature.

Prior to being shared online, four 'think aloud' cognitive pilot interviews (Leighton, 2017) were conducted with horse owners to assess question viability and identify areas for improvement. Only small changes were made to question wording following this process. The finalised questionnaire was distributed on relevant Facebook® social media pages relating to 'equestrianism' and 'horse ownership', with sharing of these posts enabled to further increase questionnaire reach. It was available online for 45 days between December 2022 and February 2023. All responses were anonymous, and participants were required to give informed consent to their responses being used for research purposes prior to completing the questionnaire.

2.1 Statistical analysis

All statistical analyses were conducted in SPSS version 29.0 for Windows® (SPSS Inc., USA). Prior to formal analysis, questionnaire responses were filtered to remove those from individuals who stated that they did not currently own or loan a horse.

Friedmans ANOVA was initially used to test for differences in the median 'likely-to-use' score between the six different TAs. Multinomial logistic regression (ordinal logistic regression was not used as the resultant models violated the proportional odds assumption (Kleinbaum & Klein, 2010)) was then used to determine whether the odds of self-reporting as 'very unlikely', 'unlikely', 'likely' or 'very likely' to use each of the five TAs described was associated with an individual's response to the demographic portion of the questionnaire. The midpoint response of 'neither likely nor unlikely' was used as the reference category for analysis. A separate model was built for each TA, which first involved conducting univariate analysis on all predictor variables to identify those that were associated with the outcome variable for each TA with a significance level of <0.25 Multicollinearity testing was carried out amongst the retained variables using Spearman's correlation coefficients (coefficients ≥ 0.4 will be considered to have collinearity) and variance inflation factor (VIF ≥ 10 and a tolerance ≤ 0.1) (Hosmer et al., 2013). If collinearity was seen between two variables, the one considered most relevant (or seen to have the largest effect size during univariate testing if deemed equally relevant) was retained. Retained variables were used to build a multinomial logistic regression model for each TA. Backwards elimination of variables that did not contribute significantly (set at P<0.05) and whose removal did not significantly reduce the overall model fit was then carried out for each model, with-2log likelihood used to assess the contribution of predictor variables to the model. During result interpretation, the odds ratio (OR) was used to determine the association between predictor and outcome variables.

Separate analysis was carried out to assess the relationship between participants' response to thirteen attitude statements and their likelihood of using each TA. For this, Spearman's correlation coefficient was used with the level of significance set at <0.05.

3.0 Results

A total of 1,593 usable responses from 42 countries were received. The mean age of respondents was 43±16(SD) years, with individuals identifying as female representing 93.59% of this sample, 2.45% identifying as male and the same number as non-binary. The largest majority of respondents (37.35%) were educated up to graduate degree level, whilst 28.56% had undertaken postgraduate study. Equine industry professionals (those whose whole income was from horses) made up 16.01%, whilst semi-professionals (those who make up to half of their income from horses) represented 13.50% of the sample, all others (70.31%) were non-professional equestrians.

When asked how likely they were to use the six different TAs, significant differences were seen between the six approaches (F=2268.27, P<0.001) *(fig. 1)*.

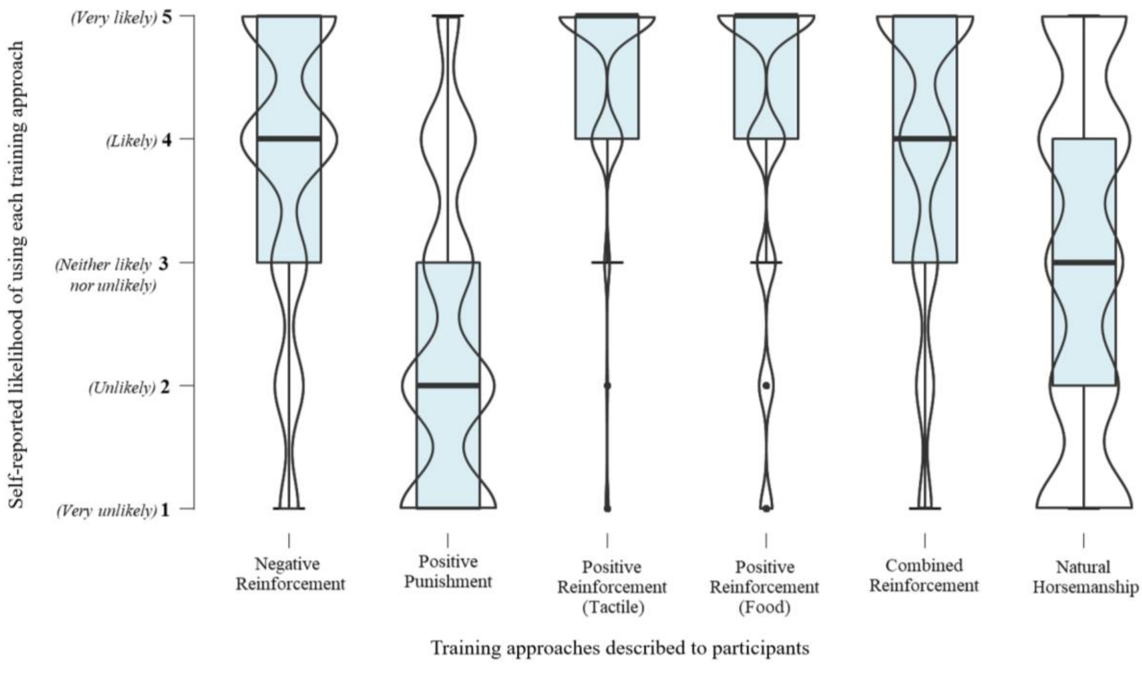

Figure 1 – Likely-to-use scores for each TA. The order of TAs along the x-axis reflects the order in which their descriptions were presented to participants. Violin elements have been included to visualise response distribution for each TA.

3.1 Multinominal logistic regression models to identify factors associated with likelihood of using each training approach

Independent regression models were created for each TA where the response rate was sufficiently high to enable this. Participants likelihood of using each TA was included as the outcome variable for each model. A total of twenty-six *(Table 2)* predictor variables were assessed to determine whether their inclusion in the model significantly improved its ability to predict the outcome variable. Two scale variables ('age' and 'years of horse experience') and 24 categorical variables were used as predictor variables for each model.

