

An investigation into equestrian spur use in the United Kingdom

Lemon, Chloe; Lewis, Victoria; Dumbell, Lucy; Brown, Hieke

Published in:
Applied Animal Behaviour Science

Publication date:
2020

The re-use license for this item is:
CC BY-NC-ND

This document version is the:
Peer reviewed version

The final published version is available direct from the publisher website at:
[10.1016/j.jveb.2019.10.009](https://doi.org/10.1016/j.jveb.2019.10.009)

[Find this output at Hartpury Pure](#)

Citation for published version (APA):

Lemon, C., Lewis, V., Dumbell, L., & Brown, H. (2020). An investigation into equestrian spur use in the United Kingdom. *Applied Animal Behaviour Science*, 36. <https://doi.org/10.1016/j.jveb.2019.10.009>

1 **An investigation into equestrian spur use in the United Kingdom**

2

3 *Lemon, C; * Lewis, V; Dumbell, L. and Brown, H.*

4 *Equestrian Performance Research and Knowledge Exchange Arena*

5 *Hartpury University, Hartpury, Gloucestershire, England, GL19 3BE;*

6 ** Corresponding author Victoria.lewis@hartpury.ac.uk*

7

8 **Abstract**

9 Spurs are traditionally worn by riders to enable more precise stimuli or ‘leg aids’
10 to be applied, prompting for changes in locomotion, activity or direction of the
11 horse. Equestrian competitions have seen eliminations and horse welfare concerns
12 raised due to the presence of blood on the horse related to spur use. The aims of
13 this study were to describe spur use across equestrian disciplines and identify
14 reported risk factors that are associated with an increased frequency of skin
15 abrasion. An online survey was administered via social media platforms, industry
16 connections and national online media sources. It included questions on rider
17 demographics, spur design, injury rates and perception of current competition
18 regulations. Inclusion criteria required that participants were aged at least 18 years
19 old, a horse owner/loaner/sharer and resided in the United Kingdom. Eight
20 hundred and fifty-eight participants responded resulting in 628 complete
21 responses for further analysis, 597 from females (95%) and 31 from males (5%).
22 The majority were aged between 18 and 29 years (47%), with 41 participants (7%)
23 reporting their age at 58 years or over. 19 types of equestrian activities were
24 reported and categorised into FEI competitive disciplines, non-FEI competitive
25 disciplines and recreational disciplines. Descriptive statistics, Odds ratios [OR]
26 and Chi-squared tests were utilized (IBM SPSS v24.0) with an alpha value set at
27 $p < 0.05$ (confidence interval 95%) unless otherwise stated. 47% of all participants
28 used spurs. Relationships were found between spur use and gender and duration
29 of years riding. Males were 2.88 times more likely to use spurs than females
30 ($p = 0.005$). Riders within competitive non-FEI disciplines were 1.53 times more
31 likely to use spurs than recreational riders and 1.48 times more likely to use spurs

32 than those competing in FEI disciplines. Longer spur shanks (>32 mm)
33 significantly increased the risk of skin abrasions or hair loss related to spur use
34 ($p < 0.0001$). Rotating spur designs were 1.5 times more likely to be associated
35 with injury compared to fixed shank designs. Future research should consider
36 motivational factors for equipment selection and how it then affects the horse.
37 This information may aid policy makers to formulate ethical guidelines for
38 equestrian sport but also extends to inform riders of all levels how their choice of
39 day-to-day equipment can affect equine welfare.

40 **Keywords: Equestrian; Spurs; Equine welfare**

41 **Introduction**

42 The role of the horse within human society has adapted from that of a working animal
43 to its current widespread use in leisure and sporting contexts (Hill et al., 2015; Gorecka-
44 Bruzda et al., 2015). In 2017, high-profile UK equestrian events attracted 7.5 million
45 spectators at paid-attendance sporting events (Deloitte, 2017). Increasing consumerism
46 and participation in equestrian sport remains central to the aims of national and
47 international federations (British Horse Industry Confederation, 2017; FEI, 2018, BEF;
48 2018). Yet the use of animals for human entertainment attracts differing levels of
49 concern and requests for justification from the general public (Jones and McGreevy,
50 2010). The longevity of equestrian sport relies on policy makers to minimise welfare
51 risks, imposed on horse and rider, in order to maintain a positive perception from the
52 wider public audience (Jones and McGreevy, 2010; Owers, 2017).

53 Methods of horse-training and the types of equipment which are used have attracted
54 public attention in recent years over equine welfare concerns (McLean and McGreevy,
55 2010; Owers, 2017). Previous research in this area has focused on welfare linked to bit
56 use (Tell et al., 2008; Cook, 2011; Björnsdóttir et al., 2014) and nosebands (Randle and
57 McGreevy, 2013; Doherty et al., 2017). To date there has been limited research on spur
58 use. Spurs are a piece of riding equipment used to reinforce the rider's leg aids
59 prompting locomotion, activity or direction (Arkadiusz, 2010; Hill et al., 2015; Uldahl
60 and Clayton, 2019). Recently spur use in equestrianism has attracted negative public
61 attention over the presence of blood on the horse's side in competition (Roome, 2015;
62 Jones, 2017; Jones, 2018). The misuse of spurs can result in worn or hairless areas on
63 the horse's side, which in some cases results in the presence of blood. With increased
64 media and social media attention focusing on social licence to use horses within
65 competitive sport it is essential that the governing bodies are seen to champion equine
66 welfare and where ever possible support evidence based decisions. To date, there is one
67 study that describes the prevalence of equine injuries post-competition in Danish
68 Equestrian Federation competitions in dressage, showjumping, event and endurance
69 (Uldahl and Clayton, 2019). The prevalence of equine injury from spur use in a sub-
70 elite population has not been documented. For this reason, this study sought to examine
71 the prevalence of equine injuries related to spurs across all levels of equestrian
72 disciplines.

73 Spurs are commercially available in a variety of designs and have become a regular part
74 of horse-riding equipment (Hill et al., 2015; Hockenhill and Creighton, 2012).
75 Regulations exist for the types and dimensions of spurs permitted in competition but
76 there is a lack of literature which describes the demographics of spur users, spur designs
77 and the interaction between equine injuries. Peripheral research has associated spur use
78 with increased tendencies to use stronger bits (Hill et al., 2015) and higher frequencies
79 of equine conflict behaviour (Hockenhill and Creighton, 2012). Understanding how
80 equipment affects equine welfare from an evidence based view-point extends to have
81 direct application to industry and have wider socio-economic implications for the future
82 of equestrian sport (Owers, 2017; FEI, 2018; Dumbell et al., 2019).

83 The purpose of this study was to record the use and type of spurs across UK equestrian
84 disciplines and relate these findings with the frequency of equine injury associated with
85 their use. The objectives were to provide prevalence of use data describing current
86 equipment trends in UK equestrians and disciplines.

