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A SURVEY OF SENIOR EQUINE MANAGEMENT: OWNER PRACTICES AND CONFIDENCE

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Abstract

Senior equines (16 years and over) comprise a significant proportion of the global equine population and there is concern that their management practices may not be entirely appropriate, particularly given recent evidence to suggest an under recognition of disease for which alterations are necessary to ensure optimal care. However, there has been minimal research to investigate the appropriateness of senior equine care and how capable their carers’ are in providing care. Consequently, this study used a survey approach to investigate the management practices and health care provision for senior equines. A series of likert type questions were used to assess respondent confidence in aspects of management regimes, recognition of age associated equine conditions, and perceived importance of nutrition advice sources, using a scale of 1-5 (1 being low and 5 high confidence). In addition, a combination of multiple response and open questions were used to report
management practices in place. The survey was administered to those enrolled on a massive open online equine nutrition course and received 1342 responses. Results indicated an encouraging provision of care for senior equines, with associated high carer confidence in management regimes and concerted effort to understand and fulfil their senior equines requirements. However, the study highlighted key areas of requirements for owner education. In particular, the combined lack of frequent body condition monitoring and low confidence in disease recognition and supplement feeding. There was also a prevalence of suboptimal strategic worming and dry hay feeding. Given that veterinarians were consistently considered as the most important advice source it is likely that they will have an important role to play in the education that is required.

Key words (5): Equine, senior, nutrition, management, survey.

Introduction

Aging equines represent an increasing proportion of the global equine population (Ireland et al., 2011), but they can often be overlooked. Inappropriate management regimes can facilitate or exacerbate diseases and conditions at any time of life (Secombe and Lester, 2012). But, whilst age is not necessarily indicative of degeneration, senescence increasingly predisposes equines to particular conditions, the majority of which are related, to nutrition (Jarvis, 2009). Loss of body weight and or condition is prevalent (Jarvis, 2009) and could be influenced by a variety of age-associated factors including endocrine disorders, digestive dysfunction from dentition to nutrient
absorption, in-appetence, and musculoskeletal conditions (Elzinga et al, 2011; Durham et al, 2014). In addition obesity is also a major concern and exacerbates age associated disease (Alford et al, 2001) and requires different management (Geor and Harris, 2009; Secombe and Lester, 2012). It is essential therefore that owners have sufficient knowledge to formulate management and nutritional regimes, and also that they monitor their senior equines condition to assess if or indeed when alterations are required (Geor and Harris, 2009; Durham et al., 2014) thus optimising senior equine care. For owners to do this requires that they have the necessary information but there is a paucity of health, disease, and nutritional information for the senior equine (Ireland et al, 2011) and a variety of sources, which may undermine their confidence. There have been few attempts to assess the feeding and management practices of senior equines, particularly with a view to the confidence owners have in both recognizing prevalent conditions and formulating their management regimes as a consequence. The objectives of the present study were firstly, to assess in general the feeding and management practices of senior equines for their appropriateness. Secondly, to assess owner confidence in recognizing conditions associated with the senior equine and formulating management regimes in relation to their experience. Finally, to ascertain which sources of information are most important for them in so doing.

Materials and methods

Study population
The study population included those enrolled on a massive open online course in equine nutrition, which ran from February to March 2014. The course was provided by Coursera, which is an online platform offering free open courses in a variety of disciplines through affiliated academic institutions. Participation can have multiple motivations from furthering knowledge to enhancing career prospects as statements of accomplishment and verified certificates are available. Those enrolled on this course represented various nationalities and equine backgrounds. Thus, this offered an ideal opportunity to reach a large population of horses owners or carers.