***Table 2** – Variables (n=26) considered for inclusion in multinomial regression models. A total of 1593 usable questionnaire responses were obtained, although some questions were left blank by respondents – hence number responses in each category do not always total 1593. Blank responses were automatically excluded during analysis.*

Variable	Categories
Age *(continuous)*	Responses (n=1566)
Years of horse experience *(continuous)*	Responses (n=1572)
Place of residence	Africa[R] (n=17) Asia[R] (n=10) Australia & New Zealand (n=183) Europe (n=334) North America (n=550) South America, Latin America and Caribbean[R] (n=5) **UK *(reference)*** (n=472)
Gender Identity	Male (n=39) Non-binary (n=39) Prefer not to say[R] (n=24) **Female *(reference)*** (n=1491)
Horse ownership status	Currently have one (or more) horses on loan/ lease (n=84) **Currently own one (or more) horses *(reference)*** (n=1509)
Equestrian industry role	Industry professional (make their complete living from horses) (n=255) Semi-professional (make up to half of their living from horses) (n=215) **Non-professional (none/ less than half of their financial gain from horses) *(reference)*** (n=1120)
Highest level of education	No formal academic qualification (n=39) Further education (e.g. above high school but below degree level) (n=43) Higher education (e.g. bachelor's degree) (n=617) Postgraduate (e.g. Masters degree, PhD) (n=455) **High school *(reference)*** (n=404)
Do they have an Equine specific qualification?	Yes (n=668) **No *(reference)*** (n=919)
Equestrian goal	'Begin competing with their horse' (n=108)

	‘Compete at a higher level than they currently are’ (n=254) ‘Continue competing at the level that they currently are’ (n=101) ‘Continue participating in leisure activities with their horse’ (n=471) ‘Start participating in new activities with their horse’ (n=315) Other (n=131) **No real plans/ particular goals *(reference)*** (n=213)
Do they have formal training in animal behaviour?	Yes (n=746) Self-study but no formal training (n=72) **No *(reference)*** (n=758)
Participate in ‘Showing’	Yes (n=281) **No *(reference)*** (n=1312)
Participate in ‘Dressage’	Yes (n=592) **No *(reference)*** (n=1001)
Participate in ‘Show jumping’	Yes (n=272) **No *(reference)*** (n=1321)
Participate in ‘Eventing’	Yes (n=174) **No *(reference)*** (n=1419)
Participate in ‘Unaffiliated competition (any of the above disciplines)’	Yes (n=675) **No *(reference)*** (n=918)
Participate in ‘Affiliated competition (any of the above discipline)’	Yes (n=288) **No *(reference)*** (n=1305)
Participate in ‘Hacking/ trail riding’	Yes (n=1251) **No *(reference)*** (n=342)
Participate in ‘Endurance’	Yes (n=95) **No *(reference)*** (n=1498)
Participate in ‘TREC’	Yes (n=62) **No *(reference)*** (n=1531)
Participate in ‘Riding club activities’	Yes (n=310) **No *(reference)*** (n=1283)
Participate in ‘In hand activities’	Yes (n=864) **No *(reference)*** (n=729)
Participate in ‘Horse agility’ (mounted or unmounted)	Yes (n=324) **No *(reference)*** (n=1269)
Participate in ‘No activities’ with their horse/s (e.g. ‘horse is retired’)	Yes (n=125) **No *(reference)*** (n=1468)
Participate in ‘Other’ equestrian activities	Yes (n=420) **No *(reference)*** (n=1173)
Free text response referred to participating in ‘Carriage driving’ activities	Yes (n=38) **No *(reference)*** (n=1555)
Free text response referred to participating in ‘Liberty work’	Yes (n=56) **No *(reference)*** (n=1537)

[R] Category removed due to low (< 20) response.

Within each model, the middle category for likelihood of use (‘neither agree nor disagree’) was used as the reference, so all results in the following sections should be interpreted in relation to this response category.

3.2 Negative reinforcement (NR)

Initial univariable screening and collinearity testing resulted in the exclusion of six variables. Further reduction of the model was carried out in a backward stepwise manner, with 10 variables used to build the final model *(table 3)*. This was seen to be significantly better at predicting the dependent variable with the addition of the predictor variables ($\chi 2$ (N=1593)= 267.25, $P < 0.001$), with an overall correct classification rate of 40.3%. Pseudo R^2 suggested that the variables in the model explained between 16.8% (Cox and Snell) and 17.8% (Nagelkerke) of the variance between categories.

Table 3 link here (supplementary file)

3.2.1 Factors associated with higher likelihood of using negative reinforcement

Taking part in **riding club activities** was associated with significantly increased odds of being 'likely' (OR=1.673, 95% CI [1.016, 2.755]) and 'very likely' (OR=2.003, 95% CI [1.221, 3.286]) to use NR, compared to those who do not participate in riding club activities. Those who participated in **dressage** had significantly reduced odds of being 'very unlikely' to use NR (OR=0.512, 95% CI [0.274, 0.995]), as did those who participated in **hacking/ trail riding** (OR=0.410, 95% CI [0.232, 0.723]).

Significantly increased odds of being 'very likely' to use NR (vs reference) was seen for individuals with the **goal 'begin competing'** (OR=4.984, 95% CI [1.937, 12.825]), **'compete at a higher level'** (OR=2.659, 95% CI [1.385, 5.105]), **'continue competing at current level'** (OR=4.038, 95% CI [1.554, 10.492]), **'continue participating in leisure activities'** (OR=1.916, 95% CI [1.082, 3.393] or **'start participating in new activities with their horse'** (OR=2.163, 95% CI [1.164, 4.016]), compared to individuals without an equestrian goal. Those that aimed to **'begin competing'** also had significantly increased odds of being 'likely' to use NR (OR=2.785, 95%CI [1.107, 7.004]) compared to the reference category.

Those working in the equestrian industry as a **semi-professional** had significantly greater odds of being 'very likely' to use NR (OR=1.808, 95% CI [1.048, 3.117]), compared to those not working in the industry. These odds were also increased for those working as an **industry professional** (OR=1.252, 95% CI [0.784, 2.002]), although this was not statistically significant.