87 **Materials and methods**

88 *Participants*

89 Following full institutional ethical approval, an online survey was designed to
90 investigate spur use across UK horse riders with reference to the rider, the discipline
91 and spur designs. The online link circulated via social media platforms, industry
92 connections and national online media sources. Inclusion criteria required that
93 participants met the following conditions: a horse owner/loaner/sharer, reside in the
94 United Kingdom and aged over 18 years old. All responses remained anonymous, as
95 such, participant consent was given by their completion of the survey (as described in
96 the briefing page of the survey). The survey was accessible for a six week period [16
97 April, 2018 to 28 May, 2018] which is within the standard activity time for online
98 surveys (CASE; 2018) and offered no incentive for participation.

99 *Measure*

100 A three section survey was constructed using the principles put forward by Diem (2002).
101 The survey containing twenty questions was developed containing closed-responses
102 (e.g. Yes/no and Likert scale). Section 1 ascertained participant demographics for both
103 horse and rider including perceived rider level e.g. professional, amateur or leisure riders
104 who do not compete. Within this categorisation riders could further describe their

105 interaction within the discipline from either affiliated, unaffiliated or leisure riding.
106 Section 2 asked questions on the choice of equipment used at home or “in training” and
107 competition environments. The survey design enabled non-spur users to skip questions
108 related to spurs which included type of spur (Table 2), length of spur shank, the
109 prevalence of skin abrasions on the horse and associated practices related to spur
110 abrasions. To clarify the terminology relating to skin abrasions, the question asked
111 whether the participants had experienced ‘skin abrasions’ or ‘hair loss’ related to spur
112 use. The decision to omit the word *blood* in this question was purposeful in efforts to
113 reduce the ‘participant effect’ whereby participants subconsciously alter their behaviour
114 in a way they assume the researcher expects (Nichols and Manner, 2008). The final
115 section was to explore rider perception of “the blood rule” in FEI regulations. Questions
116 included rating scales to whether the participant agreed with elimination of competitors
117 for excessive spur use *and/or* spur abrasions without the presence of blood *and/or* spur
118 abrasions with the presence of blood.

119 Validity evidence for the instrument was provided by reviewing the questionnaire for:
120 (1) clarity of wording, (2) use of standard English and spelling (3) reliance of items, (4)
121 absence of biased words and phrases, (5) formatting of items, and (6) clarity of
122 instructions (Fowler, 2002). Two faculty senior academics experienced in survey
123 design, were asked to use these guidelines to review the instrument. Based on the
124 reviewers’ comments the instrument was revised and as a pilot study the questionnaire
125 was distributed to several test participants before further revisions were made prior to
126 final administration.

127

128 *Data analysis*

129 A total of 858 initial responses were received. Data validation elucidated a 73%
130 completion rate resulting in 628 complete responses for further analysis. Partial
131 responses (n=230/858) were excluded from analysis as the nature of the study required
132 all three sub-sections to be completed. Additionally during data validation, there was no
133 apparent pattern for survey abandonment and to prevent false-positive assumptions from
134 incomplete responses, partial surveys were not included in analysis. Data were
135 downloaded from Kwik Survey into a Microsoft Excel (2010) spreadsheet (Microsoft
136 Corporation, Redmond, WA). Descriptive statistics were used to report frequencies and
137 percentages within data. Odds ratios [OR] and Chi-squared tests were utilized with an

138 alpha value set at $p < 0.05$ (confidence interval 95%) unless otherwise stated. To explore
139 the interactions between multiple variables log-linear analysis, a form of generalized
140 linear regression, was performed. Statistical analysis were performed by IBM SPSS
141 Statistics Software.

142

143 **Results**

144 Of the 628 participants, 597 were female (95%) and 31 male (5%). The majority were
145 aged between 18 and 29 years (47%), with 41 respondents (7%) reporting their age at
146 58 years or over. Overall, 19 types of equestrian activities were reported and categorised
147 into FEI competitive disciplines, non-FEI competitive disciplines and recreational
148 disciplines (Figure 1). A small number of respondents reported disciplines which were
149 combined as “*other*” in the recreational category and include: British Trec (n=2),
150 positive reinforcement training (n=2), riding for the disabled (n=1) and no discipline
151 specified (n=1). Participants self-declared their interaction within their disciplines as
152 one of the following levels: professional rider affiliated to their discipline (6%);
153 professional rider unaffiliated to their discipline (4%); amateur rider affiliated (36%);
154 amateur rider unaffiliated (34%) or leisure riders who do not compete (20%). All
155 respondents had at least one-year riding experience and the majority of respondents
156 reported at least 16 years horse-riding experience (74%). The majority of respondents
157 (85%) had received training from an equestrian coach during the previous 12 months
158 (n=531/628) with monthly and fortnightly coaching frequency most commonly reported
159 (n=134, 21% and n=126, 20% respectively).

160

161 *Spur use*

162 47% (n=294) of participants reported using spurs. There was a significant association
163 between gender and spur use ($X^2_1 = 7.640$; $p = 0.006$) in that males were 2.88 times more
164 likely to use spurs than females. The duration of years’ riding experience appeared to
165 have no relationship with spur use ($X^2_5 = 4.994$; $p > 0.05$). However there was a positive
166 trend found (Figure 2) in that riders with excess of 21 years’ riding experience were
167 3.14 times more likely to use spurs than riders with 3-5 years’ riding experience.

168

169 The distribution of spur users across individual disciplines varied from 0% of endurance
170 riders to 63% of reining riders using spurs (Table 3). After reining, the highest frequency
171 of spur users within disciplines included polo (62%), showing and hunting (both 54%)
172 and show jumping (50%). Riders within competitive non-FEI disciplines were 1.53
173 times more likely to use spurs than recreational disciplines and 1.46 times more likely
174 to use spurs than competitive FEI disciplines ($X^2_2 = 5.981$; $p=0.050$).

175

176 There was a highly significant association between rider level and spur use ($X^2_4 =$
177 93.225 ; $p=0.000$). 60% of professional riders used spurs and were 1.5 times more likely
178 to use spurs than to “not use spurs.” 54% of amateur riders used spurs and 16% of leisure
179 riders. Furthermore, a highly significant association was found between discipline
180 affiliation and spur use ($X^2_2 = 91.319$; $p<0.0001$). Riders affiliated to their discipline
181 (professional and amateur combined $n=265/628$) were 1.94 times more likely to ride
182 with spurs than without spurs. Affiliated riders were 2.81 times more likely to ride with
183 spurs than unaffiliated riders and 10.21 times more likely to use spurs than leisure riders.

184

185 *Skin abrasions – the spur*

186 Overall, 34% of spur users ($n=101/294$) reported skin abrasions on the horse related to
187 spur use. A significant association was found between spur shank length and skin
188 abrasions ($X^2_3 = 9.228$; $p=0.026$) in that spur-shanks exceeding 31 mm (1.25 inches)
189 were 3.3 times more likely to be associated with abrasions than shanks less than 25 mm
190 (1 inch) (Table 4). Of those that experienced abrasions, only 28% used methods which
191 are perceived within industry as techniques intended to avoid skin abrasions. The most
192 popular technique was the use of a lubricant (Vaseline) to reduce the friction between
193 spur and the horse (49%) followed by leaving a patch of hair when clipping (33%) and
194 commercial spur guards ‘Equine Belly Band’ (31%).