Questionnaire Design

An online survey was created in Survey Monkey, a free online software for survey development and administration. Specifically for the purposes of the survey to gather information on the feeding and management practices of senior equines, to assess owner confidence in these practices and disease recognition, and investigate sources of nutritional advice. Participants were asked to complete the survey at the start of the course. The senior equine was defined as 16 years and older to encompass all ages considered in previous literature (McGowan, 2010a; Ireland et al., 2011). The survey comprised three sections: (1) demographics of owner and equines; (2) current feeding practices and management of senior equines; (3) owner confidence and advice sources. The majority of questions were either multiple choice, some allowing multiple responses, or likert scale rating questions where there was a choice of a number of fixed alternatives. Open text boxes allowed for
‘other’ comments. Only participants with senior equine management experience answered questions pertaining to senior equine management. Every effort was made to link the questions to the research objectives and to control for confounding factors. A pilot study was conducted to identify technical issues with administration and clarity of questions and instructions. Statistical treatment of results

Data were gathered in Survey Monkey and downloaded into excel where open responses were manually sorted into common themes and other responses transformed into appropriate form before export to SPSS statistical software version 19. Descriptive statistics were obtained including frequencies and proportions with 95% confidence interval for categorical data, whilst medians, modes, with interquartile ranges (IQR) for continuous and likert responses. Pearson Chi-squared tests were used to assess associations between categorical variables and Spearman Rho for correlations. Kruskal wallis or friedman test were used to analyse variation in likert response levels and Wilcoxon signed rank sum tests to test statistical significance of variation between paired categorical data. Influences for average confidence levels were analysed by fitting independent variables with P values of <0.05 and potential biological significance into a generalized linear mixed models with wald chi-square tests of significance. The most parsimonious model was found by sequential removal of non-significant variables, in order of least significance. Significance levels for all analyses were set at p d 0.05.

Results
Demographics

Of the 10,268 individuals registered on the equine nutrition course, 1,342 responded to the survey (13% response rate). Respondents were predominantly (91%) female and in age groups 25-34 (25%) or 45-54 (23%). Countries of residence covered all continents with Great Britain and Ireland being most common (32%). The USA, (28%), rest of Europe, (18%) and Canada (11%) were also common. 39% of respondents listed equine industry related professions and of these, 83.% were involved equine care and management, with 48% specifically health care related. Equine management experience was typically high (25% over 26 years); however, senior equine management experience was consistently lower ($Z = -26.810, p < 0.0005$), predominantly (24%) 1-5 years (Figure 1). Survey respondents managed a total of 13,367 equines, of which 28% were senior. Senior breeds most commonly represented were thoroughbreds and thoroughbred crosses (21%), followed by ponies (13%) of which the majority (61%) were native to Britain. Breeds with counts less than 10, not readily categorized within another group were classified as other (8.%). The majority of senior equines were used mainly for hacking/pleasure purposes (54.%) and retired or companion animals (43%); however, a large proportion (22.%) were still in medium to heavy intensity work.

Senior equine monitoring and health care provision

Body condition scoring (BCS) was assessed more frequently than weight, but not significantly so ($p = 0.053$), weight being most commonly assessed monthly (30%) and BCS weekly (28%) (Figure 2). A small proportion of the
respondents did not assess weight (8%) or BCS (9%). Some respondents did not know the weight or BCS of their horse, 1.4% and 4.1% respectively. There was a relationship between amount of senior equine management experience and frequency of weight (p<0.0005) and BCS (p=0.010) assessment. Weight was assessed most commonly by eye (34%), eye in combination with another technique (32%) or weight tape (25%) (Figure 3). Assessment by eye was significantly more likely to occur on a regular basis (p<0.0005) than tape (p<0.0005) formula (p=0.004), or scales (p<0.042).