3.2.2 Factors associated with lower likelihood of using negative reinforcement

Participants who reported doing **liberty work** with their horse had significantly increased odds of being 'unlikely' to use NR (OR=2.808, 95% CI [1.031, 7.652]. Participating in **horse agility** significantly increased the odds of being 'very unlikely (OR=2.015, 95% CI [1.169, 3.473]), and decrease odds of being 'likely' (OR=0.635, 95% CI [0.421, 0.959]) or 'very likely' (OR=0.57, 95% CI [0.374, 0.87]) to use NR compared to the reference mid-point.

3.3 Positive Punishment (PP)

Univariate screening and collinearity testing resulted in the exclusion of 10 variables, with a further five excluded during stepwise removal, meaning 11 were included in the final model. The final model *(table 4)* was significantly better than a null model at predicting the dependent variable ($\chi 2$ (N = 1593) = 238.64, P < 0.001), with an overall correct classification rate of 39.7%. Pseudo R^2 suggested that the variables in the model explained between 15.1% (Cox and Snell) and 15.9% (Nagelkerke) of the variance between categories.

Table 4 link here (supplementary file)

3.3.1 Factors associated with higher likelihood of using positive punishment

Participating in **hacking/trail riding (**OR=0.630, 95% CI [0.41, 0.97]), **riding club activities** (OR=0.47, 95% CI [0.3, 0.74]) and **TREC** (OR= 0.35, 95% CI [0.16, 0.8]) were all associated with significantly reduced odds of being 'very unlikely' to use PP. The latter was also seen to significantly reduce odds of being 'likely' to use PP (OR=0.36, 95% CI [0.13,0.97]). Taking part in **dressage** significantly increased odds of being likely to use PP (OR=1.52, 95% CI [1.02, 2.28]).

Individuals with the goal to **'compete at a higher level'** had significantly increased odds of being 'likely' to use PP (OR=2.02, 95% CI [1.00, 4,08]).

Respondents without a formal qualification in animal behaviour, but who reported undertaking **self-study**, had significantly increased odds of being 'very likely' to use PP (OR=3.07, 95% CI [0.95, 9.88]). Conversely, having a **formal qualification in animal behaviour** was associated with increased odds of being 'very unlikely' to use PP, and decreased odds of being in any other category when compared to the reference, although this did not reach significance.

For every one-year increase in respondents **age**, they had significantly decreased odds of being 'unlikely' to use PP (OR=0.98, 95% CI [0.97, 1.00]).

3.3.2 Factors associated with lower likelihood of using positive punishment

Taking part in **horse agility** significantly increased odds of being 'very unlikely' to use PP (OR=2.06, 95% CI [1.35, 3.16]).

Those taking part in '**other**' activities with their horse (i.e. those not listed as an option) had significantly reduced odds of being 'likely' to use PP (OR=0.57, 95% CI [0.37, 0.88]), along with reduced (although not significantly) odds of being 'very likely', 'unlikely' or 'very unlikely' to use it suggesting there were most likely to select the reference ('neither likely not unlikely') category.

3.4 Positive Reinforcement with a food reinforcer (PR-F)

Univariate screening and collinearity testing resulted in the exclusion of 10 variables. Further reduction of the model was carried out in a backward stepwise manner with four removed, meaning 12 variables were included in the final model. Although significant during univariate analysis, the variable 'gender identity' was not included in the final model as none of the respondents within the 'non-binary' group reported being 'Unlikely' or 'Very unlikely' to use PR-F, and thus odds ratios could not be reliably calculated. However, cross-tabulation analysis *(table 5)* showed that significantly less males than expected were 'very likely' to use this training approach with more than expected in the 'neither unlikely nor likely' and 'unlikely' categories (χ^2=31.729, df=8, P<0.001).

***Table 5** – Cross-tabulation analysis for 'gender identity' and likelihood of using PR-F.*

		Very unlikely	Unlikely	Neither likely nor unlikely	Likely	Very Likely	Total
Male	Count	3	8	10	6	12	39
	Expected Count	2.54	3.12	4.05	8.17	21.12	39
Non-binary	Count	0	0	1	10	28	39
	Expected Count	2.54	3.12	4.05	8.17	21.12	39
Female	Count	98	116	150	309	800	1473
	Expected Count	95.92	117.76	152.90	308.66	797.76	1473

The final model *(table 6)* was significantly better at predicting the dependent variable with the addition of the predictor variables ($\chi2$ (N = 1593) = 314.94, P < 0.001), with an overall correct classification rate of 55%. Pseudo R^2 suggested that the variables in the model explained between 19.1% (Cox and Snell) and 20.7% (Nagelkerke) of the variance between categories.

Table 6 link here (supplementary file)

3.4.1 Factors associated with higher likelihood of using positive reinforcement (food)

Compared to respondents from the UK, those from the **USA and Canada** had significantly increased odds of being 'very likely' to use PR-F (OR=1.911, 95% CI [1.203, 3.035]) This increase was also seen for those from **Europe**, although this only reached borderline significance (P=0.05) (OR=1.757, 95% CI [0.999, 3.090]).

When compared to the reference category, significantly increased odds of being 'very likely' to use PR-F were seen for those who did **in hand activities** (OR=1.625, 95% CI [1.089, 2.425]) and those who do **no activities** (e.g. horse is retired) (OR=3.84, 95% CI [1.319, 11.184]) with their horse.

Those who took part in **endurance** had significantly reduced odds of being 'very unlikely' to use PR-F (OR=0.167, 95% CI [0.036, 0.764]), although this was coupled with reduced (although not significant) odds of falling into any other category, highlighting that they were most likely to select the reference (neither likely nor unlikely).

Significantly increased odds of being 'very likely' to use PR-F was seen for those who undertook **self-study** (OR=3.268, 95% CI [1.100, 9.712]) and those with a formal **qualification in animal behaviour** (OR=2.301, 95% CI [1.54, 3.438]). The latter also had significantly increased odds of being 'likely' to use this approach when compared to the reference (OR=1.869, 95% CI [1.207, 2.893]).

