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1 **Know your noseband: an exploration of factors that influence riders' choice of noseband**

2

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7

8 **Highlights:**

9 1. Leather cavesson and flash nosebands were the most popular nosebands used.

10 2. Performance: comfort and safety, habit and appearance influenced rider choice of noseband.

11 3. Respondents seek noseband advice from coaches, veterinary professionals and peers not trained
12 bridle fitters.

13 4. The majority of respondents stated a noseband should be fitted with 2-3 fingers space under the
14 band.

15 5. Few riders were aware that the ISES taper gauges could assess noseband fit.

16

17

18

19

20 **Abstract**

21 The popularity of equestrian sports provides an increasing market for horse gear or tack. While
22 manufacturers have launched new designs to enhance the safety, comfort, effectiveness and
23 aesthetics of their products, few items of tack have been evaluated quantitatively. Nosebands are
24 not an essential component of a bridle, but are widely used across equestrian sport. Despite this,
25 little is known about factors which influence rider decision-making when selecting what noseband
26 to use for their horse. A 41 question online survey was distributed via equestrian social media sites
27 to provide insight into how riders select and fit nosebands, what factors influence decision-making,
28 and sources of information that inform practice. Frequency analysis combined with Kruskal-Wallis
29 analyses identified if differences in noseband selection, use and fit existed between recreational
30 and competitive riders. Thematic analysis analysed open questions to evaluate riders' decision-
31 making in more detail. A total of 1381 respondents completed the survey. Horse performance,
32 comfort and control, customary habit to use and appearance were key factors that informed rider
33 decision-making when selecting which noseband to use for their horse. The use of cavesson (34%)
34 and flash (20%) nosebands was prevalent across riders in the UK and North America, for
35 recreational riding, flatwork and jumping; these nosebands were perceived as kind and comfortable
36 for the horse. Differences in the use of crank nosebands ($p < 0.01$) and additional padding under the
37 noseband ($p < 0.02$) were found between disciplines. Most respondents (79%) had changed their
38 horse's noseband at least once; when more control was required, riders used nosebands
39 incorporating a strap passing below the bit e.g. flash and grackle nosebands. If the bridle or
40 noseband was thought to be causing pain or injury to the horse, the majority of respondents (95%)
41 would change the noseband. Preferred sources of information in this regard were veterinarians,
42 equine dentists and coaches or trainers, with less than 25% consulting a qualified bridle fitter. Most

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43 respondents agreed with the recommendation that there should be room for 2-3 fingers beneath a
44 correctly adjusted noseband; 44% had experienced the tightness of their horse's noseband being
45 checked at competition, however only 14% recognised the ISES taper gauge. Increased
46 communication of the value of using trained bit and bridle fitters and the ISES taper gauge to
47 assess noseband fit to riders is warranted.

48

49 **Key words:** horse-riding, equestrian sport, tack, bridle, equine performance, equine welfare

50

51 **Introduction**

52 The increase in popularity of equestrian sports over the past 50 years has provided a ready market
53 for tack and apparel. Manufacturers have incorporated new designs and different materials into
54 their products with the objectives of enhancing safety and welfare, comfort, effectiveness and
55 aesthetics for horse and/or rider. Scientific research has not kept pace with product development
56 and only a few items of tack have been evaluated quantitatively (e.g. Murray et al., 2015, 2013;
57 Kotschwar et al., 2010a, 2010b; Latif et al., 2010; Belock 2010).

58 A noseband is not an essential component of a bridle, though equestrian federation rules may
59 mandate its use for competitions in specific disciplines e.g. Dressage. Nosebands used for the
60 English riding disciplines are based on a single or double band that encircles the horse's face
61 suspended by a strap passing over the top of the head behind the ears. The basic noseband, called
62 a cavesson, has a single strap encircling the face about 2-4 cm below the facial crest with a simple
63 buckle for adjustment. The cavesson may be modified by the use of padding dorsally over the nasal
64 bones and ventrally over the mandibles where an adjustable back piece allows correct placement
65 and stabilization of the padding over the mandibles. This arrangement is known as a Swedish
66 noseband or sometimes referred to as a 'crank' noseband (McGreevy et al., 2012). The crank
67 noseband incorporates a leveraged closure mechanism, with the leather strap double-backed on
68 itself usually through a ring before fastening, which can facilitate over tightening. The drop
69 noseband fits lower on the horse's face than a cavesson. The front of the strap rests on the nasal
70 bones and the rear part passes beneath the bit to the chin groove. Since this noseband is positioned
71 further than a cavesson from the fulcrum for the jaws at the temporomandibular joint, it provides
72 greater leverage to resist opening the mouth. The flash noseband is a narrow strap that attaches to
73 the center of a cavesson noseband on the front of the face then passes below the bit on each side.

74 The figure 8 (also called a crossed, grackle or Mexican noseband) has straps that cross on the front
75 of the horse's nose. The upper straps pass over the facial crest to the underside of the mandibles
76 and the lower straps run below the bit to the chin groove. When a noseband fits below the bit, it
77 supports the canons (the part of the bit which sit in the horse's mouth) of the bit thus helping to
78 stabilize the bit within the oral cavity. Studies of the type of noseband used in different sports have
79 shown that a cavesson noseband, with or without a flash, is popular across a variety of equestrian
80 disciplines (Uldahl and Clayton, 2019; Weller et al., 2020).

81 A noseband may be used simply for its esthetically pleasing appearance, e.g. breaking up the
82 appearance of a long face, or it may be necessary to comply with competition rules (Weller et al.,
83 2020). It may also perform a useful function, such as providing an attachment point for a standing
84 martingale or may modify the horse's behaviour by discouraging the horse from opening the mouth
85 excessively, to prevent the horse from crossing its jaw or getting the tongue over the bit. It has
86 been reported that a tight noseband is associated with the horse responding to a lighter rein tension
87 (Randle and McGreevy, 2013). The cavesson can be used to teach the horse to mouth the bit
88 without opening the mouth widely through the process of negative reinforcement (Mills, 1998;
89 McLean, 2005), which is applied by having some laxity in the adjustment of the noseband when
90 the horse's mouth is closed. If the horse opens its mouth, the cavesson applies pressure to the face
91 but this is relieved immediately when the mouth is closed.

92 Rather than using the noseband to teach a horse the correct response to the action of the bit,
93 however, some trainers have been reported to use an excessively tight noseband as a physical
94 barrier to opening the mouth (Doherty et al., 2017a,b; Uldahl and Clayton, 2019). Several
95 equestrian federations have implemented rules regarding noseband tightness and tools have been

96 developed to evaluate whether competitors are compliant (Doherty et al., 2017b; Uldahl and
97 Clayton, 2019).

98 An online survey was conducted to gain insight into riders' awareness of noseband use and the
99 circumstances when riders might choose to tighten their horses' nosebands (Visser et al., 2019).

100 Less is known about why a rider chooses a specific type of noseband and what sources of
101 information are influential in their decision-making. This paper describes the use of an online
102 survey to explore these questions. The objectives were to provide insight into why owners and
103 trainers choose a specific type of noseband, what factors weigh into their decision how to adjust
104 the noseband, and the sources of information that shape their opinions and inform their choices
105 about noseband selection and use.

106

107 **Materials and Methods**

108 *Participants*

109 Participants (n=1381) were recruited online via sharing a link to the survey on selected equestrian
110 related social media (Facebook®) groups and pages. Inclusion criteria required participants to be
111 over 18 years of age and to have used a noseband on one or more horses. The survey was
112 anonymous and no personal data were collected.

113

114 *Survey Design*

115 The study was designed as an online questionnaire (Survey Monkey®) with 25 closed questions
116 including 7 multiple choice questions, 7 check box questions, 3 Likert scale questions, 1 ranking

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117 scale question and 16 open free text questions (Supplementary File 1). The questionnaire was split
118 into three major sections: 1) participant demographics, 2) noseband use and 3) noseband fit. The
119 draft survey was tested by two experienced equestrian researchers and edited to correct any errors
120 before being fully deployed. The survey was live for 16 days and 90% of the responses were
121 obtained within the first five days. The survey contained the following sections which explored:

122 Demographic factors: their age, gender, country of residence, what equestrian qualifications they
123 held, their involvement with horses and if they currently owned one or more horses and for how
124 long, as well which equestrian activities and disciplines they regularly participated and competed
125 in.