195 Rotating spur designs were 1.5 times more likely to be associated with abrasions
196 compared to fixed designs (Table 4). Although it is important to note this trend failed to
197 achieve conventional thresholds of statistical significance ($X^2_1 = 3.056$; $p=0.053$). The
198 linear model used as a 3-factor interaction showed no association between spur design,
199 abrasion rate and rider level (log linear analysis; $Z=$ various; $p>0.05$). This suggests that
200 spur design and rider level are independent factors in the prevalence of abrasions.

201

202 *Skin abrasions- the rider/discipline*

203 There were no significant relationships found between abrasions and individual
204 disciplines ($X^2_{17} = 10.213$; $p > 0.05$); or discipline categories ($X^2_2 = 0.041$; $p > 0.05$) (Table
205 5). However, a significant association was found between discipline affiliation and
206 abrasions ($X^2_2 = 21.573$; $p < 0.0001$) in that affiliated riders were 3.57 times more likely
207 to have experienced abrasions compared to both unaffiliated and leisure riders. It is
208 important to note that years' riding experience did not equate to a reduced likelihood of
209 abrasions ($X^2_4 = 10.278$; $p = 0.036$). For instance, riders with 11-15 years' riding
210 experience were 1.98 times more likely to have experienced abrasions than riders with
211 21+ years' experience. The level of rider e.g. professional, amateur or leisure did not
212 appear to effect the prevalence of abrasions ($X^2_2 = 4.863$; $p > 0.05$). 47% of professional
213 riders experienced abrasions and were 3.63 times more likely to experience abrasions
214 compared to leisure riders.

215

216 *Perception of competition regulations*

217 From the 628 responses the majority (82%) were in agreement with current FEI
218 regulations which stipulate riders can be eliminated for both (1) excessive use of spurs
219 and (2) for the presence of blood on the horse related to spur use. The remaining
220 participants were equally distributed between disagree (9%) and neutral to the statement
221 (9%). However elimination due to spur abrasions *without* the presence of blood on the
222 horse (e.g. hair loss) was significantly affected by whether the participant used spurs or
223 not ($X^2_1 = 61.743$; $p < 0.0001$). Spur users were 3.8 times more likely to disagree with
224 eliminating riders for spur-related abrasions, without the presence of blood, compared
225 to non-spur users.

226 From the alternative options listed: 60% of participants agreed with the introduction of
227 a phased-sanction approach whereby riders are issued a formal warning on their first
228 incident of spur abrasions *and* subsequent elimination for any repeat offences. 59% of
229 participants agreed with the addition of monetary fines for the presence of spur abrasions
230 involving blood. Increasing sanctions to include formal warnings *and* fines for the
231 presence of spur abrasions was the least popular option with only 50% of riders being
232 in agreement, 28% opposing the idea and 22% remaining neutral on the idea.

233 **Discussion**

234 This study describes spur use across UK equestrian disciplines and the variables which
235 may influence the prevalence of skin abrasion. This information may aid policy makers
236 to formulate ethical guidelines for equestrian sport but also extends to inform riders of
237 all levels how their choice of day-to-day equipment can affect equine welfare.

238 Sensitive topics and distribution of online surveys using convenience sampling
239 techniques are predisposed to an increased risk of response bias (Saunders, Lewis and
240 Thornhill, 2012; Keiding and Louis, 2016). Related to spurs, controversy surrounding
241 their use has been heightened by recent media coverage of high-profile riders being
242 scrutinized and sanctioned for misconduct. This could have altered the response rate
243 and/or truthfulness of participants who use spurs, if they thought their actions would be
244 scrutinized in the same way. However this study reported a similar ratio of 47:53% spur
245 users to non-spur users which suggests both sub-groups responded equally to the survey.
246 Furthermore, the overall sample population of this study reflects the findings of a
247 national equestrian survey (BETA, 2015) in that the majority of equestrians were female
248 and participated in recreational equestrian disciplines. Typically a representative study
249 population is considered beneficial in increasing the generalizability of results to wider
250 populations, referred to as external validity (Pannucci and Wilkins, 2010). Nevertheless
251 repeating this study with a larger sample population is advised so that the knowledge
252 base advances and results become more reliable.

253 Despite horse-riding being a predominantly female activity, men compete in all levels
254 of competition and dominate elite level equestrian sport (Cassidy, 2002; Dashper, 2012).
255 This study found a significant relationship between spur use and gender. The history of
256 equestrian sport derives from military riding, landed-gentry and upper-class society
257 (Dashper, 2012; Dumbell and de Haan, 2016). Dated to *circa*. 17th century, spurs were
258 used for military personnel (men) to drive horses into battle (Arkadiusz, 2010) and later
259 adapted as a status symbol within formal knighthood ceremonies. Saunders and Algar
260 (2001) suggest women in the same era seldom rode horses without the company of their
261 husbands and did not use spurs given their long skirts concealed the fashionable
262 undertones attached to their use. Although equestrianism is now more evenly spread
263 across socio-economic demographics (Dashper, 2012) the clothing and equipment
264 required in equestrian sport is firmly associated with formality and the masculine origins

265 of equestrian sport (Dashper and St John, 2016). Yet in sporting contexts it is a rare
266 example of gender equality in that men and women are able to compete against each
267 other at Olympic level, governed by the same rules and equipment restrictions (Dumbell
268 and de Haan, 2016). In spite of this, the current study reports men were 2.88 times more
269 likely to use spurs than females and had higher frequency of spur use overall (in training
270 and competitions) compared to females. Whether gender and class associations apply to
271 equipment and/or spur use due to the socio-historic background of the sport is unknown.
272 There is not enough evidence within this study to examine the motivational factors
273 behind why men and women may use certain types of equestrian equipment but it is an
274 area of research that warrants further investigation.

275 Factors which influence a rider in their choice of equipment is a current topic of interest
276 (Wolframm et al., 2015). Research has identified personality differences exist between
277 competitive and recreational riders in that competitive riders exhibit higher levels of
278 extroversion and conscientiousness (Wolframm et al., 2015). These personality traits
279 are linked with the skills required for success in sport, such as, disciplined goal-setting,
280 time-management and coping mechanisms to perform under pressure (Wilson and
281 Dishman, 2015; Williams and Tabor, 2017). At present individual personality traits,
282 coaching input and riding manuals are all considered influential but equipment selection
283 is often down to individual rider judgement and the decisions thereafter will affect their
284 horse's welfare (McLean and McGreevy 2010; Hawson et al., 2013).

285 This study found a lower use of spurs than reported by Uldahl and Clayton (2019) but
286 this is likely to be related to the fact that Uldahl and Clayton (2019) reported data
287 gathered at competition only. In this study, spur use across competitive (FEI and non-
288 FEI) and recreational disciplines was not dissimilar (Table 3). Reasons why spur use
289 was reported in hacking or natural horsemanship could be questioned as the nature of
290 these disciplines are usually for 'enjoyment' or leisure purposes. Recreational riders
291 possess different personality traits including augmented focus on negative events and
292 being more reactive to when something goes wrong during riding (Allen et al., 2011).