3.4.2 Factors associated with lower likelihood of using positive reinforcement (food)

Equestrian industry **professionals**, when compared to non-professionals, had significantly reduced odds (OR=0.585, 95% CI [0.351, 0.976]) of being 'very likely' to use PR-F.

Participating in **dressage** was associated with significantly increased odds of being 'very unlikely' (OR=0.413, 95% CI [0.221, 0.772]) and 'very likely' (OR=0.645, 95% CI [0.645, 95% CI [0.427, 0.973]) to use PR (food), suggesting that they had increased odds of selecting the reference (neither likely nor unlikely to use PR-F).

Increased **age** was associated with reduced odds of being 'likely' (OR=0.987, 95% CI [0.973, 1.000]), and significantly increased odds of being 'very likely' (OR=0.982, 95% CI [0.970, 0.995]) to use PR-F.

3.5 Combined Reinforcement (CR)

Eight variables were included in the final model, as ten were removed during univariate testing and a further eight during backwards elimination. The final model *(table 7)* was significant ($\chi 2$ (, N = 1593) = 214.24, $P < 0.001$), with an overall correct classification rate of 47.6%. Pseudo R^2 suggested that the variables in the model explained between 13.6% (Cox and Snell) and 14.6% (Nagelkerke) of the variance between outcome categories.

Table 7 link here (supplementary file)

3.5.1 Factors associated with higher likelihood of using combined reinforcement

Those who took part in **hacking/ trail riding** had significantly reduced odds of being 'unlikely' (OR=0.440, 95% CI [0.257, 0.754]) and 'very unlikely' (OR=0.545, 95% CI [0.303, 0.982]) to use CR.

Participating in **dressage** significantly increased odds of being 'very likely' to use CR (OR=1.523, 95% CI [1.031, 2.251]), whilst **showjumping** was associated with significantly increased odds of being 'likely' (OR=1.971, 95% CI [1.026, 3.785]) and 'very likely' (OR=2.293, 95% CI [1.241, 4.237]) to use CR.

Odds of being 'very likely' to use CR were significantly increased for those whose **goal was begin competing** (OR=2.401, 95% CI [1.015, 5.680]), **continue participating in leisure activities** (OR=1.691, 95% CI [1.009, 2.836]), and **start participating in new activities** (OR=1.935, 95% CI [1.093, 3.425]). The same three goals were also associated with increased odds of being 'likely' to use CR (OR=3.058, 95% CI [1.225, 7.635].; OR=1.922, 95% CI [1.085, 3.404]; OR=2.345, 95% CI [1.257, 4.377] respectively). Having the goal **'compete at higher level'** also increased odds of being 'very likely' to use CR (OR=2.109, 95% CI [1.102, 4.034]).

3.5.2 Factors associated with lower likelihood of using combined reinforcement

When compared to the reference measure having undertaken **formal training in animal behaviour** significantly increased odds of being 'very unlikely' (OR=1.791, 95% CI [1.051, 3.052]), 'unlikely' (OR=2.200, 95% CI [1.337, 3.621]), and 'very likely' (OR=1.494, 95% CI [1.053, 2.119]) to use CR, suggesting that the these individuals were less likely to select the reference (neither likely nor unlikely) compared to those with no training in animal behaviour.

A one-year increase in **age** was associated with significantly lower odds of being 'very likely' to use CR (OR=0.989, 95% CI [0.977, 1.000]).

3.6 Natural Horsemanship (NH)

Univariate screening and collinearity testing resulted in the exclusion of 10 variables. Further reduction of the model results in the removal of eight variables, leaving eight to be included in the final model. The final model *(table 8)* was significantly better at predicting the dependent variable than a null model ($\chi 2$ (, N = 1593) = 172.86, P < 0.001), with an overall correct classification rate of 30.9%. Pseudo R^2 suggested that the variables in the model explained between 11.1% (Cox and Snell) and 11.6% (Nagelkerke) of the variance between categories.

Table 8 link here (supplementary file)

3.6.1 Factors associated with higher likelihood of using natural horsemanship

Participating in **hacking/ trail riding** was associated with significantly decreased odds of being 'very unlikely' to use NH (OR=0.600, 95% CI [0.401, 0.896]) compared to selecting the reference category.

When compared to individuals with no formal **training in animal behaviour**, those with training had significantly increased odds of being both 'very unlikely' (OR=2.031, 95% CI [1.442, 2.860]) and 'very likely' (OR=1.524, 95% CI [1.073, 2.116]) to use NH - suggesting that they were more likely to have stronger likelihood at either end of the scale than they were to select the reference measure.

Odds of being 'unlikely' (OR=0.986, 95% CI [0.974, 0.997]) to use NH significantly decreased with each additional year of **age**, whilst odds of being 'very likely' significantly increased (OR=1.021, 95% CI [1.010, 1.033]).

3.6.2 Factors associated with lower likelihood of using natural horsemanship

Individuals who identified as **non-binary** had significantly reduced odds (OR=0.197, 95% CI [0.041, 0.940]) of being 'likely' to use NH compared to females.

The activity **'carriage driving'** was associated with significantly decreased odds of being 'very likely' to use NH (OR=0.186, 95% CI [0.048, 0.718]). Those who participated in **dressage**, had significantly reduced odds of being 'very unlikely' (OR=0.469, 95% CI [0.332, 0.663]), 'unlikely' (OR=0.997, 95% CI [0.483, 0.997]), 'likely' (OR=0.632, 95% CI [0.450, 0.889]) and 'very likely' (OR=0.436, 95% CI [0.450, 0.889]) to use NH compared to the reference measure, indicating that they were most likely to state that they were 'neither likely, nor unlikely' to use this approach.

3.7 Tactile positive reinforcement (PR-T)

The likely-to-use scores for PR-T showed little variation, with 91.65% of respondents reporting being 'likely' or 'very likely' to use it (22.22% (n=354) and 69.43% (n=1106) respectively). Only 1.95% (n=31) were 'very unlikely' and 0.88% (n=14) were 'unlikely' to use this approach.

This unanimity within the response meant that it was not possible to reliably identify factors that influenced an individuals' likelihood of using PR-T and was therefore decided that multinomial regression analysis was not appropriate to identify factors associated with the use of this TA.