126 Noseband use: frequency of noseband use, details of nosebands used: material, design, noseband
127 use related to specific equestrian activities, how often they would change their horses' noseband,
128 when they would consider changing their horse's noseband and what other actions or guidance
129 they may take before changing a horse's noseband.

130 Noseband fit: to describe how they would fit a noseband to a horse, how they judged noseband fit,
131 to identify common features, tools and guidance used to determine noseband fit, if they had ever
132 had their horse's noseband fit checked or commented on at an event, competition or by a third
133 party, if they would change a noseband if it was harmful to the horse and which factors influenced
134 noseband selection, use and purchase.

135 Finally respondents were asked if they had any further comments to make related to noseband use
136 and / or the survey design.

137

138 **Data analysis**

139 *Descriptive analysis*

140 Data were exported from Survey Monkey™ to Microsoft Excel™ Version 2010 (Redmond, WA,
141 USA). Frequency analysis identified the nature of equestrian activities and disciplines respondents
142 engaged with, if they competed or not, and what types of nosebands were used across a range of
143 different riding activities. Additional frequency analyses calculated the influence of factors that
144 informed noseband selection and use, and which sources of advice respondents would use to
145 inform their decision-making related to noseband use and fit (rated 1: strongly disagree, 2:
146 disagree, 3 agree, 4: strongly agree). The percentage of respondents who could identify a correctly
147 fitted noseband, could recognize the International Society for Equitation Science (ISES) taper
148 gauge and who has used a crank noseband, anatomical bridle or any padding under their noseband
149 was also calculated. A ranking question examined characteristics which respondents considered
150 important (from 1: most important to 4: least important) when choosing a noseband to use for their
151 horse. This enabled an arithmetic median and interquartile range for each factor to be calculated
152 across the factors investigated.

153 Data met non-parametric assumptions, therefore a series of Kruskal Wallis analyses identified if
154 differences occurred in participant ratings of the characteristics which influenced decision making
155 when choosing and fitting a noseband for use between the disciplines participated in: dressage,
156 showjumping, eventing, recreational riding plus unaffiliated competition and recreational riding
157 only. For factors where significant differences were found, Mann Whitney U post-hoc tests
158 identified how ratings differed between the disciplines. Median rankings for individual factors
159 were examined to identify the direction of differences between disciplines; where median values
160 were the same, mean rank differences obtained from post hoc tests differentiated between
161 disciplines. Significance was set at $p < 0.05$.

162 *Thematic analysis*

163 Respondents were also asked open questions to ascertain the reason why they used the type of
164 noseband they currently used for different equestrian activities, what factors influenced noseband
165 choice or would influence them to consider changing their horse's noseband, and what information
166 sources would they utilize to inform their decision-making. Inductive content analysis of
167 responses, within the broader framework of McClelland's Acquired-needs Theory (Pardee, 1990)
168 was undertaken utilising tags ('open-coding') to create emergent themes ('focused coding') using
169 a grounded theory approach (Lamperd *et al.*, 2016).

170

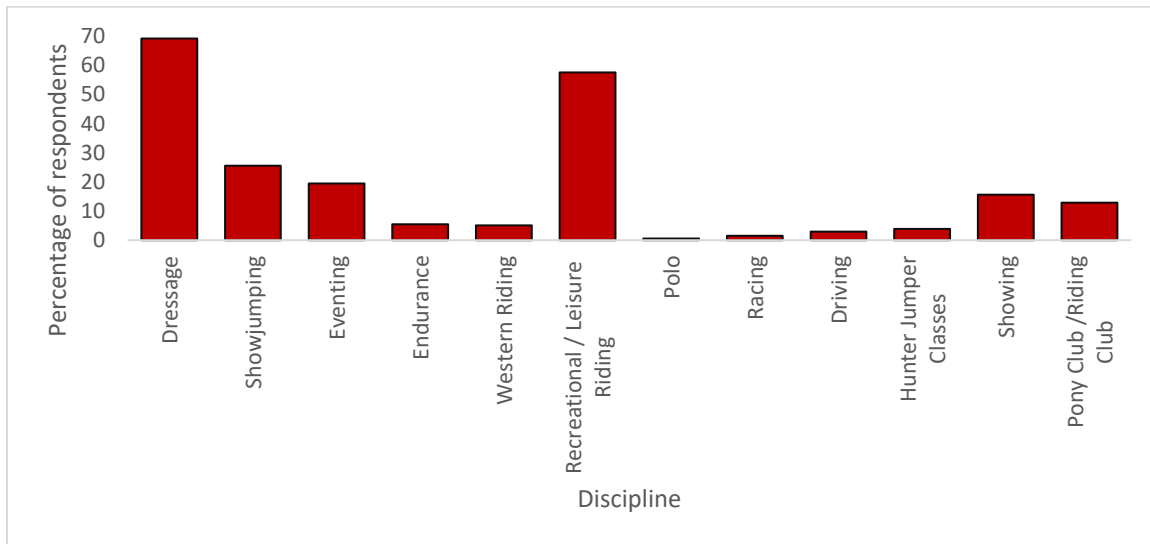
171 **Results**

172 A total of 1381 respondents completed the survey; the majority of these were female (97.2%; n =
173 1338). Responses were submitted from countries around the world, with equestrians residing in
174 the United Kingdom (55.9%; n = 767), the United States and Canada (31.3%; n = 430), Europe
175 (6.6%; n = 91) and Australian and New Zealand (5.7%; n = 78) comprising the largest geographic
176 regions represented. Less than half of the respondents (40%; n = 552) stated their highest level of
177 qualification; for those that did answer, 68.6% (n = 523) held a British Horse Society qualification
178 (32.9% Stage 1; 27.9% Stage 2; 20.8% Stage 3; 18.4% AI or higher), 23.5% (n = 179) had an
179 equine related degree and 7.9% (n = 60) had a Masters qualification.

180 The majority of respondents owned their own horse/s (71.0%; n = 1127), 25.3% (n = 402) worked
181 with horses; the remainder either leased or loaned a horse/s (2.6%; n = 42) or rode horses regularly
182 (1.0%; n = 16). Most respondents owned 1 (35.0%; n = 394) or 2 horses (31.9%; n = 360; range:
183 1 to 60 horses; mean±sd: 3±4 horses; median±IQR: 2±2 horses), and had owned their horse/s

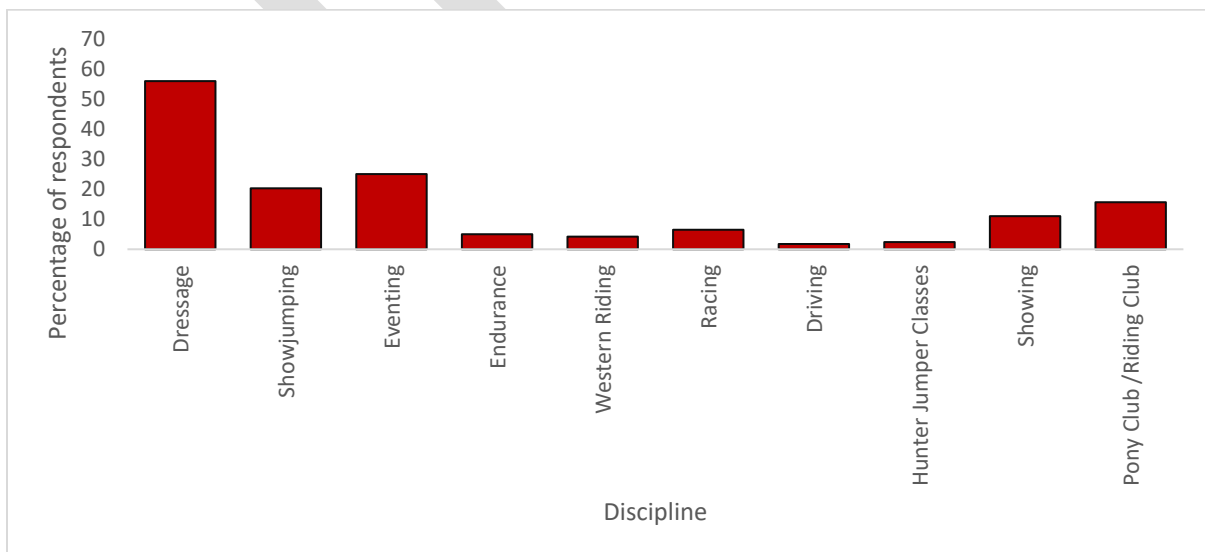
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184 generally for longer than three years. Dressage and recreational riding were the most common
185 discipline and activity respondents participated in (69.2%, 57.5%, respectively; Figure 1a).
186 Dressage was also the most popular discipline participated in by respondents who competed at an
187 affiliated level (36.0%; Figure 1b).