Strategic worming was the most frequently used (p<0.0005) either on its own (47.2%) or in combination with either targeted (7.5%) or interval (2%) dosing. More equine management experience, both in general and of senior equine particularly, was significantly (p<0.0005) associated with using strategic worming. The use of interval strategies was associated with country (p<0.0005), being most common in North America (59.6%). A minority (1.3%) reported alternative worming practices, mainly similar to targeted or interval strategies, but also natural remedies including feeding diatomaceous earth and faeces removal. Frequency of dental assessment varied significantly (p<0.0005) and was done most often annually (50%) or biannually (27%). No dental care was reported by 9 respondents (1%). Hoof care was performed mainly by farriers (62%) (p<0.0005) most commonly between 4-6 (36%) or 6-8 (34%) week intervals. Owner-only hoof care (7%) accounted for 52% of those reporting no farrier care and was significantly associated with overall equine experience (p=0.022), but not respondent profession (p=0.920) or senior experience (p=0.582).
Monitoring water intake was performed by 50% of respondents and appeared to be related to years of experience managing senior equines ($p<0.0005$). Water intake was most commonly assessed by monitoring buckets (65%). Provision of extra forage ($p<0.0005$) and concentrates ($p<0.0005$) differed with season, with highest frequency of respondents giving extra forage (93%) and concentrates (70%) in winter. Use of supplements did not vary between seasons ($p=0.251$), but was also most common done in winter (73%). Hay was the most commonly fed fibre source, being either grass (78%) or legume (29%) hay, followed by pasture (66%) and sugar beet pulp (46%). Of those that reported hay feeding method ($n=979$), the majority fed it dry (73%), with others feeding it dampened (15%), soaked (9%), or steamed (3%) (Figure 4). The majority of respondents (62%) reported feeding grains, pellets, or concentrates by pre-mixed bags, either commercially and/or locally prepared. Feeding owner-prepared mixes (23%) was not associated with equine profession ($p=0.487$) or experience ($p=0.350$). A high proportion (86%) of respondents used supplements, predominantly for providing vitamins or minerals (78%), whilst salt or electrolytes (46%), joint support (43%), fats and oils (35%), and hoof care supplements (27%) were also commonly fed. Respondents most frequently considered senior equine condition to have had ‘a lot’ of effect on their management (37.3%), whilst 8.9% selected ‘not very’. The aspects of management regime most frequently reported as having changed since the equine became senior were weight management (40.8%), supplementation (36.8%) and BCS (33.8%) the latter becoming more frequent with age ($p=0.015$). Of those respondents selecting a particular feed brand
(83.3%) the most common reasons were: (1) research or knowledge of feed contents (43.4%); (2) the brand seemed best for the equine after trial (28.7%); (3) availability of specific senior feed (22.7%).

Confidence in management regimes

Confidence in implementing management regimes was high overall, with greatest mean confidence scores for hoof care (µ=4.43), feeding forage (µ=4.37) and turnout (µ=4.36), and lowest for determining which supplements to use (µ=3.91) and when to feed those (µ=3.73). 43.7% of 588 respondents that reported their concerns, cited nutrition related concerns as the aspect of care that most worried them. Average confidence in regime has a significant positive association with disease recognition confidence (r=0.806, p<0.01). A generalized linear model to explain confidence included equine management experience, ($\chi^2=95.520$, p<0.0005), respondent sex ($\chi^2=14.207$, p<0.0005), and country ($\chi^2=12.010$, p=0.035) with those in South America (µ=2.78), North America (µ=2.67) and UK (µ=2.64) being most confident and those in Asia (µ=1.76) being least confident. Importance of advice sources differed significantly. Veterinarians, scientific publications, books, nutritionists, dentists, and farriers ranking highest (Mdn = 4) and feed stores and television ranked lowest (Mdn = 2). Veterinarians were the information source most frequently cited as the most important (27.34%).

Disease experience and disease recognition confidence
Respondents had varying experience of disease management (Figure 5). Arthritis and loss of body condition were reported as being most prevalent in senior equines. Confidence in disease recognition varied, but generally respondents were most confident at recognizing obesity, loss of body condition, and colic (mode = 5) and least confident at recognizing insulin resistance, equine metabolic syndrome, and equine grass sickness, (mode = 1) (Figure 6). Those with more experience of managing disease were more confident in disease recognition ($p<0.0005$). A generalized linear model, to explain disease recognition confidence included years experience of equine management ($p<0.0005$), diseases experienced ($p<0.0005$), age ($p=0.008$), and sex ($p<0.0005$) with females being more confident ($\mu=2.6$) than males ($\mu=2.04$).

**Discussion**

Responses and bias

Whilst the sample size (1,342) is large and comparable to other similar studies confined to individual countries (Hoffman et al., 2009, McGowan et al., 2010a, Ireland et al., 2011), it represents a small proportion of worldwide equine owners, and response rate of 13% is low. Therefore, generalisation of results to the management of the global senior equine population is limited. There is also potential for bias given that participants, enrolled on an equine studies course, are actively seeking more equine nutrition knowledge and may not be representative of the general equine owner population.