293 The current study found an increased prevalence of spur use amongst riders who
294 reported a longer duration of riding years. However, the current study did not
295 demonstrate an inverse relationship between length of time riding and equine injury
296 rates. To some degree, this concept contradicts theories which imply riders who have

297 spent more time in-the-saddle, may be more experienced (Williams and Tabor, 2017).
298 For instance, elite riders demonstrate increased postural stability and synchronicity with
299 the cyclic movements of the horse (Heleski et al., 2009; Clayton and Hobbs, 2017). By
300 contrast, inexperienced riders are not as equipped to anticipate these movements and
301 demonstrate postural instability of the trunk, arms and legs (Lovett et al., 2005). But in
302 reality it is not only rider experience which can affect rider posture (Williams and Tabor,
303 2017; Lewis et al., 2018). Research has found greater longitudinal displacement of the
304 rider's toes, in elite level horse-rider combinations, when applying the aids for variations
305 of collected trot (Bystrom et al., 2015). Additionally, sensory and neuro-muscular
306 differences are reported in the wider human population related to motor laterality
307 dominance, e.g. increased muscle mass and grip force on the dominant side of the body
308 compared to the non-dominant side (Steele, 2000; Hammond, 2002). A possible
309 limitation to the current study was that the question relating to spur abrasions did not
310 quantify location of abrasion related to rider laterality dominance. However Clayton et
311 al. (2018) reported no difference in the frequency of abrasions bilaterally.

312 It is still feasible that greater movement of the rider's legs related to laterality
313 differences, postural stability, gait-variation or otherwise would inevitably result in
314 more friction at the contact point on the moving horse. It is probable that the addition of
315 spurs is likely to exasperate this effect and therefore increase the risks of skin abrasions
316 at the same time. Future studies should explore how rider experience and posture may
317 effect spur use, whilst acknowledging the contraindications of correlating time spent in-
318 the-saddle with rider skill.

319 It is important to note there is no scientific literature available which has defined
320 optimum spur use or at which point, if any, spurs become beneficial to the rider or
321 equestrian activity. Correct equine learning theory infers horses should be taught to yield
322 to light or minimal pressures from either leg or rein cues (McLean and McGreevy,
323 2010). On the other hand, contradictory pressures whereby the horse receives a "go"
324 and "stop" cue simultaneously is linked to higher frequencies of conflict behaviours in
325 ridden horses and can lead to dulled behavioural responses (Goodwin et al., 2009). At
326 this point riders may misinterpret the lack of behavioural response and increase the
327 severity of their equipment (Symes and Ellis, 2009; McLean and Christensen, 2017).
328 This trend has been reflected in research showing increased tendencies to use stronger
329 bits in conjunction with spurs across leisure disciplines (Hill et al., 2015). Anecdotally,

330 the same trend is commonly seen in competitive environments with some disciplines
331 stating bit types and spur use is mandatory (British Dressage, 2018). Whilst it was not
332 within the scope of this current study to analyse bit use in relation to spurs, the notion
333 that riders may become involved in a cycle of increasing equipment severity in place of
334 better understanding of horse-training principles, raises concerns for equine welfare. It
335 is recommended that future research examines how variations of equipment are used in
336 practice and their combined effect on horse welfare.

337 Socio-economic factors can affect individual athletes and organisations within
338 equestrian sport (Downward, 2007; Hemsworth et al., 2015). For example, decision
339 making for professional riders can be influenced by financial incentives, owner opinion,
340 qualification boundaries and ultimately, the need to maintain their reputation in the
341 pursuit of success (Parkin and Rossdale, 2006). This current study supports previous
342 findings in that professional riders were more inclined to use spurs (60%) than leisure
343 riders (18%). Australian leisure riders reported overall spur use of ~32% compared to
344 77% of Danish riders competing at national level equestrian disciplines (Hill et al. 2015;
345 Uldahl and Clayton, 2019). Professional riders can be idolised by sub-elite riders and
346 perceived as role models (Williams and Tabor, 2017). Role models or “celebrity riders”
347 can generate fashion-trends related to the type of tack or equipment used (Mutter and
348 Pawlowski, 2014). In this current study, riders affiliated to their equestrian discipline
349 were 1.94 times more likely to use spurs, than to ‘not use spurs,’ which could be a
350 reflection of the trend set by professional riders.

351 Spurs can be used to increase speed or direction (Clayton and Uldhal, 2018) which in a
352 competitive environment has the potential to improve performance. Show jumping for
353 example, is judged by the ability to jump obstacles without knock-downs and the speed
354 of successful completion denotes competitive success. To date there is no study which
355 describes competitive success related to spur use. This study suggests there is a trend
356 emerging which links a high proportion of professional riders use spurs, and most
357 critically, also experience spur abrasions. The methodological protocols varied between
358 this current study and Uldahl and Clayton (2019), survey vs. post competition
359 evaluation, but report similar frequencies of spur-related abrasions in show jumping for
360 example, 50% and 47% respectively. In other sports, athlete transgression for socially
361 undesirable behaviour, contextualised as the misuse of spurs, can result in reputational
362 and financial consequences for individual athletes (Trosby, 2010). There have been

363 similar incidences in equestrian sport related to spur use. Most recently British
364 showjumper Ben Talbot was disqualified from international competition (Jones, 2018)
365 and the consequences resulted in severe backlash on social media, the loss of
366 sponsorship and the horse being removed from his care by the owners. In the absence
367 of knowledge to suggest how spurs relate to performance, riders should be aware of the
368 welfare implications to the horse but also their own reputation which accompanies user
369 misconduct. Future research should examine spur use in relation to competitive success
370 which may then benefit riders in evaluating the costs/benefits of using spurs and
371 ultimately safeguard equine welfare.

372 One study has previously investigated the effect of spurs on the frequency of equine
373 injury (Uldahl and Clayton, 2019). Similar results were reported in this current study
374 identifying a linear relationship between spur length and frequency of skin abrasions
375 (Table 4). However the frequency of abrasions differed between studies. For instance,
376 Uldahl and Clayton (2019) reported a 20% of riders using spurs of 3cm in length
377 experienced skin abrasions compared to 40% of riders using the same spur length in this
378 current study. Whilst rider skill and postural variation appear to be influential factors
379 in the frequency of skin abrasions, the degree to which horse-related variables may
380 affect the likelihood of abrasions is unknown. For instance, equine coat or 'hair' length
381 will fluctuate with seasonal variations being longer in winter and shedding pre-summer
382 months to aid thermoregulation (Bocian et al., 2016). Coat type can also vary between
383 breeds and due to husbandry management such as dietary influence or clipping the hair
384 in winter months (Dunnet, 2005; Bocian et al., 2016).

385 An alternative explanation to the higher frequency of abrasions reported in this current
386 study, relative to Uldahl and Clayton, (2019), is that data collection took place in the
387 UK during the months of April to May which coincides with seasonal changes in
388 temperature and daylight hours (Ibbotson et al., 2016). As such there is the potential that
389 repetitive friction caused by the small surface area of the spur *may* increase natural, but
390 more localised hair loss during seasonal changes. At this stage there is no empirical
391 evidence to quantify the mechanism of spur use or how different designs affect the
392 prevalence of skin abrasions. Should pressure-gauge technology be adapted to measure
393 the impact of spur designs and friction to the horse, this could advance how riders select
394 the length and type of spur they use with equine welfare in mind. The practicalities of
395 such studies may be unrealistic given the high costs associated with experimental

396 research and complicated logistics of organising large samples (Pierard et al., 2015). In
397 place of this, further qualitative research could yield more detailed descriptions of the
398 prevalence of skin-abrasions and identify risk factors related to designs *and/or* users.