3.8 Association between response to belief statements and likelihood of using each training approach

Participants responses to the thirteen horse training belief statements can be seen in *Fig. 2.*

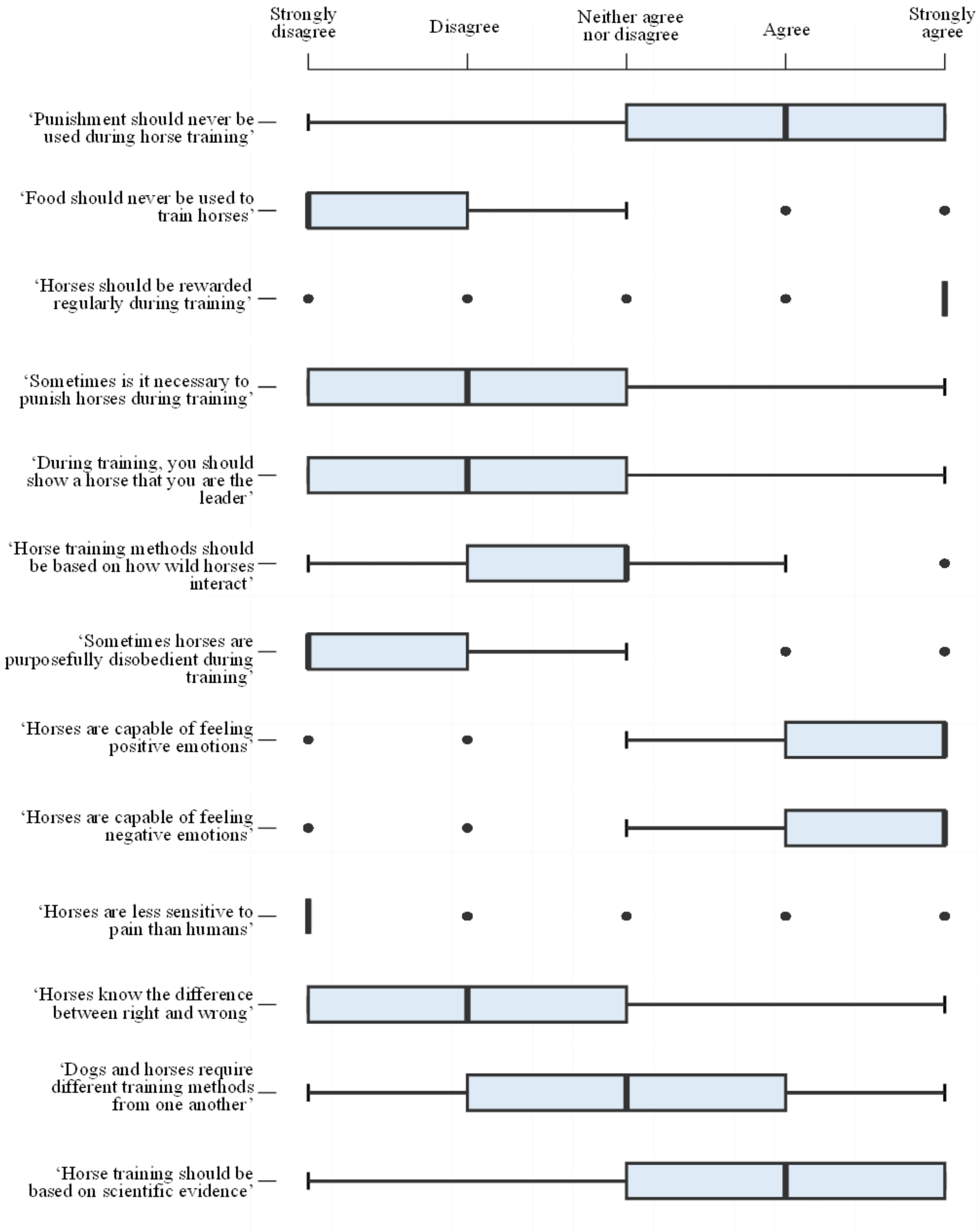

Figure 2 – Median (± range) agreement scores for each statement.

Spearman's correlations were used assess association between participants self-reported agreement with each statement (1='*Strongly disagree'* – 5 = '*Strongly agree'*) and their likelihood of using (1='*very unlikely to use'* – 5 = '*Very likely to use'*) each training approach. The strength and directionality of these associations (R-values) are shown in *Table 9*, with asterisks used to denote their level of statistical significance. In total, 72/78 of the associations tested were found to be significant, with all but one of the non-significant associations seen in relation to combined reinforcement.

Table 9 *– Relationship (R-values) between participant likelihood of using each TA and their agreement with each belief statement.* ***NR****= negative reinforcement;* ***PP*** *= positive punishment;* ***PR-T*** *= tactile positive reinforcement;* ***PR-F*** *= food-based positive reinforcement;* ***CR*** *=combined reinforcement;* ***NH*** *= natural horsemanship.*

-1.00 0.00 1.00

	NR	PP	PR-T	PR-F	CR	NH
a) 'Punishment should never be used during horse training'	-.296**	-.423**	.073**	.211**	-.218**	-.111**
b) 'Food should never be used to train horses'	.237**	.238**	-.253**	-.679**	0.022	.323**
c) 'Horses should be rewarded regularly during training'	-.067**	-.106**	.195**	.217**	.056*	-.121**
d) 'Sometimes it is necessary to punish horses during training'	.247**	.395**	-.089**	-.195**	.178**	.132**
e) 'During training, you should show a horse that you are the leader'	.333**	.349**	-.174**	-.379**	.188**	.456**
f) 'Horse training methods should be based on how wild horses interact'	.187**	.201**	-.118**	-.299**	.105**	.561**
g) 'Sometimes horses are purposefully disobedient during training'	.179**	.295**	-.132**	-.227**	.098**	.223**
h) 'Horses are capable of feeling positive emotions'	-.094**	-.093**	.187**	.206**	0.001	-.057*
i) 'Horses are capable of feeling negative emotions'	-.107**	-.095**	.156**	.187**	-0.013	-.058*
j) 'Horses are less sensitive to pain than humans'	.111**	.186**	-.153**	-.195**	-0.002	0.046
k) 'Horses know the difference between right and wrong'	.052*	.203**	-.071**	-.178**	.060*	.214**
l) 'Dogs and horses require different training methods from one another'	.218**	.179**	-.148**	-.324**	.129**	.279**
m) 'Horse training should be based on scientific evidence'	-.117**	-.186**	.175**	.361**	-0.034	-.361**