188

189 Figure 1a: Participation of respondents within different equestrian disciplines



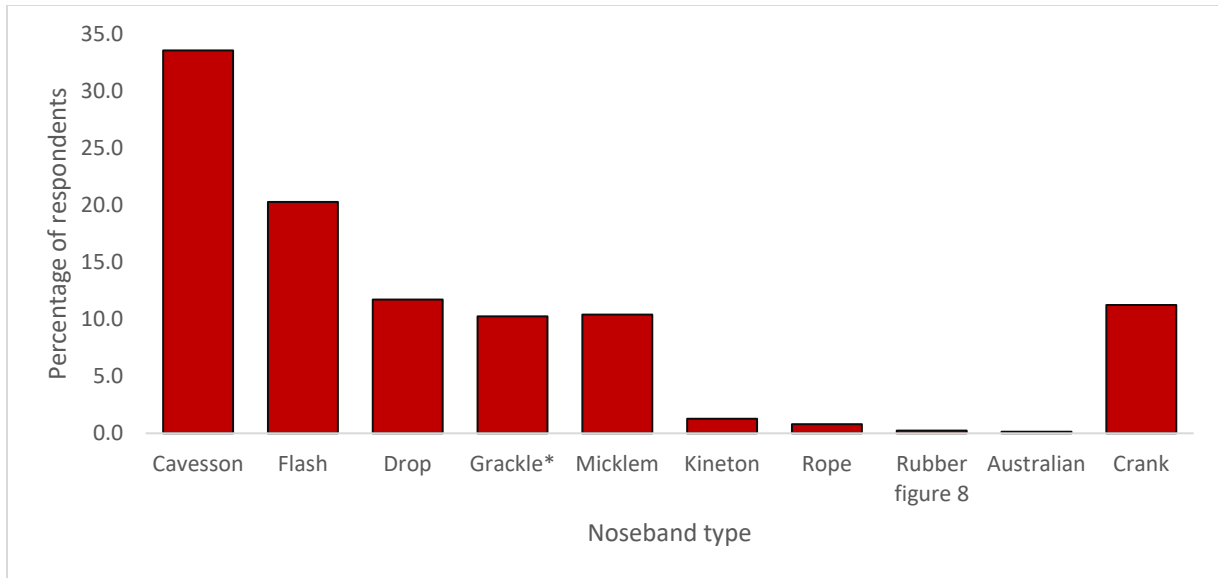
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191 Figure 1b: Equestrian disciplines respondents competed in to an affiliated (aligned to a national
192 or international equestrian federation) level

193 *Noseband use*

194 The majority of respondents (89.9%; n = 772) currently rode regularly in a noseband. Leather
195 was the most popular type of material used (97.6%; n =803) with few riders using synthetic
196 (2.3%; n = 19) and only one person reporting they used a rope noseband. Cavesson (33.6%) and
197 flash (20.3%) nosebands were the two most common designs of noseband owned by respondents
198 (Figure 2). However a wide range of noseband types were owned and used including anatomical
199 bridles / nosebands and bitless bridles or hackamores. Fifty eight percent of respondents (n=502)
200 had used a crank noseband at some point in time. Cavesson nosebands were the most popular
201 noseband that respondents used across all types of equestrian activity; for hacking and
202 recreational riding, anatomical nosebands / bridles and flash nosebands were the second and third
203 most popular nosebands used, respectively. This pattern was reversed for flatwork or schooling
204 with flash nosebands the second most popular choice followed by anatomical nosebands. While
205 for both showjumping and cross-country schooling, a grackle (also known as a Mexican or figure
206 eight) noseband was the second most popular option after the cavesson, followed by a flash
207 noseband. Respondents who engaged in Western riding also used a cavesson predominately. The
208 next most popular nosebands used in Western riding were a hackamore or bosal followed by a
209 rope halter.

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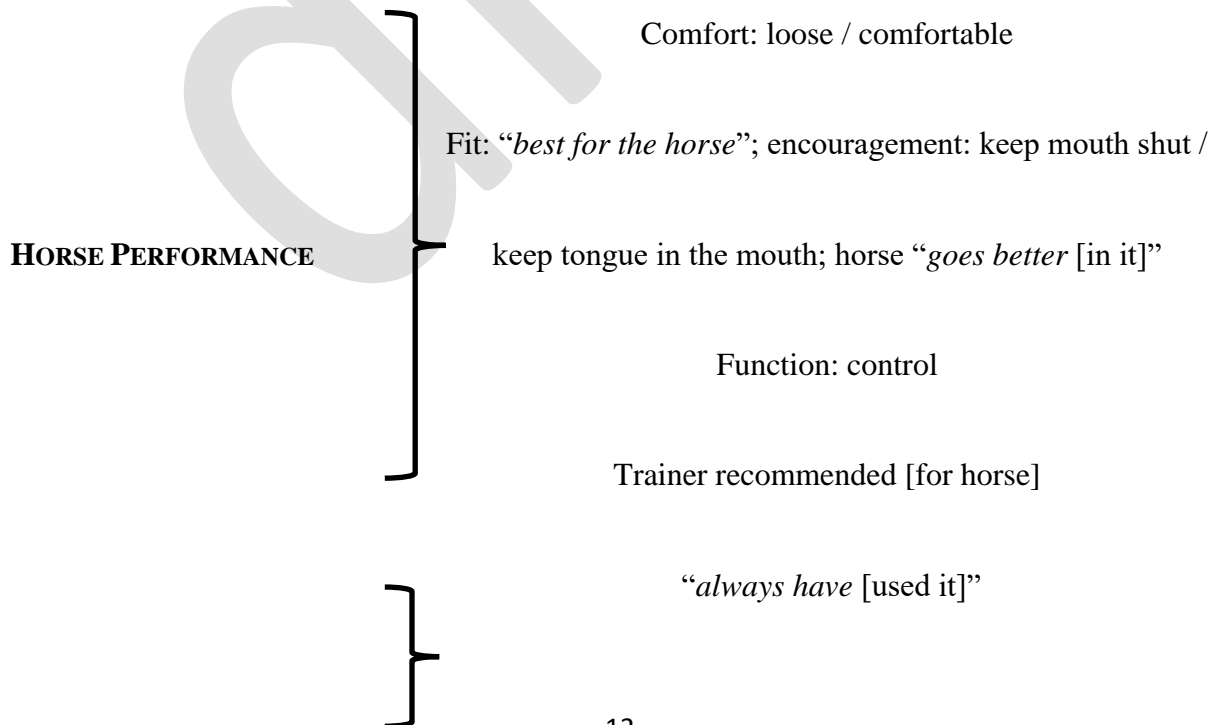
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211 Figure 2: Range of nosebands owned by respondents

212 Respondents identified three key reasons why they selected specific noseband designs for use:

213 1) horse performance; 2) habit; and 3) appearance (Figure 3). Specific noseband use was
 214 generally related to horse performance (Table 1).

215



HABIT

Came with horse or bridle

APPEARANCE

Aesthetics: design; color; fit

Visual appeal: “*look*”

Fashionable



216

217 Figure 3: Higher (overarching themes) and lower order themes (concepts which underpin the

218 higher order themes) identified by respondents that inform their choice of noseband use.