Demographics

The vast majority of respondents were female, indicating that females might
be more likely to seek knowledge or that a larger proportion of equine owners are female. The predominance of western nationalities, mainly European, may reflect unequal global availability or advertisement of Coursera courses. Similarly, the high frequency (40%) of equine professionals that responded may be attributed to their greater awareness of such courses, but is also a potential cause for concern that such numbers of equine professionals (including veterinarians and nutritionists who are traditionally turned to for nutritional advice), were undertaking an introductory nutrition course.

The lack of experience of respondents in managing senior equines was not unexpected, although the number of senior equines is increasing, the number of equines in this age group is substantially smaller than 15 years and younger. In the current study, senior and geriatric equines comprised 28% and 3% of the population respectively, comparable to American (Brosnahan and Paradis, 2003a), Australian (McGowan et al., 2010), and British (Ireland et al., 2011) studies. This indicates senior equines consistently constitute between a quarter and a third of the global equine population, which highlights the importance of providing for the specific needs of these animals. Thoroughbreds or thoroughbred crosses were the most common breed reported, which concurs with the findings of other studies (Brosnahan and Paradis, 2003a; McGowan et al., 2010; Ireland et al., 2011). The large proportion of ponies over 15 also corresponds with other studies in which their prevalence increased with age (Ireland et al., 2011). The prevalence of senior equines engaged in medium to high intensity activities is encouraging and, whilst perhaps influenced by the wide age range used to define senior equines, also supports that senior equines can lead active lives.
Health care provision

Despite dental care, hoof care and worming regimes being important for the overall health and wellbeing of the equine, it is commonly reported that provision of such care decreases with equine age (Ireland et al., 2011) despite evidence that increased provision is advisable (Jarvis, 2009).

Encouragingly, frequent dental and hoof care was reported by many respondents. There are three common worming strategies; interval, strategic, and targeted. Interval dosing at set intervals, is not recommended as it disregards variability in individual equine parasite burden that can lead to unnecessary overdosing and contribute to drug resistance (Stratford et al., 2013). This is also true of Strategic dosing, which times treatment according to parasite lifecycle, and can be undermined if environmental conditions lead to abnormal parasite occurrence (Lester and Matthews, 2014). Targeted worming is currently advocated in some European countries becoming legislation in Denmark (Nielsen et al., 2006), the Netherlands and Sweden (reported by respondents). Treatment is based on individual equine burden by assessing faecal egg counts (FEC) and refers to parasite lifecycle in combination with environmental factors (Stratford et al., 2013).

Of primary concern with regard to optimal health care therefore was the high prevalence of strategic worming strategies, also reported by Stratford et al., (2013), which was associated with more experience of general, and senior equine management. The requirement for potentially expensive FEC may explain the lower occurrence of targeted regimes and why strategic regimes
maybe favoured as an easier alternative to the now less advised interval regime. Stratford et al., (2013), proposed that an increase in FEC was associated with higher levels of veterinary involvement, indicating a requirement for increased veterinary input, either by targeting better worming regime advice, or facilitating access to FEC analysis. A number of respondents reported using natural wormers, most often diatomaceous earth, the fossilized remains of algae or diatoms (Bernard et al., 2009). However, whilst these alternatives maybe perceived as preferable to the administration of chemical anthelmintics, they could potentially cause more harm than good if they are not effective in combating parasitic infection. Particularly given the potential consequences of parasitic infection on senior equine digestive function (Ralston et al., 2001). Further scientific testing of the efficacy of such preparations in equines is therefore required, particularly given the evidence suggesting that diatomaceous earth is ineffective at combating parasite infection in other species (Bernard et al., 2009).

Nutrition

Good quality safe feeds are essential for optimum nutrition. Readily digested forage sources including pasture, sugar beet pulp, and hay cubes were common, perhaps reflecting adjustments in response to dental degeneration, but hay was still the most commonly fed forage, despite being more problematic for older horses to chew.