** Correlation is significant at the 0.01 level (2-tailed). *Correlation is significant at the 0.05 level (2-tailed).

4.0 Discussion

Usable responses were received from a diverse group of horse-owners, with a mix of individuals from various countries, ages, and industry roles, although the bias towards female respondents frequently seen within leisure horse-owner research (e.g. Bowden et al., 2020; Fenner, Caspar, et al., 2019; Hemsworth et al., 2021) was present. Significant differences in the median likelihood scores for each TA supports the idea that horse-owners do perceive these six approaches differently and do appear to show preferences for specific TAs. Multinomial regression models were created for five of the six TAs, all of which identified variables that were significantly associated with the likelihood of using that TA. The implications of these findings are discussed below, although as the quantitative approach followed does not enable the motivation behind the associations to be determined it's important that a causal relationship between horse-owner attributes and TA-use is not assumed.

4.1 Equestrian activities and goals

Individuals who took part in equestrian activities that involved riding their horses (e.g. riding club activities, hacking, dressage, showjumping), or had a goal that related to competing with their horse, were more likely to use NR and PP during training. This is unsurprising given that these TAs often involve the application and release of physical pressure, which is generally considered the most convenient way for riders to communicate with the horse whilst seated on them (McLean, 2005). They also allow behaviours to be subtly reinforced or punished without interruption to riding 'flow' which is particularly desirable during timed events, or in competitions (e.g. dressage (FEI, 2022)) where traits such as horse-rider 'harmony' are highly prized. Using NR also means that riders are not subjected to the practical challenges that come with the use of other TAs, such as the need to deliver food rewards whilst mounted. These challenges may explain why a higher likelihood of using PR-F was seen amongst individuals who participate in non-ridden activities (e.g. in-hand work) with their horse, as the delivery of food reinforcement is more easily achieved from the ground. However, implementation difficulties alone do not appear to be the sole reason why an individual may be unlikely to use PR-F, as in the final section of this questionnaire stronger agreement with the statement *'horses should never be trained with food'* was seen to be associated with an increased likelihood of using both NR and PP. In dog owners, an unwillingness to train their animals with food has been attributed to the belief that this constitutes 'bribery' rather than 'proper training' (Feng et al., 2017), whilst in horse training the concerns that this may result in horses performing unwanted oral investigative behaviour has been raised (Hockenhull & Creighton, 2010), although much of this is anecdotal and further exploration of attitudes towards this topic is warranted. Greater long-term consistency in learning was also seen when young horses underwent an avoidance learning test (PP/NR used to shape behaviour) when compared to a reward learning test (PR used) (Visser et al., 2003). This could be another reason why during ridden activities, where rider safety would be at risk if horses do not respond consistently to cues, NR and PP was more likely to be used. Ultimately, it appears that unfavourable attitudes toward the use of food during horse training are contributing to the continued reliance on NR and PP seen throughout the industry – suggesting that even if all practical barriers were removed, some owners would still be unwilling to utilise food-based training.

In an earlier section of this questionnaire (Bartlett et al., 2023), NR and PP were rated as the least ‘ethical’ TAs by horse-owners. Prioritising ethics when selecting a TA may therefore result in some owners favouring PR based-methods over NR or PP, and potentially then choosing not to ride or compete with their horses, instead preferring non-ridden activities that more readily facilitate the use of PR-F which would explain the differences in activity participation reported. Additionally, the fact that individuals who participate in riding club activities or equestrian competition are more likely to be surrounded by other riders who frequently use NR/ PP may result in them being less likely to question its ethicality or to seek out other training practices. Alternatively, it could simply be that these riders do also consider NR and PP as being less ethical but choose to prioritise their own competition goals/ success over what they consider to be best for the horse, which aligns with the conclusion reached by Luke, et al. (2023).

These findings would suggest that TA selection is driven, at least in part, by factors beyond simply TA practicality or efficacy, and highlights a need for more in depth exploration of owner TA perception. Although, this subject is further complicated by the fact that additional confounding factors may be responsible for the associations seen. For example, owner ‘confidence’ was not measured in this study, but it’s plausible that those who are ‘nervous’ when riding would favour training their horse from the ground (as mentioned by a participant in Birke (2007)) and would subsequently be less likely to have a goal that relates to ridden competition. These same individuals may also be less inclined to utilise training approaches that involve applying aversives, for fear of eliciting a negative behavioural response from their horse, which may have encouraged them to seek out TAs more reliant on the use of positive reinforcement or negative punishment.

Participant likelihood of using NH was not significantly associated with any goals, and only two activities (hacking/ trail riding and carriage driving). This may reflect tha fact that likelihood of using NH is not tied to a particular discipline and that is it equally likely to be used regardless of whether individuals currently, or aim to, compete. However, it could also be due to the description provided for NH being considerably broader than the other TAs, referring more to a belief system rather than a specific method of punishment/ reinforcement delivery. There are also a multitude of different trainers and ‘schools of thought’ that sit within the NH belief system (Birke, 2007; Goodwin et al., 2009), so simply presenting this as a singular TA may not have been sufficient for more specific trends to be identified.

4.2 Owner age and gender identity

Participant age was seen to be a highly influential factor that was significantly associated with likelihood of using PP, PR-F, CR and NH. Increased age reduced their likelihood of using CR and PR-F, and increased likelihood of PP and NH being used, suggesting that older individuals may be less likely to utilise TAs that involve actively providing reinforcement, or are more reliant on methods involving the addition or removal of aversives. This finding aligns with patterns seen amongst dog-owners where those aged >55 years were less likely to use exclusively reward-based training techniques (Woodward et al., 2021). This may be the result of growing emphasis being placed on the use of reinforcement-based animal training in recent times (Carroll et al., 2022; De Castro et al., 2020; Platzer & Feuerbacher, 2022) or attitudinal changes towards 'punishment' as a concept over the last 40 years (Clément & Chamberland, 2014; D'Souza et al., 2016). Moving away from the traditional reliance on punishment and NR in horse training, and adopting more novel TAs (e.g. CR and PR-F) would likely be challenging for individuals who have spent many years in the industry, as this would necessitate changing their pre-established training behaviours and habits (Michie et al., 2011). Barriers to the adoption of novel TAs may therefore be reduced for younger individuals who have recently entered the equestrian industry (Visser et al., 2011), which could further explain the effect of age seen here.