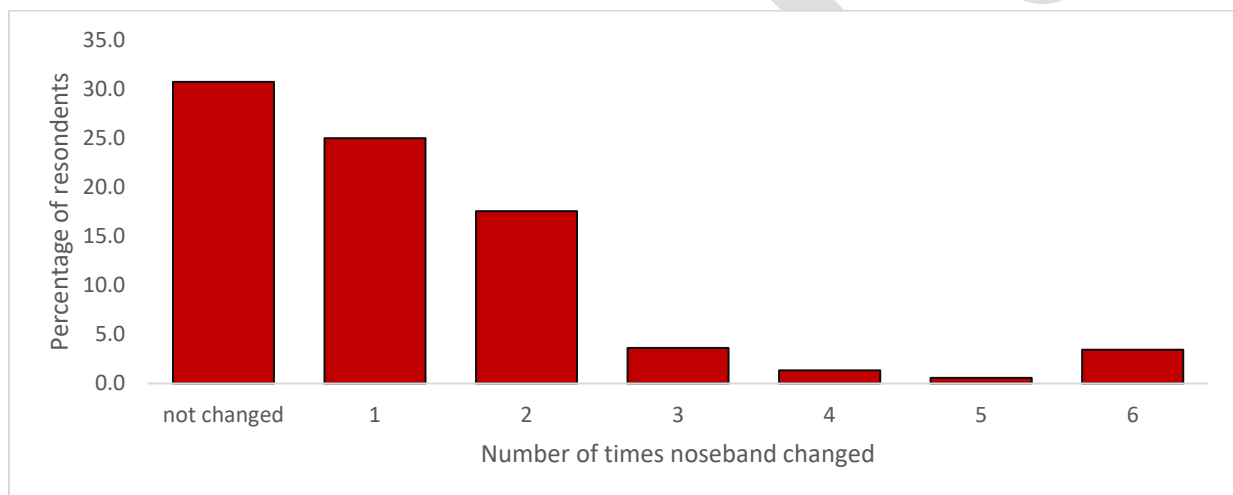
219 Table 1: Key reasons respondents use different noseband types

| | |
|-----------------------------|---|
| Cavesson | Loose fit Freedom Aesthetic “ <i>look</i> ” Kinder |
| Crank | Padding [kinder] |
| Flash | Prevent jaw opening / opening mouth Prevent horse chewing on the bit To stabilize the bit in the horse’s mouth |
| Grackle | Prevent horse crossing the jaw Prevent horse opening the mouth Increased control Use if horse is “ <i>strong</i> ” |
| Drop | Increased control |
| Micklem (anatomical bridle) | Fit Kinder Increased comfort Reduced pressure on nose / face |

220

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221 Most respondents had changed their current horse's noseband at least once (78.8%; Figure 3). The
222 most popular reasons for changing their horse's noseband were to 1) improve performance: either
223 to stop the horse opening the mouth or to prevent the tongue from coming out of the mouth
224 (changed predominately to a flash noseband) or because they knew the horse better after
225 purchasing it and then changed the noseband as a result; 2) to enhance control: improved steering
226 or brakes, or because the horse was evading the contact; due to fit of the noseband: current
227 discomfort or to make the horse more comfortable; 3) because they had changed the horse's bridle
228 (and it came with a different noseband); or 4) after discussion with their trainer / coach or equine
229 dentist because the horse was "fussy" in the mouth or they had changed the horse's bit.



230

231 Figure 3: Number of times respondents have changed the noseband used on their current horse

232 Over two thirds of respondents would arrange a dental checkup for their horse, consult their coach
233 or trainer and review the stage of training of the horse before changing their noseband; however
234 less than a third would seek advice regarding their horse's health or behavior, or book a riding
235 lesson beforehand (Figure 4). The majority of riders agreed or strongly agreed that riders should
236 change the horse's noseband if it was causing damage or injuring the horse or as a result of their

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237 coach or trainer's recommendation (Figure 5). Just over half of riders also agreed or strongly
238 agreed a horse's noseband should be changed if riders were experiencing control issues during
239 hacking (54%), flatwork (50%) or when jumping (57%).

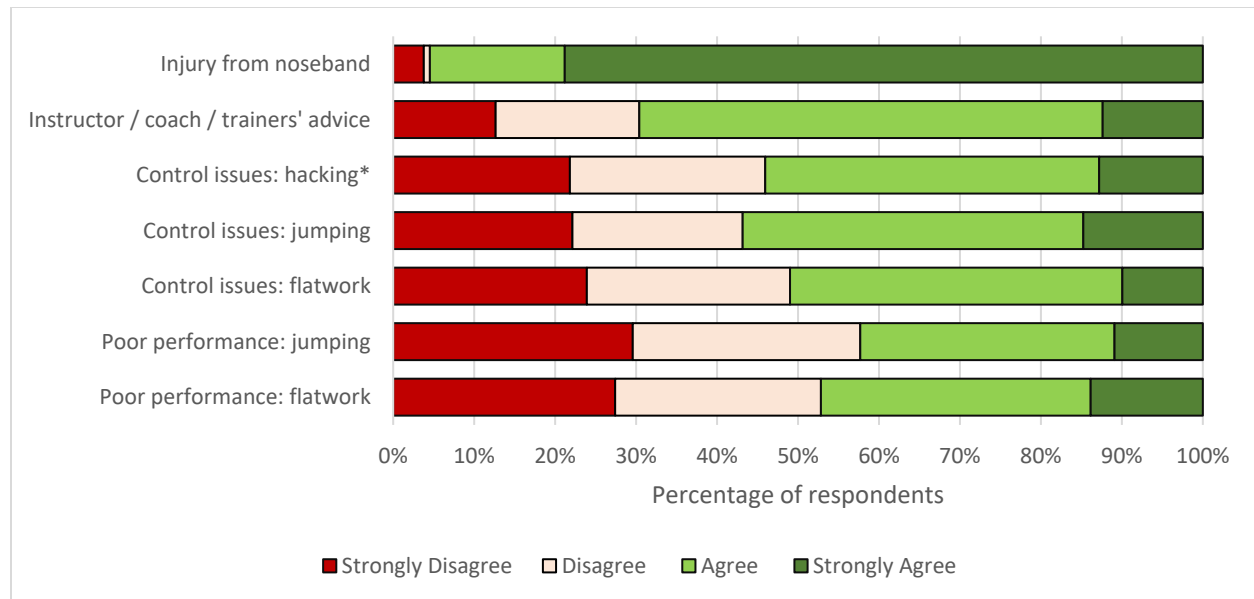
240 The most popular information source respondents used to seek advice or guidance from if they
241 were thinking about changing a horse's noseband was their trainer / coach or a friend: "*would*
242 *discuss with trusted peers or professionals*". Other key information sources identified included the
243 horse's equine dentist or veterinarian, while others would base their decision on their own
244 knowledge and experience, or undertake research to find an answer. Interestingly very few
245 respondents stated they would consult a bridle or bit fitting professional first.