399 Inter-discipline regulations are inconsistent relating to whether spurs are optional,
400 mandatory or prohibited entirely (FEI, 2018; British Dressage, 2018). It could be argued
401 that competition guidelines offer a positive influence on a rider's choice of equipment
402 given their core values include protecting equine welfare (FEI, 2018). However, there
403 are discrepancies between industry regulations on spur use; advanced-medium level
404 dressage states spurs are mandatory and riders can be eliminated for non-use (British
405 Dressage, 2018). Other disciplines, for example categories of horse-showing prohibit
406 spur use entirely (VHS, 2018). Inevitably, as this study confirms, competition guidelines
407 do not necessarily extend to restrict the types of equipment that are used in training
408 environments. Horse-racing and mounted games prohibit the use of spurs in competition
409 (BHRA, 2018; MGAGB, 2018) yet participants in these disciplines reported using spurs
410 (Table 5).

411 Additionally there are varying degrees of restrictions on spur design, length, level of
412 competition, age of rider/horse but how these rules were developed is unknown. Akin
413 to variability in permitted use, the sanctions related to the misuse of spurs range from
414 instant elimination, steward discretion and monetary fines. Although with sufficient
415 motivation competition rules can be adapted to reduce adverse effects on horses (Jones
416 and McGreevy, 2010). For example, societal-pressures have resulted in a phased-ban of
417 hind-boots in show jumping that are intended for any other purpose than protecting the
418 legs, implemented first with ponies, children and amateur competitions from 2019, and
419 then across all FEI competitions by 2021 (Roome, 2015).

420 Whether the findings of future research recommended throughout this study help to
421 identify risk factors for spur use, a similar phased approach could limit lower level
422 competitions on the type and length of spur permitted. Prior to any rule changes it is
423 recommended that a scientific review of current spur regulations and sanctions is
424 undertaken first. This information may motivate policy makers to improve the
425 consistency of regulations across equestrian disciplines and at the same time clarify the
426 sanctions riders are subject to.

427 *Limitations*

428 The impact of inductive research ideology should be considered before taking the results
429 transcribed in this study as conclusive evidence. The patterns and theories described in
430 this study derive from one researcher's interpretation of data, from a comparatively
431 small sample, relative to the larger UK equestrian population. A recent review of
432 equitation research acknowledges research in this field is often hindered by small
433 sample sizes due to access to participants (Pierard et al., 2015). The findings within this
434 study may have valid claims and be applicable to industry however future research
435 should re-visit these themes with larger sample sizes. This would reduce the risk of false
436 positive assumptions common in small scale studies which lead to inaccurate
437 associations being found or conversely, true associations not being reported
438 (Schlesselman, 1974).

439 This study used a self-completed questionnaire to investigate a topic that respondents
440 may have believed would reflect on their own riding ability, practices or welfare
441 standards. This may have resulted in responses that were affected by social conformity.
442 If this occurred it is likely that abrasions and impact of spur use would be under-reported
443 within the responses, and this should be considered when interpreting results.

444 Furthermore, this current study reported the investigated interactions irrespective of
445 statistical significance so to reduce publication bias (Perreault, 1975) but also so that
446 future studies are able to use the findings as a benchmark for further investigation.

447 **Conclusions**

448 Equestrian sport is required to adapt in accordance to societal pressures and minimise
449 risks the risks imposed on horses and riders in sport. This study found that spurs are
450 used by a variety of UK riders across competitive and leisure disciplines. Associations
451 were found between types of spur design and the frequency of equine injury. The results
452 of this study are provided for educational purposes for policy makers and riders alike so
453 that a holistic approach to safeguarding horse welfare is adhered to.

454 It is recommended that future research should work towards defining quantifiable
455 characteristics for optimum spur use and continue to explore the factors which influence
456 a rider's choice of equipment. Competition regulations should be reviewed on the basis
457 of evidence-based research when it becomes available. Prior to this, a review of current
458 regulations, sanctions and permitted designs across equestrian competitive disciplines
459 is recommended.

460

461 **Authorship Statement**

462 The idea for the paper was conceived by C. Lemon and V. Lewis, in discussion with H

463 Brown and L Dumbell

464 The experiments were designed by C. Lemon, H. Brown and V. Lewis.

465 The experiments were performed by n/a

466 The data were analyzed by L Dumbell and C Lemon

467 The paper was written by V Lewis and L Dumbell, with input from C Lemon

468 **References**

- 469 Allen, M.S., Greenlees, I., Jones, M., 2011. An investigation of the five-factor model of
470 personality and coping behaviour in sport. *J. Sp. Sci.* 29 (8), 841–850.
- 471 BEF (2018) BEF - About the BEF. Available at:
472 <http://www.bef.co.uk/Detail.aspx?page=BEF> (Accessed: 11 June 2018).
- 473 BETA (2018) British Equestrian Trade Association - Market Information. Available at:
474 <http://www.beta-uk.org/pages/industry-information/market-information.php>
475 (Accessed: 30 January 2018).
- 476 Björnsdóttir, S. et al., 2014. Bit-related lesions in Icelandic competition horses. *Acta*
477 *Vet. Scand.* 56, 40.
- 478 Bocian, K. et al., 2017. Length of winter coat in horses depending on husbandry
479 conditions. *Anim. Sci. J.* 88 (2), 339–346.
- 480 British Horse Industry Confederation, 2018. Equine Sector 2017 Mid-Term Manifesto
481 for the Horse. Available from: [http://www.bvec.co.uk/downloads/external-](http://www.bvec.co.uk/downloads/external-information/mid-term-review-manifesto-for-the-horse-v7-jan-2017.pdf)
482 [information/mid-term-review-manifesto-for-the-horse-v7-jan-2017.pdf](http://www.bvec.co.uk/downloads/external-information/mid-term-review-manifesto-for-the-horse-v7-jan-2017.pdf). Accessed
483 December 19, 2017.
- 484 British Horse Racing Authority, 2018. Rider Manual (D) - PART 5 - GENERAL
485 DUTIES OF RIDERS - (D)30 to (D)57 - 38. Other requirements as to equipment etc for
486 racing. Available from: [http://rules.britishhorseracing.com/Orders-and-](http://rules.britishhorseracing.com/Orders-and-rules%26staticID=126094%26depth=3?zoom_highlight=spurs)
487 [rules%26staticID=126094%26depth=3?zoom_highlight=spurs](http://rules.britishhorseracing.com/Orders-and-rules%26staticID=126094%26depth=3?zoom_highlight=spurs). Accessed July 4, 2018.
- 488 Byström, A. et al., 2015. Differences in rider movement pattern between different
489 degrees of collection at the trot in high-level dressage horses ridden on a treadmill. *Hum.*
490 *Movement Sci.* 41, 1–8.
- 491 CASE, 2018. CASE - FAQ: The CASE Benchmarking Toolkit. Available from:
492 [https://www.case.org/Samples_Research_and_Tools/Benchmarking_and_Research/Be](https://www.case.org/Samples_Research_and_Tools/Benchmarking_and_Research/Benchmarking_Resources/CASE_Benchmarking_Toolkit/FAQ_The_CASE_Benchmarking_Toolkit.html)
493 [nchmarking_Resources/CASE_Benchmarking_Toolkit/FAQ_The_CASE_Benchmarki](https://www.case.org/Samples_Research_and_Tools/Benchmarking_and_Research/Benchmarking_Resources/CASE_Benchmarking_Toolkit/FAQ_The_CASE_Benchmarking_Toolkit.html)
494 [ng_Toolkit.html](https://www.case.org/Samples_Research_and_Tools/Benchmarking_and_Research/Benchmarking_Resources/CASE_Benchmarking_Toolkit/FAQ_The_CASE_Benchmarking_Toolkit.html). Accessed July 4, 2018.
- 495 Clayton, H. M., Hobbs, S.J., 2017. The role of biomechanical analysis of horse and rider
496 in equitation science. *J. Vet. Behav.* 190, 123–132.
- 497 Heleski, C.R., McGreevy, P.D., Kaiser, L.J., Lavagnino, M., Tans, E., Bello, N. and
498 Clayton, H.M., 2009. Effects on behaviour and rein tension on horses ridden with or
499 without martingales and rein inserts. *Vet. J.* 181 (1), 56–62.