Gender identity was also seen to have an effect, with individuals identifying as male less likely to use PR-F than females, and less likely than expected to use PR-T, which suggests that males are overall less likely to use, or to admit using, TAs that involve providing their horse with positive reinforcement. Whilst the high ratio of female to male respondents means that this result should be interpreted with caution, it does align with trends seen in dog-training where males were more likely than females to report using punishment (Blackwell et al., 2012) and less likely to use reward-based methods when training their dog. This could reflect attitudinal differences towards animal training techniques, animals in general (Herzog, 2007; Signal et al., 2018) or altered perceptions of problematic behaviour as reported by (Bennett & Rohlf, 2007). Rider gender has also been shown to influence perceptions of horse-rider pairings in a theoretical matching exercise where males were more likely than females to be allocated a stallion, who was less likely to be described as *'safe'* (Fenner et al.,2019). If these perceptions hold true in real-life scenarios, males may be more likely to be matched with horses that show challenging behaviour, thus resulting in altered TA selection. It's equally possible that TA difference between male and females in this context may simply be attributed to the fact that males are more motivated to compete, as evidenced by their low prevalence within the leisure rider population but considerable presence at high level equestrian competition (Hedenborg & White, 2012). Interestingly, those who identified as non-binary were less likely than both male and female respondents to use NH, and appeared more open to the use of food during training. This may represent an area for further work, although the small sample must again be taken into consideration when interpreting this result.

4.3 Industry role and country of residence

Respondents working as equestrian industry professionals were less likely to use PR than non-professionals, but more likely to use NR. Similar findings were reported by Brown and Connor (2017) where a greater number of amateur equestrians reported that they would use PR if their horse performed well during training, whilst more professional equestrians selected the NR option. This may reflect the increased pressure that professionals are under to obtain ‘quick results’ when training horses (Dashper, 2014; Hogg & Hodgins, 2021), or be attributed to the fact that industry professionals, having decided to dedicate their working life to equestrianism, would presumably be more likely to have horse-related goals. Country of residence was also seen to be influential, with participants based in Europe, the USA and Canada significantly more likely to use PR-F than those based in the UK. However the ‘snowball’ method of questionnaire distribution used considerably limits the reliability of this result, as the individuals reached will be wholly dependent on the type of social media groups it was shared to, which are often location specific. Consequently, these findings are unlikely to be representative of whole country and further work is required explore differences in TA selection across different countries.

4.4 Education, beliefs about equine sentience, cognitive ability, and the role of science in horse training

Despite horses being widely accepted as sentient beings that are capable of experiencing both positive and negative emotions (Hall et al., 2018; Trösch et al., 2020) and appearing to have pain sensitivity comparable to that of humans (Gleerup & Lindegaard, 2016; Tong et al., 2020), some questionnaire respondents still appeared to underestimate or question these abilities. Agreement with the idea that horses are capable of experiencing emotions, or that they have pain sensitivity equivalent to that of humans, was negatively correlated with owner likelihood of using NR, PP, and NH. This seemingly demonstrates that individuals with less awareness of equine emotions or pain sensitivity are more likely, or more willing to admit to, using TAs that rely on the application of aversives. This may be because these individuals are less aware or conscious of the negative impact that applying aversives may have on equine physical and psychological state (Baragli et al., 2015; McGreevy & McLean, 2009; McLean & Christensen, 2017). Belief in equine sentience (Haddy et al., 2023) and awareness of horse pain (Luna et al., 2018) have both been seen to correlate with equine welfare state, adding further weight to this theory. Alternatively, it may reflect a state of cognitive dissonance (Harmon-Jones & Mills, 1999), or a reluctance to fully acknowledge their horses emotions by individuals more likely to use aversive TAs. Interestingly, alongside underestimating their emotional capabilities, these same individuals appear to be overestimating their horses’ mental abilities, as the belief that horses can intentionally misbehave was also associated with increased likelihood of using NR, PP and NH. Psychology research has shown that humans utilise punishment as a means to promote social cooperation (Seymour et al., 2007). Singer et al. (2006) showed that if a person considers another to be acting 'unfairly', seeing physical punishment delivered to these unfair players increased activation in reward-related areas of their brain and seemingly satisfied their desire for justice. This concept may be equally relevant when extended to horse training, resulting in individuals who believe their horse is purposefully disobedient (which may be perceived as them acting ‘unfairly’ or behaving unreasonably) having stronger motivation to deliver punishment in these instances. This further highlights the importance of ensuring horse-owners have a realistic understanding of equine cognitive capabilities (Randle & Waran, 2017) and a need to prioritise this during future educational interventions.