246
247 Figure 4: Actions respondents would undertake if considering changing their horse's noseband

248

Equine noseband use



249

250 Figure 5: Respondent rating of factors which could influence a rider to change a horse's noseband

251 Horse comfort (mean±sd: 1±1) was ranked the most important factor by respondents when

252 choosing which noseband to use on their horse, followed by safety (mean±sd: 2±1), control

253 (mean±sd: 3±1) and aesthetics (mean±sd: 4±1; Figure 6). Additional factors which respondents

254 rated as influential to noseband selection included whether the noseband came with padding or not

255 (always: 53.1%; n = 455; sometimes: 40.8%; n = 350), the width of the noseband (always: 51.4%;

256 n = 442; sometimes: 45.6%; n = 393), and the rigidity of the material the noseband was made of

257 (always: 55.0%; n = 471; sometimes: 32.6%; n = 279). Forty five percent (n = 385) of respondents

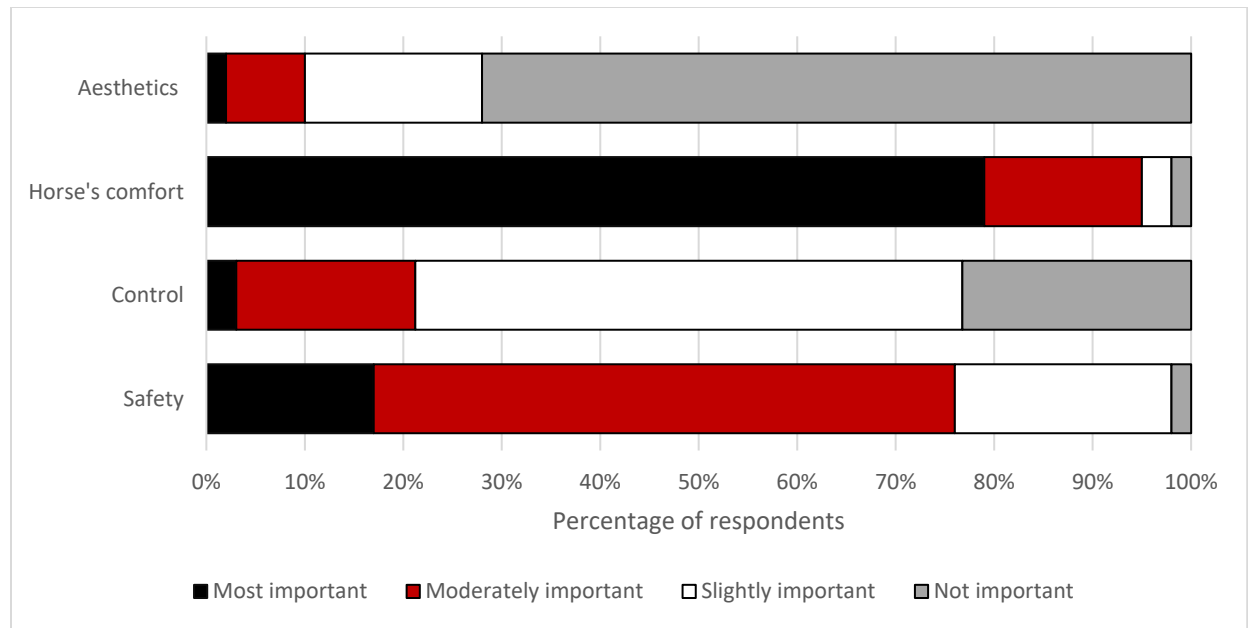
258 had used external padding under the horse's noseband; the use of padding was similar across

259 dressage (46.5%), showjumping (44.2%) and eventing (45.9%). The main reasons stated for using

260 padding under the noseband were to enhance the horse's comfort and to prevent rubbing.

261

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262

263 Figure 6: Key factors that influence rider choice of noseband

264

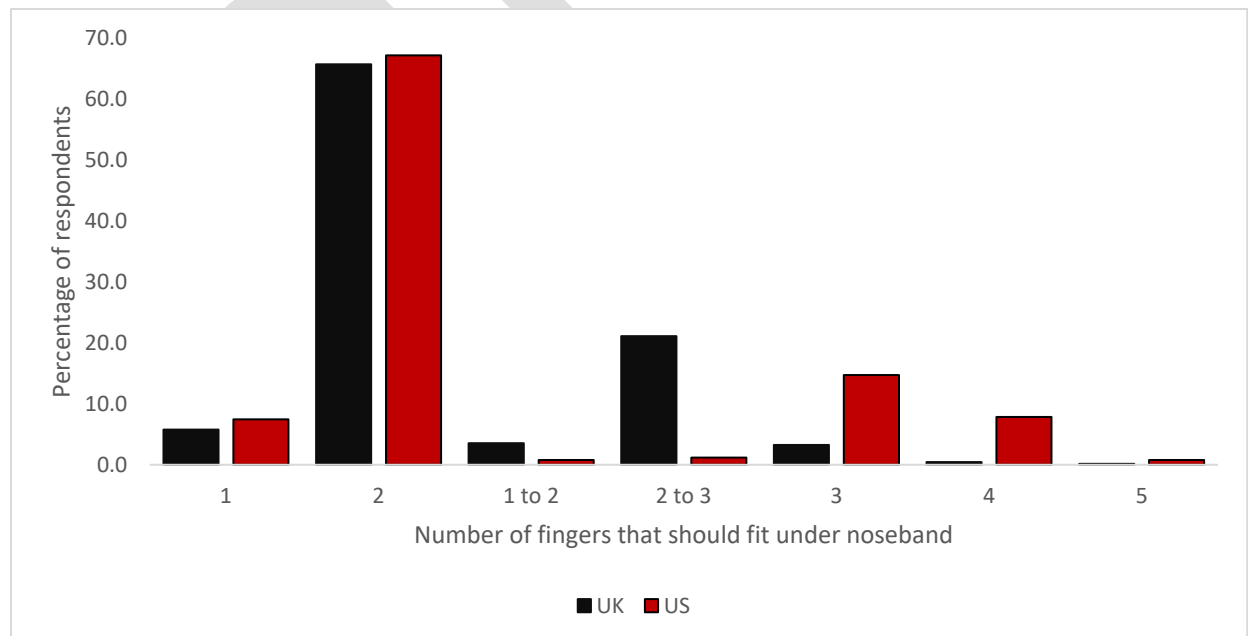
265 *Noseband fit*

266 When asked how a noseband should be fitted correctly, there was a general consensus amongst
267 respondents that two or three fingers (*“the 2 finger rule”*) should be able to be placed under, or
268 between the horse’s nose and, the band of the noseband, which should sit below the horse’s cheek
269 bones / facial crest (Figure 7). Descriptions of correct noseband fit varied: *“(should) sit in the*
270 *correct place”*, *“so it sits right”*, *“comfortable but effective”* but *“not too low / high but low / high*
271 *enough”* as well as being fitted: *“loosely”*, *“snug but not tight”*, *“tight enough, but so it doesn’t*
272 *rub”* with some respondents preferring to refer to the manufacturer’s instructions for fit as they
273 felt fit depended on the type of noseband being used. Only a quarter of respondents (24.2%) had
274 ever had a noseband professionally fitted, with most stating they would consult their trainer / coach
275 or online sources such as You Tube for guidance on noseband fit. Fifty nine percent (n = 497) of

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276 respondents who attempted to select the correct noseband fit from the images provided
277 (Supplementary file 1), correctly identified image B as being the correct fit. Generally images A
278 and C were not selected as respondents felt the noseband was too tight or fitted too low.

279 Less than one third of respondents (31.4%; n = 259) correctly identified the device in question 27
280 as a device to measure noseband tightness; of those that did only 13.9% (n = 36) correctly identified
281 the device as the ISES taper gauge. In contrast, 43.6% (n = 348) of this sample were aware of the
282 ISES guidelines for noseband fit. Very few riders (3%; n = 26) had ever had their noseband
283 checked using the taper gauge. These checks had largely occurred linked to clinics, participation
284 in research studies or were undertaken by the rider themselves, and were only perceived positively
285 in 40% cases (4 /10 comments). A larger percentage (43.6%; n = 348) of the riders surveyed had
286 experience of having their noseband checked at a competition; a further 37.2% (n = 233) reported
287 having their horse's noseband's tightness commented on while riding by their trainer / coach (too
288 loose), other riders at a show (too loose), a steward or technical delegate (majority too loose) or
289 peers at home (too loose).