500 Cook, W. R., 2011. Damage by the bit to the equine interdental space and second lower
501 premolar. *Equine Vet. Educ.* 23 (7), 355–360.

502 Creswell, J., 2014. *The Selection of a Research Approach*. SAGE Publications Ltd.,
503 London.

504 Dashper, K., 2016. Strong, active women: (Re)doing rural femininity through equestrian
505 sport and leisure. *Ethnogr.* 17 (3), 350–368.

506 Dashper, K., 2012. Dressage is full of queens!” Masculinity, sexuality and equestrian
507 sport. *Sociol.* 46 (6), 1109-1124.

508 Dashper, K. and St John, M. 2016. Clothes make the rider? Equestrian competition dress
509 and sporting identity. *Annals Leis. Res.* 19 (2), 235-250.

510 Deloitte, 2017. Almost 75m tickets sold for UK sports events in 2017 | Deloitte UK.
511 Available from: [https://www2.deloitte.com/uk/en/pages/press-releases/articles/almost-](https://www2.deloitte.com/uk/en/pages/press-releases/articles/almost-75m-tickets-sold-for-uk-sports-events-in-2017.html)
512 [75m-tickets-sold-for-uk-sports-events-in-2017.html](https://www2.deloitte.com/uk/en/pages/press-releases/articles/almost-75m-tickets-sold-for-uk-sports-events-in-2017.html). Accessed January 4, 2018.

513 Doherty, O., et al., 2017. An objective measure of noseband tightness and its
514 measurement using a novel digital tightness gauge. *PLoS ONE*, 12(1).

515 Downward, P., 2007. Exploring the economic choice to participate in sport: Results
516 from the 2002 general household survey. *Int. Rev. Appl. Econ* 21(5), 633–653.

517 Dumbell, L., Lemon, C., Williams, J., 2019. A systematic literature review to evaluate
518 the tools and methods used to measure rein tension. *J. Vet. Behav.* 29, 77-87.

519 Dunnett, M., 2005. The diagnostic potential of equine hair: A comparative review of
520 hair analysis for assessing nutritional status, environmental poisoning, and drug use and
521 abuse. In: Pagan, J.D., (Ed), *Advances in Equine Nutrition III*. Nottingham University
522 Press, Nottingham, pp. 85–106.

523 Fédération Equestre Internationale, 2018. Dressage rules - FEI. Available from:
524 https://inside.fei.org/sites/default/files/DRE-Rules_2018_Clean_Version_0.pdf.
525 Accessed January 21, 2018.

526 Fielding, N., Lee, R. M., Blank, G., 2018. *The SAGE handbook of online research*
527 *methods*. SAGE Publications, London.

528 Górecka-Bruzda, A, Kosinska, I., Jaworski, Z., Jezierski, T., Murphy, J., 2015. Conflict
529 behavior in elite show jumping and dressage horses. *J. Vet. Behav.* 10 (2), 137–146.

530 De Haan, D., Dumbell, L., 2016. Equestrian Sport at the Olympic Games from 1900 to
531 1948. *Int. J. Hist. Sp.* 33 (6–7), 648–665.

532 Hammond, G., 2002. Correlates of human handedness in primary motor cortex: A
533 review and hypothesis. *Neurosci. Biobehav. Rev.*, 285–292.

534 Hawson, L. A., McLean, A. N. and McGreevy, P. D., 2013. A retrospective survey of
535 riders' opinions of the use of saddle pads in horses. *J. Vet. Behav.* 8(2), 74–81.

536 Heleski, C.R., McGreevy, P.D., Kaiser, L.J., Lavagnino, M., Tans, E., Bello, N.,
537 Clayton, H.M., 2009. Effects on behaviour and rein tension on horses ridden with or
538 without martingales and rein inserts. *Vet. J.* 181 (1), 56–62.

539 Hemsworth, L. M., Jongman, E. and Coleman, G. J., 2015. Recreational horse welfare:
540 The relationships between recreational horse owner attributes and recreational horse
541 welfare. *Appl. Anim. Behav. Sci.* 165, 1–16.

542 Hill, E., McGreevy, P.D., Caspar, G., White, P., McLean, A.N., 2015. Apparatus use in
543 popular equestrian disciplines in Australia. *J. Vet. Behav.* 10 (2), 147-e152.

544 Hockenull, J., Creighton, E., 2012. Equipment and training risk factors associated with
545 ridden behaviour problems in UK leisure horses. *Appl. Anim. Behav. Sci.* 137 (1–2),
546 36–42.

547 Ibbotson, S., Stones, R., Bowling, J., Campbell, S., Kownacki, S., Sivaramakrishnan,
548 M., Valentine, R., Morton, C.A., 2017. A consensus on the use of daylight
549 photodynamic therapy in the UK. *J. Dermatol. Treat.* 28(4), 360–367.

550 Jones, B., McGreevy, P. D., 2010. Ethical equitation: Applying a cost-benefit approach.
551 *J. Vet. Behav.* 5 (4), 196–202.

552 Jones, E., 2017. 'The blood rule has to change': top British rider disqualified. Available
553 from: [http://www.horseandhound.co.uk/news/blood-rule-change-top-british-rider-](http://www.horseandhound.co.uk/news/blood-rule-change-top-british-rider-disqualified-625936)
554 [disqualified-625936](http://www.horseandhound.co.uk/news/blood-rule-change-top-british-rider-disqualified-625936). Accessed January 21, 2018.

555 Jones, E., 2018. Death threats made to rider banned from show for whip use - Horse
556 & Hound, Horse and Hound. Available at:
557 [http://www.horseandhound.co.uk/news/showjumper-ben-talbot-banned-whip-use-](http://www.horseandhound.co.uk/news/showjumper-ben-talbot-banned-whip-use-656893)
558 [656893](http://www.horseandhound.co.uk/news/showjumper-ben-talbot-banned-whip-use-656893). Accessed July 4, 2018.