Selecting good quality hay, produced and stored correctly to maximize quality is of primary importance for best nutrition. Treating hay by dampening or
soaking is recommended by some to remove dust that can exacerbate RAO (Pirie, 2013), but can result in loss of nutrients whilst, streaming can additionally combat spoilage organisms with minimal nutrient loss. Most respondents fed hay dry, as found in other studies (Hotchkiss et al., 2007), perhaps awareness of hay treatment is low, supported by equine related professionals and experience of RAO making it more likely. Therefore promoting awareness of RAO and the potential benefits of hay treatment, could increase the prevalence of appropriate hay feeding. Selection of feeds based on composition or suitability for the senior equine demonstrates an encouraging and concerted effort to select the best feed for equine requirements and a knowledge of nutrition to do so. This may have been more evident in the study sample given their proactive search for knowledge demonstrated by their enrolment on an equine nutrition course.

Supplements were the element of nutrition most commonly reported as changing since the equine had become senior. Similar to other studies of both all equines (Hoffman et al., 2009) and senior equines specifically (McGowan, 2010), joint and vitamin/mineral supplements usage were most prevalent. Many also reported to use vitamin supplementation and certainly vitamins have been purported to be beneficial for senior equines, including the antioxidant vitamin E, which has been reported to delay aging and reduce inflammation (Siciliano, 2002). However, equine supplement requirements are a fairly recent addition to equine nutrition and have had minimal research and respondents may be unfamiliar with the variety and applications of available supplements. In addition, evidence for efficacy and safety of supplements is therefore lacking which creates doubt about advocating their use as they can
cause nutritional imbalances and be as detrimental as lack of supplementation (Brosnahan and Paradis, 2003a; Hoffmann et al., 2009). Therefore high supplement use on its own does not necessarily imply optimal equine care and further research is required to support the use and selection of supplements, and perhaps there is a case for professional involvement to help advise owners to promote the use of the right supplement at the right time. Fewer respondents reported feeding supplements associated with senior diseases including equine metabolic syndrome, respiratory health and insulin resistance, which whilst this may reflect a lack of requirement it may also represent an under recognition of these conditions.

Water is an essential element of equine digestion and waste product excretion through the kidneys and dehydration can lead to many complications including impaction colic (Frape, 2010), yet despite this water consumption it is often overlooked as part of equine nutrition. The finding that over half of respondents did not monitor water consumption is perhaps therefore not surprising, but no less concerning. Difficulty in monitoring from automatic waterers or when equines are kept in groups, were reasons stated by some respondents. Monitoring consumption from buckets, most common among respondents, is an accurate, and hence optimal, indication of equine hydration (Pritchard et al., 2010). Indirect assessment including equine excretions and physical state might be advocated suitable alternative for those who find bucket monitoring impracticable as reported by a number of respondents. However, an indirect assessment, the skin tent test, does not reliably indicate dehydration (Pritchard et al., 2010) neither does it monitor variation in water consumption which can be an indicator of disease, for instance excessive
thirst can indicate Cushing’s disease (Equine Hyperadrenocorticism) (Geor, 2007). Thus, attempting to observe equine drinking behaviour, as often as possible, for instance after exercise, maybe a feasible alternative to bucket monitoring. Whilst it remains the responsibility of the equine carer to familiarise themselves with their animals normal thirst level, an increased emphasis of the importance of water consumption from health professionals is required.