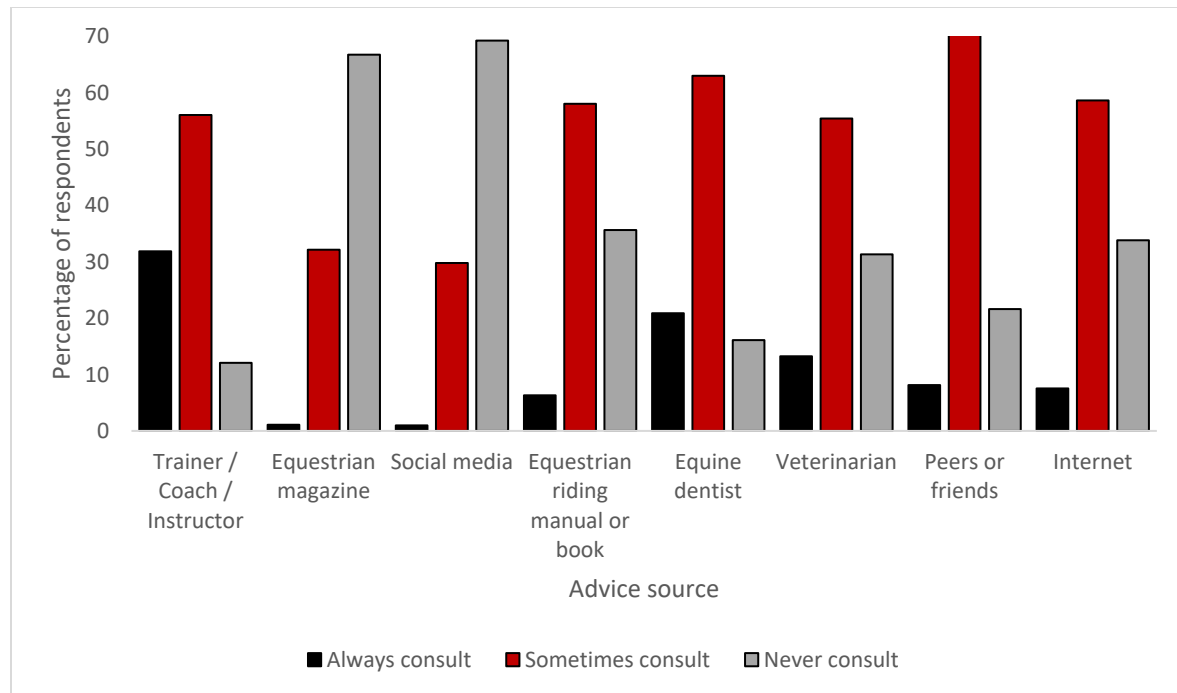


290

291 Figure 7: Comparison of how many fingers respondents from the United Kingdom (UK) and the
292 United States (US) stated should be able to fit under the noseband (UK: front and back of the
293 horse's nose; US: at the side of the horse's face just below the cheekbone).

294 The top five information sources that respondents would always or sometimes use for guidance on
295 noseband use or fit were: 1) trainer / coach / instructor; 2) equine dentist; 3) peers or friends; 4)
296 veterinarian; and 5) the internet (Figure 8). Respondents were also asked to give their thoughts on
297 noseband use; five key themes emerged: 1) nosebands are often perceived to be used to compensate
298 for poor training and / or riding: *“People rely on nosebands to mask poor riding and training”*,
299 *“sadly, I see noseband used to cover up training failures very often”*, *“I think it's important to note*
300 *that equipment doesn't actually train a horse, but when properly fitted, it can certainly enhance*
301 *the process”*, *“like a bit, a noseband is only as hard as the hands that use it. I would rather upgrade*
302 *a noseband”*, cavesson to a flash, or flash to a grackle, for an example, before trying a stronger
303 bit; 2) lots of nosebands (used / observed) are fitted too tight: *“most people over tighten”*; *“see a*
304 *lot of nosebands that look too tight at competition”*, *“my barn owner has her horse’s noseband so*
305 *tight! So does a friend”*; 3) nosebands are often a fashion statement: *“far too much tack use is*
306 *governed by fashion rather than functionality and comfort these days”*, *“it’s increasingly difficult*
307 *to find a simple snaffle bridle with no flash or a double without padding and a crank”*, *“could*
308 *probably go without one, but it completes the look”*; 4) nosebands shouldn't be used to keep a
309 horse's mouth shut: *“there are far too many people that rely on very tight flash or drop nosebands*
310 *to keep their horse's mouths shut rather than addressing it as a training issue”*, *“it seems to be*
311 *acceptable still to strap a horse's mouth shut”*; and 5) riders should have the option to not have to
312 use a noseband in competition (dressage predominately: *“I would love to see the option to not use*
313 *nosebands in dressage”*).

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314

315 Figure 8: Key information sources respondents are likely to consult to find out more information
316 about nosebands

317 *Differences between the disciplines*

318 Significant differences were observed in respondent ratings of situations which would make them
319 consider changing their horse's noseband on the trainer / coach's advice ($p = 0.0004$) or related to
320 poor performance or control issues during flatwork ($p = 0.0004$; $p = 0.07$, respectively) and
321 jumping ($p = 0.001$; $p = 0.07$) but not during hacking (Table 2).

322 When selecting a new noseband, differences were found between the discipline groups for padding
323 ($p = 0.0004$) and width ($p = 0.001$) but not for the rigidity of the material the noseband was made
324 from. Respondents who engaged in recreational riding and unaffiliated competition (RC;
325 median±IQR: 2±1) agreed that the padding of noseband was important in contrast to those
326 competing in dressage (DR; $p = 0.0004$, median±IQR: 3±1), showjumping (SJ; $p = 0.019$,

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327 median±IQR: 3±1) and eventing (EV; $p = 0.01$, median±IQR: 3±1) who strongly agreed that
328 padding was a key consideration when choosing a noseband. Riders who engaged in recreational
329 riding only (R; median±IQR: 2±1) were more likely to strongly agree that noseband padding was
330 key when choosing a noseband than RC riders ($p = 0.0004$); a similar relationship existed between
331 RC and DR riders ($p = 0.0004$) and EV and DR riders ($p = 0.0004$). DR (median±IQR: 3±1)
332 respondents were more likely to rate width as an important factor when choosing a noseband than
333 RC (median±IQR: 2±1) and R (median±IQR: 3±1) respondents ($p = 0.0004$; $p = 0.001$,
334 respectively).

335

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336 Table 2: Comparison of respondent ratings for factors which would make a rider / horse owner
 337 consider changing a horse's noseband.

338 *Kruskal-wallis analyses identified if significant differences in respondent rating occurred between discipline groups,*
 339 *where results were significant, subsequent post-hoc Mann Whitney U analyses established if differences existed*
 340 *between disciplines. Where median values where the same, mean rank differences were used to establish the direction*
 341 *of significant difference. Discipline groups: RC: engage in recreational and unaffiliated competition; DR: engage in*
 342 *affiliated dressage; SJ: engage in affiliated showjumping; EV: engage in affiliated eventing; R: engage in recreational*
 343 *riding only; P: probability; Rating: 1: strongly disagree, 2: disagree, 3: agree, 4: strongly agree.*

| Factor | Difference across discipline groups | Pairwise comparisons where significant differences occurred between disciplines for respondent ratings (median±IQR) |
|---------------------------------------|-------------------------------------|---|
| Poor performance: flatwork | p = 0.0004 | RC (2±1) decreased to R (3±1) p = 0.03 RC (2±1) decreased to DR (3±1) p = 0.0004 RC (2±1) decreased to SJ (2±1) p = 0.0004 RC (2±1) decreased to EV (3±1) p = 0.0004 R (2±2) decreased to DR (3±1) p = 0.0004 |
| Poor performance: jumping | p = 0.001 | RC (2±2) decreased to R (2±2) p = 0.001 RC (2±2) decreased to DR (2±1) p = 0.001 RC (2±2) decreased to SJ (3±1) p = 0.03 RC (2±2) decreased to EV (3±1) p = 0.004 |
| Control issues: flatwork | p = 0.07 | RC (2±2) decreased to R (3±2) p = 0.04 RC (2±2) decreased to DR (3±1) p = 0.006 RC (2±2) decreased to SJ (3±1) p = 0.006 RC (2±2) decreased to EV (3±1) p = 0.02 |
| Control issues: jumping | p = 0.005 | RC (2±2) decreased to R (3±1) p = 0.02 RC (2±2) decreased to EV (3±0) p = 0.0004 DR (2±1) decreased to EV (3±0) p = 0.01 R (3±1) decreased to EV (3±0) p = 0.01 |
| Control issues: hacking | p = 0.243 | RC (2±2); DR (3±1); SJ (3±1); EV(3±1); R(3±1) |
| Trainer / coach's advice | p = 0.0004 | RC (3±1) decreased to DR (3±0) p = 0.0004 RC (3±1) decreased to SJ (3±0) p = 0.0004 RC (3±1) decreased to EV (3±0) p = 0.0004 R (3±1) decreased to DR (3±0) p = 0.02 R (3±1) decreased to SJ (3±0) p = 0.02 R (3±1) decreased to EV (3±0) p = 0.05 |
| Injury to the horse from the noseband | p = 0.157 | RC (4±0); DR (4±0); SJ (4±0); EV(4±0); R(4±0) |