559 Keiding, N., Louis, T. A., 2016. Perils and potentials of self-selected entry to
560 epidemiological studies and surveys. *J. R. Stat. Soc.* 179 (2), 319–376.

561 Lewis, V., Dumbell, L., Magnoni, F. 2018. J Phy Fit Treatment & Sports A
562 Preliminary Study to Investigate the Prevalence of Pain in Competitive Showjumping
563 Equestrian Athletes. *J Phy Fit Treat. Med. Sp.* 4 (3): JPFMTS.MS.ID.555637.

564 McLean, A. N., Christensen, J. W., 2017. The application of learning theory in horse
565 training. *Appl. Anim. Behav. Sci.* 190, 18–27.

566 McLean, A. N., McGreevy, P. D., 2010. Horse-training techniques that may defy the
567 principles of learning theory and compromise welfare. *J. Vet. Behav.* 5(4), 187–195.

568 MGAGB, 2018. MGAGB Dress and Saddlery Rules. Available from:
569 <http://mgagb.co.uk/rules/mgagb-dress-saddlery-rules/>. Accessed July 4, 2018.

570 Mutter, F., Pawlowski, T., 2014. Role models in sports - Can success in professional
571 sports increase the demand for amateur sport participation? *Sp. Manag. Rev.* 17 (3),
572 324–336.

573 Nichols, A.L., Maner, J.K., 2008. The good-subject effect: Investigating participant
574 demand characteristics. *J. Gen. Psych.* 135 (2), 151–166.

575 Pannucci, C. J., Wilkins, E. G., 2010. Identifying and avoiding bias in research. *Plastic*
576 *and reconstructive surgery. NIH Pub. Access*, 126 (2), 619–25.

577 Parkin, T.D., Rosedale, P., 2006. Epidemiology of equine performance wastage:
578 importance of analysing facts and implementing their message in management. *Eq. Vet.*
579 *J.* 38 (2), 98–100.

580 Perreault, W. D. Jr., 1975. Controlling Order-Effect Bias. *Pub. Opin. Q.* 39 (4), 544–
581 551.

582 Pierard, M., Hall, C., Borstel, U.K. von, Averis, A., Hawson, L., McLean, A.,
583 Nevison, C., Visser, K. and McGreevy, P., 2015. Evolving protocols for research in
584 equitation science. *J. Vet. Behav.* 10 (3), 255–266.

585 Randle, H., McGreevy, P.D., 2013. The effect of noseband tightness on rein tension in
586 the ridden horse. *J. Vet. Behav.* 8 (2), e18–e19.

587 Roome, P., 2015. What's the real question in the Bertram Allen saga? Available from:
588 [http://www.horseandhound.co.uk/blog/bertram-allen-disqualified-olympia-blood-](http://www.horseandhound.co.uk/blog/bertram-allen-disqualified-olympia-blood-521883)
589 521883. Accessed July 4, 2018.

590 Saunders, M., Lewis, P., Thornhill, A., 2012. *Research Methods for Business Students*,
591 6th Ed., Pearson, Harlow.

592 Schlesselman, J.J., 1974. Sample size requirements in cohort and case-control studies
593 of disease. *Am. J. Epidemiol.* 99 (6), 381–384.

594 Steele, J., 2000. Handedness in past human populations: skeletal markers. *Laterality*, 5
595 (3), 193–220.

596 Symes, D., Ellis, R., 2009. A preliminary study into rider asymmetry within equitation.
597 *Vet. J.* 181 (1), 34–37.

598 Tell, A., Egenvall, A., Lundstrom, T., Wattle, O. 2008. The prevalence of oral ulceration
599 in Swedish horses when ridden with bit and bridle and when unriden. *Vet. J.* 178(3),
600 405–410.

601 Trosby, E., 2010. Public relations, football and the management of player transgressions
602 in Australia. *Public Commun. Rev.*, 1(2).

603 Uldahl, M., Clayton, H. M., 2019. Lesions associated with the use of bits, nosebands,
604 spurs and whips in Danish competition horses. *Eq. Vet. J.* 51(2), 154-162.

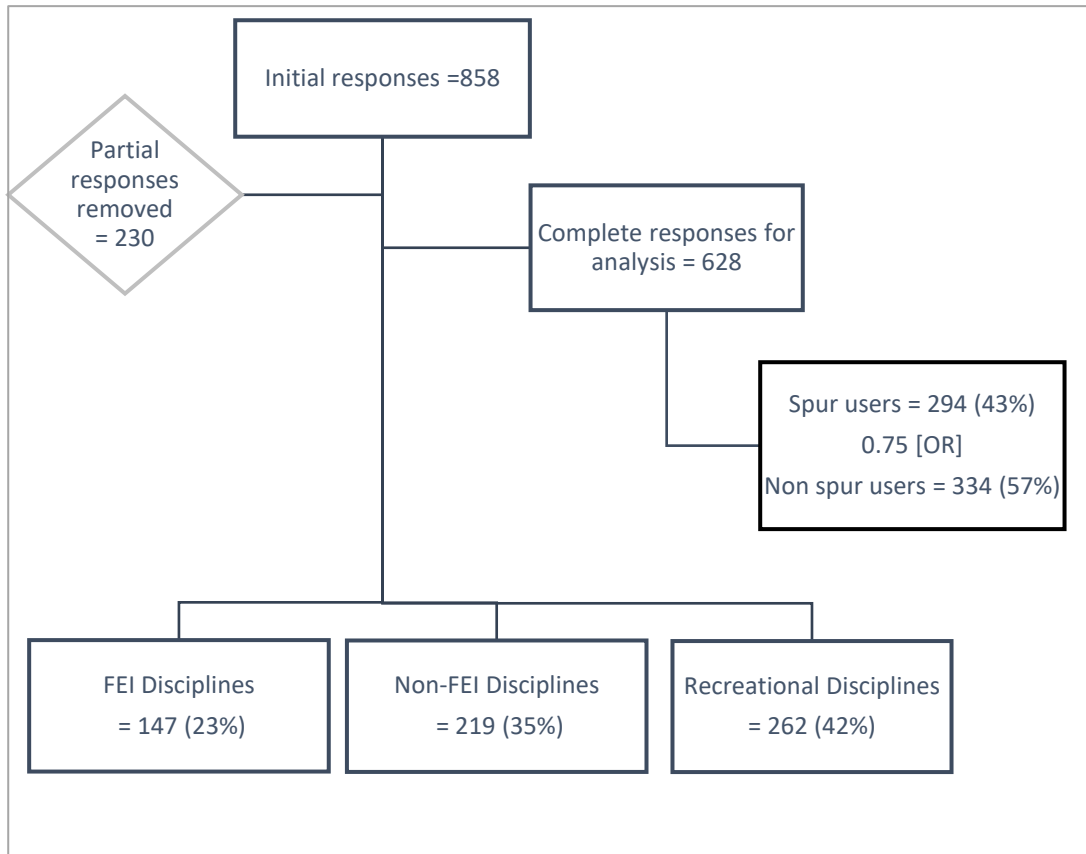
605 VHS, 2018. Rulebook - Veteran Horse Society. Available from: [http://veteran-horse-](http://veteran-horse-society.co.uk/showing-rulebook/)
606 [society.co.uk/showing-rulebook/](http://veteran-horse-society.co.uk/showing-rulebook/). Accessed July 4, 2018.