The likelihood of using these same three TAs, and in particular NH, was also seen to increase for individuals who showed reduced agreement with the statement *‘horse training should be based on scientific evidence’*. Thompson and Haigh (2018) identified beliefs that prevent the uptake of equitation science, which included the idea that *‘Science discounts feel’* and does not adequately account for the complexity of individual horse–human interactions. Given that within NH heavy emphasis is often placed on the idea of developing a ‘connection’ or ‘relationship’ between horse and human (Birke, 2007) which defies clear definition or objective measurement, those who use NH may find it challenging to align their own beliefs with the scientific evidence available. Additionally, in recent years a number of peer-reviewed articles (Campbell, 2023; Fenner, Mclean, et al., 2019; Muller et al., 2016; Rozempolska-Rucińska et al., 2013) have been produced by the scientific community on the subject of NH, with particular focus on the use of ‘round pen training’ and the concept of ‘dominance’, highlighting it’s potential to compromised welfare. This may contribute to increased resistance towards the concept of ‘science informing horse training’, as the evidence presented may conflict with NH users fundamental beliefs. In contrast, there is a growing body of evidence to support the use of PR to train horses (Carroll et al., 2022; Dai et al., 2019; Innes & McBride, 2008), which may explain why those likely to use this approach showed strongest agreement with the idea that science should underpin horse training. Differences in knowledge level about equine learning may also play a role, as undertaking training in animal behaviour was associated with increased likelihood of using PR-F. Furthermore, individuals more likely to use PR-F responded to statements in a way that most closely aligned with current scientific thinking on the subject (for example, agreeing that horses can feel emotions and disagreeing with the idea that they can intentionally misbehave). Overall, these findings emphasise the role that owner beliefs and attitudes play in TA selection, and highlights the potential value in focusing on owner education when developing behaviour change to promote the use of more ‘welfare-friendly’ TAs. In these instances, it may be beneficial to place particular emphasis on delivering training that specifically focuses on animal learning/ behaviour, as this was significantly associated with reported TA use, whilst more general ‘education level’ was not.

4.5 Polarisation of horse training beliefs

The directionality of the correlation between agreement with each of the statements and participant likelihood of using PR (both tactile and food-based) is always opposite that of the relationship between the statements, NR and PP *(table 9)*. This suggests that individuals who are highly likely to use PR and those who are likely to use methods involving the addition or removal of aversive stimuli hold opposing horse training beliefs. This could be considered to mirror the divide seen in the dog training world where training styles are typically categorised as being either purely 'reward-based' or 'balanced', the latter of which involve a combination of NR, PP, PR and negative punishment (Johnson & Wynne, 2023). Such definitive categorisation of TAs as either 'potentially aversive' or 'force-free' is not generally seen in the equestrian world, as NR continues to be the standard and is not often considered as an 'aversive training technique' in the same way as in dog training. The stark contrast in training beliefs seen between these two groups is particularly interesting given that the descriptions provided for PP and NR were intentionally 'mild' (i.e. did not involve inflicting high levels of pain) in an effort to reduce the effect of social desirability bias (Krumpal, 2013), reflecting the fact that some horse owners appear to be strongly opposed to the use of any aversive training methods regardless of severity. These findings seem to indicate that some horse-owners do hold a more 'black or white' perspective when it comes to horse training, and in particular the use of aversives, which should be considered when delivering training advice to specific populations. For example, individuals who disagree with the use of NR when training horses are unlikely to be receptive, and may in fact respond negatively, if training advice that focuses on the correct use of NR is delivered. In this instance, tailoring the type of advice that is delivered would likely improve its uptake.

4.6 Limitations and areas for further study

Whilst considering limitations is vital for any study, it's particularly important for questionnaire-based projects, where response and sampling bias are likely to influence the information gathered (Fenner et al., 2020). Several limitations have already been highlighted within this discussion and, alongside these, it must ultimately be remembered that the sample and their views towards TAs are not necessarily representative of the whole target population, especially as participants were required to 'self-select' rendering those with stronger feelings about horse training more likely to participate. Likewise, it should be acknowledged that these findings don't tell us anything about how the different TAs are applied, how often they are used, or the extent to which they may represent a welfare concern. A higher likelihood of using PP, does not necessarily equate to the welfare of these horses being lower than those owned by individuals who report being less likely to use punishment. Similarly, the incorrect application of PR could result in horses experiencing negative states (e.g. frustration) or represent negative punishment, the latter of which was not included as a TA in this study as it tends to be used inadvertently rather than intentionally in horse training (McGreevy & McLean, 2009), although exploration of horse-owner attitudes towards it is warranted. Additionally, the way in which participants interpreted the TA descriptions and statements is subject to individual variation. For example, whilst there was almost unanimous agreement across all study participants that horses should be rewarded regularly during training *(fig. 2)*, what participants consider to constitute a 'reward' is likely to vary and may not align with actions that are innately reinforcing or beneficial to the horse (Heleski et al., 2015; Kieson et al., 2020; Takahashi et al., 2016). A final point to consider is that simply asking individuals to rate their likelihood of using each approach doesn't allow for subjectivity in what constitutes 'very likely' to be considered, and is only representative of their training intentions which may not always align with real-life practice. Additionally, no information about the horses themselves, their ages, sex, behaviour or temperament was collected. These factors have been seen to influence how horses respond to training (Janczarek et al., 2013), how 'trainable' they are perceived to be (Fenner et al., 2019; Graf et al., 2013) and are likely to correlate with owner activities and goals. Consequently, further work is required to understand the drivers that underpin the associations identified in this study, and understand the impact that wider owner, horse, and environmental factors have on TA selection.

Ultimately, this study has identified areas warranting future consideration in empirical hypothesis driven research, as well as complexities that would benefit from investigation using qualitative approaches. An improved understanding of the factors that influence horse-owner decision making in relation to training could serve to inform the development of future strategies that promote the wider use of TAs that align with best-practice recommendations, and facilitate the delivery of more targeted training advice to horse owners. Not only would this contribute to improved horse and rider safety (Starling et al., 2016) and equine welfare through the reduction of TAs that are outdated, ineffective or involve inflicting high levels of pain/ punishment (Fenner, Mclean, et al., 2019; McGreevy & McLean, 2009; McLean & McGreevy, 2010) but may subsequently help to meet the equestrian industry's goal of fostering a more positive public image (Douglas et al., 2022; Heleski, 2023).

5.0 Conclusion

The results of this study demonstrate that certain horse-owner attributes do appear to be related to their self-reported likelihood of using specific training approaches. In particular, the role that horse-owner goals, activities, industry-role, belief about equine sentience, and the extent to which they feel science should inform horse training were seen to influence TA use. Whilst this information in itself can be used to support the delivery of more tailored, population-specific training advice to horse-owners, it highlights a need to further explore this topic, potentially utilising a more qualitative approach, to gain greater understanding of the motivations that underpin the associations seen. This study raises some key questions about horse-owners motivation during TA selection and serves as an important starting point in the move towards an improved understanding of horse owner-decision making, the consideration of which is vital in the promotion of more effective, socially acceptable and ethical horse training strategies.

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Supplementary information – see additional file.