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Physical assessment

Equine body weight estimates are required to calculate nutritional requirements and medical doses including anthelmintics. Furthermore, body weight and condition are useful indicators of health status, for example non-optimal weight and fat deposition in specific bodily regions can predispose equines to diseases including laminitis (Alford et al., 2001) and ECD (Durham et al., 2014). Altered physical condition can indicate the efficacy of a change in regime (Geor and Harris, 2009) or the occurrence of disease, for example chronic weight loss is the primary clinical sign for mal-absorption (Mair et al., 2006). Therefore, it is recommended that weight and body condition scores are determined on a regular (2-4 weekly) basis, (Geor and Harris 2009) to monitor any change, which is particularly important for senior equines. Whilst frequency (daily-weekly) assessment was conducted by a significant proportion of respondents in the current study, an equally large proportion reported monthly or less frequent assessment, and a small, but important, number never carrying out or knowing what either assessment was. This
might reflect a perceived lack of importance by those respondents for weight assessment, or indeed any focused assessment of equine condition, which might potentially contribute to the lack of disease recognition found in other studies (Ireland et al., 2012). Those assessing weight did so with a combination of techniques, predominantly by eye, and assessments were likely to be more frequent with this method. However, visual assessment is considered less accurate than other techniques (tape/formula) and monitoring changes is difficult. Formulas are generally considered the more accurate estimation than using weigh tapes (Wager and Tyler, 2011), whilst weigh bridges are most accurate. However, accuracy depends on the type of formula or indeed tape used and also the type of equine assessed (Reavell, 1999). Reavell, (1999) found tapes more effective for thoroughbred types whilst the Carroll and Huntington formula (Carroll and Huntington, 1988) was best for small ponies. Requirements for ‘specific’ equipment or apparently complicated procedures may cause tapes, formulas, and body condition scoring to be perceived as difficult. Addressing this issue may require more that just increasing awareness of the need to conduct such assessment. One potential measure may be to utilise the expanding applications of technology, for instance specific apps that are designed to help make formula use and BCS easier, and which may increase confidence and therefore encourage more frequent condition assessment. Although this does require the use of technology and is hence not inclusive to all.

Confidence in management regime
Overall respondents reported high confidence in management regimes, although it must be remembered that this does not necessarily indicate knowledge or that the regimes were appropriate. Respondent sex significantly influenced confidence, with females being more confident than males. Females may be more intrinsically confident in equine managements for a variety of reasons Lenney, (1977) but males may have had lower experience and as a consequence reported lower confidence. Respondents from western countries appeared more confident than elsewhere. This may be linked to preponderance of equine research in western countries thus providing them with more information to base management decisions on. There is perhaps therefore a need for research on equine requirements in other countries to increase available information.

Disease experience and respondent confidence

The majority of diseases for which respondents were asked to report their experience and confidence are commonly associated with senior equine age and therefore unsurprising the majority were most commonly experienced in senior equines compared to non-senior. This supports the assertion that equines are increasingly predisposed to such disease with senescence. Less experienced conditions including insulin resistance, equine metabolic syndrome, cataracts, and diabetes may reflect both their rarity and lower average experience of senior equine management by survey respondents, given that they occur more frequently in older equines (Chandler et al., 2003). However, it may also indicate under recognition, found elsewhere (Chandler et al., 2003, Ireland et al., 2012). Laminitis and obesity were common in both senior and non-senior equines. There is much advice relating to these
conditions due to their prevalence, the potential severity of laminitis, and consequences of obesity resulting in heightened awareness that may explain the high confidence in laminitis and obesity recognition. However, the prevalence of essentially preventable diseases indicates that whilst respondents can recognise them, they are less able to anticipate and prevent them. The reported lack of frequent weight and BCS determination by objective measures in this study highlights an area that could be improved to potentially help combat these issues and indicates that current methods to increase awareness are not entirely effective.

Greater confidence in disease recognition was associated with greater confidence in management regimes. If confidence indicates a certain level of competence, then perhaps those better at recognising disease are consequently better able to formulate appropriate management. This suggests education in the diseases of senior equines will have a positive impact on all areas of their care. Whilst this is an assumption, it is supported by the association between experience and confidence. Average confidence in disease recognition was increased with more years of equine management experience, more diseases experienced, being older, and being female. The association between disease/management experience, and disease recognition confidence highlights a need to target education of diseases, particularly those that are rarer, to owners that have less experience. This is not to say that those with greater experience may not benefit from education to consolidate and expand their knowledge of new developments. Senior equine management experience, however did not significantly influence disease recognition confidence. This could be due to correlation with overall
equine experience so that it had no additional effect on the statistical model. 

However, it suggests that senior equine management does not imply experience of age-associated diseases, perhaps due to the rarity of some diseases, or that they are more prevalent equines in the higher end of the age bracket used and not all respondents would have had experience of managing equines of this age. This indicates all carers of senior equines (aged 16 and over) irrespective of experience, would benefit from information on rare, age associated diseases.