607 Williams, J., Tabor, G., 2017. Rider impacts on equitation. *Appl. Anim. Behav. Sci.*
608 190, 28–42.

609 Wilson, K. E., Dishman, R. K., 2015. Personality and physical activity: A systematic
610 review and meta-analysis. *Personal. Individ. Differ.* 72, 230–242.

611 Wolframm, I. A., Williams, J., Marlin, D., 2015. The role of personality in equestrian
612 sports: an investigation. *Comp. Ex. Physiol.* 11 (3), 133-144.

613

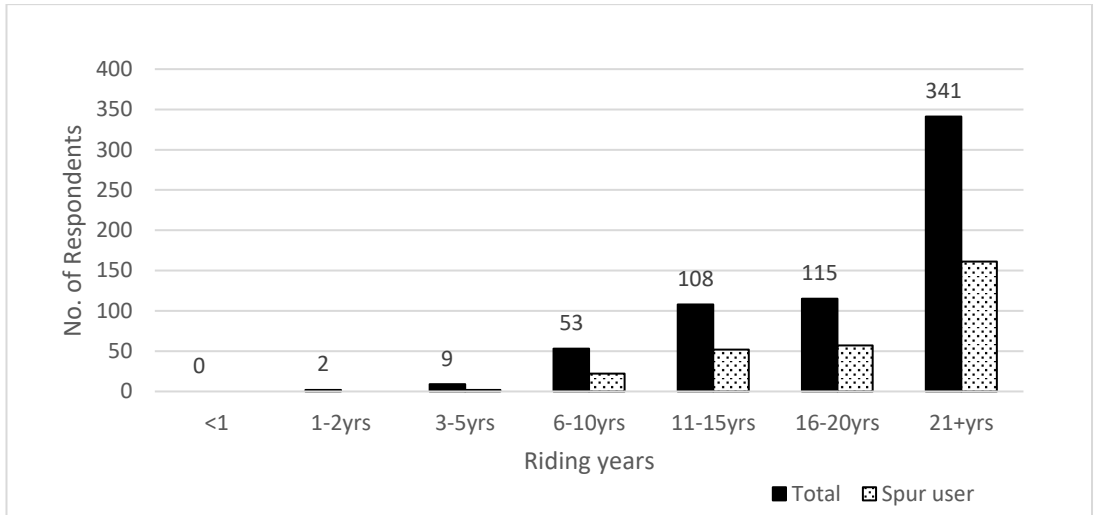


614

615 Figure 1: Online survey responses

616 [Key: FEI Disciplines = Dressage, Show jumping, Eventing, Reining, Endurance; Non-
 617 FEI Disciplines = Showing, Polo, Mounted Games, Racing, Horseball; Recreational
 618 Disciplines = Riding School, Pony Club, Adult Riding Club, Western, Hacking,
 619 Hunting, Natural Horsemanship, British Trec, Positive reinforcement training, Riding
 620 for the disabled; [OR]=Odds ratio calculated for spur use].

621



622

623

624 Figure 2 Spur use distribution across years' riding from the 628 respondents.

625

626 Table 1 Spur use across equestrian disciplines [Key: OR=Odds Ratio for spur use;
 627 Other= see Results]
 628

Category	Discipline	Total (n)	Spur user (% within discipline)	Spur users across discipline category [OR]
RECREATIONAL	Riding School	43	14 (33)	43% [0.75]
	Pony Club	35	16 (46)	
	Adult Riding Club	36	14 (39)	
	Western	33	16 (48)	
	Hunting	28	15 (54)	
	Hacking	44	20 (45)	
	Natural Horsemanship	38	16 (42)	
	Other	5	1 (20)	
	-	262	112	
FEI	Dressage	39	18 (46)	44% [0.79]
	Show jumping	32	16 (50)	
	Eventing	33	12 (36)	
	Reining	30	19 (63)	
	Endurance	13	0 (0)	
	-	147	65	
NON FEI	Polo	37	23 (62)	53% [1.15]
	Mounted Games	29	15 (52)	
	NH Racing	37	20 (54)	
	Flat racing	32	15 (47)	
	Horseball	49	25 (51)	
	Showing	35	19 (54)	
	-	219	117	

629

630

631 Table 4: The effect of spur design and shank length on the prevalence of spur related
 632 abrasion [ABR=abrasions].
 633

SPUR DESIGN (p=0.053)					
Spur Type		Freq. of use	% ABR	Indiv.[OR]	ABR within category [OR]
Rotating	Vertical Rowel	20	25	0.33	41% [0.69]
	Horizontal Rowel	1	100	1.00	
	Roller plastic	39	44	0.68	
	Roller metal	45	44	0.69	
Fixed	Swan neck	6	17	0.20	31% [0.45]
	Prince of Wales	71	31	0.45	
	Dummy	1	0	-	
	Rounded/blunt end	101	33	0.49	
	Comb	3	0	-	
-	Other*	7	29	0.92	-
	Spursuader	0	0	-	
SPUR SHANK (p=0.026)					
Length		Freq. of use	% ABR	Indiv.[OR]	-
No shank		5	0	-	-
< 25 mm (<1")		183	31	0.45	-
25 – 32 mm (1-1.25")		91	40	0.67	-
>32 mm (>1.25 ")		15	60	1.50	-

634

635

636 Table 5; The effect of discipline and rider level on the prevalence of spur related
 637 abrasions in 294 survey responses [Key:ABR=abrasions].

DISCIPLINE (p>0.05)					
Discipline category	Individual discipline	Spur users	% ABR	Indiv. [OR]	ABR within category [OR]
RECREATIONAL	Riding School	14	36	0.56	43% [0.75]
	Pony Club	16	38	0.60	
	Adult Riding Club	14	14	0.17	
	Western	16	44	0.78	
	Hunting	15	20	0.25	
	Hacking	20	35	0.54	
	Natural horsemanship	16	50	1.00	
	Other	1	0	-	
FEI	Dressage	18	44	0.80	44% [0.79]
	Show jumping	16	25	0.33	
	Eventing	12	25	0.33	
	Reining	19	42	0.73	
	Endurance	0	0	-	
NON FEI	Polo	23	30	0.44	53% [1.15]
	Mounted Games	15	27	0.36	
	NH Racing	20	35	0.54	
	Flat racing	15	33	0.50	
	Horseball	25	40	0.67	
	Showing	19	37	0.58	
RIDER LEVEL (p>0.05) RIDER AFFILIATION (p<0.0001)					
Professional	Affiliated	24	58	1.38	47% [0.87]
	Unaffiliated	12	25	0.33	
Amateur	Affiliated	152	43	0.75	34% [0.52]
	Unaffiliated	85	18	0.22	
Leisure	Leisure Rider	21	19	0.24	19% [0.24]