344 Few significant differences existed between which information sources respondents in different
345 discipline groups would consult when thinking about purchasing a new noseband. DR respondents
346 were less likely to consult their veterinarian (median±IQR: 2±0) but more likely to use the internet
347 (median±IQR: 2±1) when thinking about buying a new noseband than R (veterinarian: $p = 0.002$;
348 median±IQR: 2±1; internet: $p = 0.008$; median±IQR: 2±1) and RC respondents (veterinarian: $p =$
349 0.03; median±IQR: 2±1; internet: $p = 0.03$; median±IQR: 2±1). DR respondents were also more
350 likely to consult the internet than SJ respondents ($p = 0.02$; median±IQR: 2±1).

351 There was no difference in the frequency of use of anatomical bridles across the discipline groups,
352 but differences did exist for use of crank nosebands ($p = 0.002$) and using padding material
353 underneath the noseband ($p = 0.01$). More RC respondents (48%) had used a crank noseband than
354 those who competed in DR (32%, $p = 0.001$), however more SJ respondents (67%) had used a
355 crank noseband compared to RC ($p = 0.03$), and less EV (35%) had used them compared to DR (p
356 = 0.03), with more R (57%) having ridden in a crank at some point than DR (0.0008). The use of
357 padding under the noseband was more prevalent in DR respondents (54%) than in RC (37%; $p =$
358 0.004), R (42%; $p = 0.01$) and EV respondents (35%; $p = 0.02$).

359 **Discussion**

360 This survey included 1381 riders representing a variety of equestrian disciplines and with a wide
361 geographic distribution including 55.9% from the United Kingdom and 31.3% from the United
362 States and Canada which differs from previous surveys focusing on European countries (Doherty
363 et al., 2017a; Uldahl and Clayton, 2019; Visser et al., 2019) or Australia (Hill et al., 2015).
364 Information was gathered not only regarding selection of the type of noseband and how it was
365 fitted but also the reasons why these choices were made. Overall, the cavesson (33.6%) and flash
366 (20.3%) were the most commonly owned nosebands and were preferred by respondents across a

367 wide range of equestrian disciplines. The drop, crank, grackle and Micklem were each owned by
368 about 10% of respondents. There are minor differences between surveys performed in different
369 geographical areas. Other studies have reported the most popular noseband choice to be a cavesson
370 with flash (Doherty et al., 2017a; Uldahl and Clayton, 2019; Weller et al., 2020). In Australia,
371 noseband use was significantly higher in dressage than all other sports with the cavesson (~40%),
372 flash (~25%), and crank (~20%) being the most popular nosebands used (Hill et al., 2015). A
373 recent Dutch study indicated that the crank noseband was most common in dressage whereas the
374 cavesson was more common in show jumping (Visser et al., 2019).

375 With regard to the reasons for choosing a specific type of noseband, both the cavesson and crank
376 were selected because they were perceived as being kind and comfortable for the horse. More
377 specifically, the cavesson was believed to have a degree of laxity in its adjustment that allowed
378 the horse freedom, while the crank was chosen because the soft padding that lines the nasal and
379 mandibular regions cushions these sensitive areas. Similarly, the Micklem anatomical bridle was
380 also seen as being kind and comfortable to the horse and thought to exert lower pressure on the
381 nose and face than more conventional designs. In the Netherlands, the primary reasons cited for
382 choosing a specific type of noseband were to prevent the horse putting the tongue over the bit,
383 which is a safety issue, to improve the horse's appearance or to align with the rules (Visser et al.
384 2020). Some researchers have expressed an opinion that riders choose the crank noseband because
385 it offers greater leverage to tighten it around the horse's nose (McGreevy et al., 2012; Visser et al.,
386 2020) but this was not a consideration for respondents in the current study.

387 Riders reported they would change a horse's noseband if they perceived the noseband to be
388 detrimental to the horse's performance or if they were experiencing control issues. Horse riding
389 involves the rider controlling the direction and speed of the horse's locomotion (McLean and

390 McLean, 2008). Much of the tack used within equitation, including nosebands, are designed to act
391 as an interface for the application of cues, usually associated with the application and release of
392 pressure via negative reinforcement, to control and direct the horses' movement and pace
393 (McGreevy et al. 2018b). When applied correctly, the pressure cues used in negative reinforcement
394 should reduce in strength as the horse learns to respond to lighter cues to offer the desired response,
395 representing a higher level of training expertise for both horse and rider (McGreevy et al., 2018a;
396 McLean and Christensen, 2017). Rider error in the timing and accuracy of the application and
397 removal of aids can result in confused messages to the horse that may manifest as performance
398 and control issues (McGreevy et al., 2018a; McLean and McLean, 2008).

399 Riders here reported selecting nosebands such as a flash or grackle noseband when they felt they
400 needed more control or to prevent horses extending the tongue outside of the mouth during ridden
401 work. When seeking greater control over the horse or to prevent bad habits associated with opening
402 the mouth, respondents' choice of a noseband with a strap passing below the bit (flash, drop,
403 grackle) is a reasonable approach given the greater leverage applied around the
404 temporomandibular joint by a strap fitting lower on the horse's face, if correctly fitted. It has also
405 been shown that a strap fitting beneath the bit does not compress the cheek tissue against the
406 premolar teeth so it is less likely to be associated with ulceration (Uldahl and Clayton, 2019).
407 However rider skill and the training level of the horse should also inform rider decision-making
408 when considering a change of noseband, as these factors may also underpin the poor performance
409 or control issues experienced (Williams and Tabor, 2017).

410 If presented with a situation in which the bridle or noseband was thought to be causing pain or
411 injury to the horse, the majority of respondents would change the noseband. Their preferred
412 sources of information in this regard were veterinarians, equine dentists and coaches or trainers.

413 Competitive riders were more focused on performance and this was associated with a greater
414 likelihood of seeking advice from their trainer. Few respondents considered taking riding lessons
415 to evaluate their own skills and communication with the horse. It was, perhaps, a little surprising
416 that none would consult a professional bridle or bit fitter trained in analysing and correcting these
417 issues.

418 Nosebands are sometimes over-tightened. In subjectively judged sports, such as dressage, the horse
419 is penalized for oral behaviours that are perceived to represent a failure to accept the bit, such as
420 opening the mouth or protruding the tongue. These behaviours may be associated with a variety
421 of issues related to the dimensions and the fitting of the tack, the horse's oral conformation, pre-
422 existing injuries, or the aids given by the rider. The underlying issues may be difficult to identify
423 and correct. It has been suggested that tightening the noseband circumvents the problem by
424 preventing the horse from opening its mouth (McGreevy et al., 2017) which may result in high
425 interface pressures between the noseband and the horse's skin (Casey et al., 2013). Furthermore,
426 tight nosebands have been reported to improve sensitivity to the bit (Randle and McGreevy, 2013;
427 Pospisil et al., 2014). Respondents to the study reported here did not describe tightening the
428 noseband either to keep the mouth closed or to sensitize the horse to the bit.