Sources of Advice

Veterinarians were rated highest in terms of important sources of nutritional advice, which concurs with the findings of other studies (Hoffman et al., 2009). However, there is some concern over the ability of veterinarians to offer up to date nutritional advice, specifically with respect to senior equines. Veterinary nutritional education is minimal and the profession requires a broad knowledge base making it difficult to keep abreast of advancements in every field and indeed, perceive their own knowledge to be suboptimal (Roberts and Murray, 2013). This is possibly the reason why there were a number of veterinary surgeons, nurses, and technicians enrolled on this introductory equine nutrition course. Nutritionists also featured highly as sources of advice, which is encouraging as they can provide specific nutritional support. However, in a study asking respondents which advice sources they actually use, nutritionists ranked seventh, below vet, trainer, feed store, book, Internet, and magazine (Hoffmann et al., 2009). This indicates that the perceived importance of a source does not necessarily reflect its use. For nutritionists
this may reflect inaccessibility or cost, but nevertheless highlights a need to promote their services. Encouragingly, scientific publications and books featured highly, again indicating an active effort for respondents to seek their own information, although as previously discussed, this may have been skewed by the fact that respondents were enrolled on an education course, and hence not representative of the general equine carer population. The majority of respondents reported using multiple sources, which has also been found elsewhere (Hoffman et al., 2009). Whilst this may allow a more comprehensive and balanced knowledge base from which to make appropriate management decisions, which is advisable, many sources particularly those available on the internet, are not based on scientific evidence and may contradict each other. As individuals are only likely to increase their use of the Internet for their own research, it is imperative that reliable and adjudicated sources of information are promoted. As Roberts and Murray (2013) suggest being able to direct their clients to these sources may be where the role of veterinarians could lie in the future. Finally, given the increasing use of the internet and the evident popularity of the nutrition course on which respondents were enrolled, perhaps increased provision of online courses would be beneficial. Not only do such courses offer the potential to deliver reliable and accurate information that can be retained for future reference, they can also provide an opportunity for assessment, offering feedback on performance that can increase confidence (Lenney, 1977), and the opportunity to engage with professional lecturers to address personal areas in which confidence is lacking.

**Conclusion**
In general respondents were highly confident in many aspects of senior equine management, which overall indicated a high level of care provision and effort to fulfil equine welfare and nutritional needs. However, low confidence in feeding supplements highlights a need for education in their applications and continued scientific investigation of their uses and efficacy. Furthermore despite high overall confidence, various findings indicate a requirement for continued owner education in best management practices, particularly optimal worming strategies, hay feeding, water consumption, and body condition monitoring. Low confidence in disease recognition, particularly those common in senior equines, highlights a need for information exchange between veterinarians and owners, particularly those with least experience. Veterinarians were perceived as the most important advice source and are therefore integral to increasing the knowledge and confidence of equine owners and carers.

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References


**Figure captions**

**Figure 1** Percent of respondents reporting different amounts of equine management experience in years, both overall (grey bars) (n=1334) and for senior equines specifically, (≥16 years) (white bars) (n=1259).

**Figure 2** Frequency of weight assessment (black bars) and Body condition scoring (white bars) reported by respondents (n=732). No significant difference in frequency of weight or BCS (Z=-1.933, p=0.053)

**Figure 3** Frequency of weight assessment methods reported by respondents (n=732). Some respondents represented more than once. Other includes photographs and monitoring when doing up the girth.

**Figure 4** Frequency of different hay feeding methods reported by respondents that fed hay (n=1011). Respondents could select multiple responses and could therefore be represented more than once.
Figure 5 Number of respondents (n=967) reporting experience of various age associated conditions or diseases in senior and non-senior equines. Experience of conditions was significantly greater in senior and conditions differed in their prevalence. ECD (Equine Cushing’s disease), DJD (degenerative joint disease), EGS (equine grass sickness), EMS (equine metabolic syndrome), IR (Insulin resistance), LBC (Loss of body condition), RAO (respiratory airway disease).

Figure 6 Respondent confidence of recognizing age associated conditions and diseases, reported on a likert scale from 1 (not at all) to 5 (very) (n=1043). ECD (Equine Cushing’s disease), DJD (degenerative joint disease), EGS (equine grass sickness), EMS (equine metabolic syndrome), RAO (respiratory airway disease).