429 Noseband comfort was a consistent theme that informed respondent decision-making, with padded
430 nosebands and the addition of external padding felt to be kinder to the horse, to increase comfort
431 and to prevent rubbing. Modelling of pressure distribution beneath a tight noseband (Casey et al.,
432 2013) showed the highest pressure at sites where the surface contour changed, particularly the
433 lateral edges of the nasal bones and over the ventral surface of the branches of the mandibles.
434 Pressure concentration at the edges of the nasal bones was confirmed using a pressure mat (Murray
435 et al., 2015) which showed that focal pressures could be significantly reduced using a foam pad

436 over the bridge of the nose that unloaded the edges of the nasal bones. The amount of pressure on
437 the nasal bones has an intermittent pattern during locomotion which tends to ameliorate the
438 potential for damage to the underlying tissues (Thomas, 2001). The same authors showed that the
439 physical properties of the noseband affected pressure distribution with a stiffer noseband having
440 the high-pressure areas further from the nasal bones. Clearly, pressure distribution under a
441 noseband is a multi-faceted problem affected by the adjustment and physical properties of the
442 noseband and the type and distribution of padding.

443 In response to concerns that an overly tight noseband exerts high pressure on the horse's facial
444 structures, the International Society for Equitation Science supported the idea that it should be
445 possible to insert two fingers between the noseband and the bridge of the horse's nose. A majority
446 of the respondents to this questionnaire were aware of the recommended adjustment with around
447 80% stating that there should be room for two or three fingers beneath a correctly adjusted
448 noseband. Respondents who had received feedback regarding the tightness of their noseband were
449 reported to have been told, in every case, that their noseband was too loose, regardless of whether
450 the recommendation came from a rider, trainer or competition official. Their sensitivity to the
451 importance of noseband tightness was further emphasized by comments received in response to an
452 open question about noseband use in which respondents indicated concern about other riders over-
453 tightening their nosebands.

454 Pressure-sensing technology has provided valuable information about the amount and distribution
455 of pressure on the horse's skin but is not a practical technique to use to check noseband tightness
456 at competitions. For this purpose, special tools have been developed for insertion between the
457 noseband and the nasal bones. One of these is the ISES taper gauge (Doherty et al 2017b) that is
458 marked in increments of 0.5 fingers, based on the size of average human fingers. The taper gauge

459 has been in use since 2013 and has been adopted for checking noseband tightness at competitions
460 by several national equestrian federations in recent years, though very few respondents indicated
461 that their noseband tightness had been checked at a competition using the ISES taper gauge.
462 Respondents demonstrated a strong level of awareness regarding the “two finger rule” reflecting
463 widespread anecdotal knowledge of this guideline across equestrian disciplines. However, it was
464 surprising that less than one third could correctly identify the function of the taper gauge and only
465 14% of those who knew the function could identify it by name. Visser et al. (2019) found a similar
466 lack of recognition of the ISES taper gauge by 95.9% of their respondents. Apparently, information
467 regarding noseband tightness *per se* has been disseminated more effectively than information
468 about the availability of a tool to measure tightness objectively.

469 During a study of noseband tightness in Dutch horses and the intentions of equestrians when
470 fastening their noseband, riders were classified into three groups based on cluster analysis of their
471 own attitude to noseband tightening behaviour, how peer pressure may affect tightening behaviour
472 and how they perceived new regulations that mandate measurement of noseband tightness in
473 competitions (Visser et al., 2019). One of their conclusions was that individuals in the three groups
474 were likely to respond to different strategies for knowledge transfer. That statement may have
475 broader implications for information transfer in the equine industry suggesting a need to use
476 different types of delivery to broaden the audience and disseminate information more widely. A
477 person’s social network is made up of family, friends and acquaintances who influence their
478 decision-making; within this the concept of role models (someone individuals look up to or aspire
479 to duplicate) and more recently digital influencers (role models on social media platforms) are
480 perceived to influence individuals’ behavior (Jiménez-Castillo & Sánchez-Fernández, 2019;
481 Gibson, 2004; MacCallum & Beltman, 2002). Despite this, little is known about who the core

482 influencers within equestrianism are and what level of influence these individuals exert over horse
483 owner and rider behavior. Our respondents identified their trainer / coach, veterinary professionals
484 and peers as key information sources they would utilize when seeking advice on noseband
485 selection and use; these groups are likely to represent role models and will engage in different
486 information gathering strategies to inform their own decision-making, impacted by their own role
487 models and experience. Future work evaluating who are equestrian role models and influencers,
488 and to analysis their influence on the horse owner and their decision-making warrants further
489 investigation.

490 With regard to noseband position (height) on the horse's face, there were a variety of opinions.
491 Since the decision about where a nosebands looks 'best' is related to aesthetics and conformation,
492 it is likely to vary between horses and between individuals. The median noseband position was
493 reported to be 17 mm from the facial crest with a range of 0-70 mm (Doherty et al., 2017a), which
494 is in accordance with the wide-ranging opinions on placement voiced in this survey.

495 Data collected at competitions have shown that nosebands are often adjusted tightly, especially in
496 eventers (Doherty et al., 2017a; Uldahl and Clayton, 2019). Some national equestrian federations
497 have introduced rules regarding noseband tightness and surveys performed since these rules were
498 enacted have indicated a good level of compliance. In The Netherlands, during the first competition
499 season after introduction of a noseband tightness rule, more than half of the nosebands checked
500 were in compliance (Visser et al., 2019) with nosebands in dressage horses being looser than those
501 in show jumpers.

502

503 Limitations to this study include bias due to self-selection of participants and the fact that the vast
504 majority of respondents (97.2%) were female which is not representative of the general equestrian
505 population. Similarly, respondents from the United Kingdom, the United States and Canada
506 comprised 87% of the sample, which could introduce a bias towards noseband practice in these
507 countries within the results. The sample size represents a margin of error of $\pm 3\%$ at the 95%
508 confidence interval for an estimated equestrian population of 6 million riders. However it should
509 be noted that response bias could be present within the results. Mazor et al. (2002) report the views
510 of survey responders can differ from those of non-responders; the online format used here may
511 also isolate some equestrians from participating. Positional reflexivity could have also influenced
512 the interpretation of the results as both authors are advocates of practices that enhance equine
513 welfare

514 Condon et al. (unpublished data) identified a single piece of apparatus alone cannot explain ridden
515 behavior observed in the horse, and the rider will be influential on horse performance (Williams
516 and Tabor, 2017). Cross-sectional surveys, such as used here, also do not reliably identify causal
517 relationships and cannot be accurately translated to practice; therefore further work is needed to
518 confirm the self-reported action of nosebands reported here with due consideration of the tack used
519 and the impact of the rider on the horse.

520 An actionable item from the results of this study is the need for more education about ISES taper
521 gauge, its purpose and its potential educational value for informing riders about noseband
522 tightness. Another area in which further education may be warranted is in the value of using trained
523 bit and bridle fitters, e.g. Master Saddlers who are trained to fit both saddles and bridles, to help
524 with horses that are showing resistance problems. Glanville et al. (2020) advocate that behaviour
525 change interventions are one of the most promising avenues to improve animal welfare. Therefore

526 to facilitate successful rider education, future research should also aim to gain a better
527 understanding of how riders' beliefs and experience have influenced their current practice.
528 Increased knowledge of how riders define and assess horse performance, how habits related to
529 noseband use have formed, and if broader societal influences have informed how riders select and
530 fit nosebands are required to underpin future interventions focused on enhancing equine welfare
531 through informed noseband use.

532 **Conclusions**

533 The findings of the study confirm the popularity of the cavesson and flash nosebands particularly
534 in the UK and North America. Crank nosebands were less popular and were used primarily because
535 the extra padding was seen as being kinder and more comfortable for the horse. Respondents did
536 not mention preferring a crank noseband because it could be tightened excessively. There was
537 apparently good awareness of the importance of not over-tightening the noseband and of the
538 recommendation to allow space for two fingers under the noseband over the bridge of the nose,
539 indicating that this information has been disseminated effectively. However, very few respondents
540 recognized the ISES taper gauge suggesting the need for further education.

541 **Conflict of interest statement**

542 No conflicts of interest apply to this work.

543 **Authorship statement**

544 The idea for the paper was conceived by HMC and JMW. The survey was designed by HMC and
545 JMW. The data were analyzed by JMW. The paper was written by HMC and JMW.

546 **Ethics statement**

547 This study was approved by Hartpury University's Ethics Committee.

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