Equine nutrition: A survey of perceptions and practices of horse owners undertaking a massive open online course in equine nutrition

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Abstract

~~This study involved a global survey designed to assess perceptions and practices of horse owners registered on an open access online equine nutrition course.~~ An online survey was designed to ascertain the following information: demographics, current feeding practices, and perceptions and knowledge of equine nutrition, including nutrition-related disorders. Response rate was 34 ~~percent~~% (6538 respondents). Over 80 ~~percent~~% of respondents were horse owners or carertakers~~s~~, with the majority owning between one and five horses (75 %) aged 5 and over (74 %). Most kept their horses for pleasure (54 %), with 33 ~~percent~~% using them mostly for competition and 13 ~~percent~~% using them for an equal mix of both pleasure and competition. Concentrates were fed by the majority (87 %) and over 70 ~~percent~~% stated that their horses had some access to pasture. Over half of respondents (60 %) regularly monitored their horses' weight, with most doing this monthly. Weight tapes were most commonly used (62%), although many reported to guess the weight of their horse(s) with very few (5 %) ~~5~~ using weight scales. Under half (46 %) stated that they regularly used body condition scoring (BCS), many did not BCS at all (24 %) and some did not know what BCS was (10 %). Of those that did BCS, most (36 %) did this monthly, with others doing this weekly (25 %), daily (14 %) and when they remembered (15 %). Overall knowledge of nutrition was reported by most as average (median = 3 on Likert scale: average); however, respondents were less knowledgeable on the management of nutrition-related disorders.

1. Introduction

Equine nutrition, and the importance of implementing correct diets for horses, is becoming increasingly significant to ensure good health and welfare. There are a number of equine ailments that are commonly seen that could be prevented if dietary rations were better understood by those who administer them [1]. However, despite the growing recognition and evidence of the impact of poor nutrition on equine health, widespread inappropriate feeding management still exists [2-4]. There is evidence to suggest that many horse owners have a poor understanding of equine nutrition [2] and decisions regarding nutritional management are often based on tradition, folklore and misinformation [5]. Equine nutritional issues are a growing concern as there is an increase in horses suffering from nutrition-related disorders such as obesity, colic, laminitis and equine metabolic syndrome (EMS) [2]. Such issues often occur due to a lack of knowledge and understanding of how nutritional management can impact ~~on~~ the development of several equine clinical conditions [6] and indeed it has been reported that many horse owners have been identified as incorrectly feeding their horses [3]. However, whilst there have been some studies undertaken to evaluate the nutritional practices of horse owners [2-4], all of which have yielded valuable information, further information on the nutritional perceptions and practices of a widespread population of horse owners/~~carers~~caretakers would be extremely useful. Consequently, the aim of this study was to investigate the knowledge and confidence and perceptions and practices of equine nutrition by a global population of horse owners/~~carers~~caretakers registered on a free online course in equine nutrition.

2. Materials and Methods

2.1 Participants

This study involved a global survey designed to ascertain participants' knowledge of equine nutrition. Nineteen thousand participants were registered ~~i~~on an open access online equine nutrition course that ran in January 2013. The course was open to anyone to join, with the only requirements being internet access and the ability to communicate in English. The course content included anatomy and physiology of the equine digestive tract, equine nutrient sources and dietary management for horses and ponies, particularly those with nutrition-related disorders. Ethical approval was sought and received from the University's School of Veterinary Studies' ethics committee.

2.2 Survey Design

An online survey (Bristol Online Surveys, 2011) was designed ~~specifically for the purposes of the survey~~ to assess participants' knowledge of equine nutrition. All 19,000 p~~P~~articipants were asked to complete the survey at the start of the online course. The survey consisted of three sections: demographics, current feeding practices, and perceptions and knowledge of equine nutrition (a copy of the survey can be obtained from the author). The survey mainly consisted of Likert scale questions, where there was a choice of a number of fixed alternatives. A number of questions were similar to some of those asked by Hoffman *et al*. [2] in their survey of horse owners' feeding practices and knowledge of nutrition. As the study population was global it was particularly important to ensure clarity of questions in order to reduce the impact of differences in language and culture within the survey results [7]. Survey questions were kept short to increase participant understanding and response rates [8]; specific terms rather than generalised ones were used where possible, again to aid in respondents understanding [9]. Vague terms such as 'maybe' or 'probably' were avoided to improve clarity and validity of answers as recommended by Dillman [10]. Questions were designed to encourage participants to think about what they currently do and not about past behaviour; research has shown that

more accurate responses are obtained when people are asked to consider something that has occurred recently, within the last month, as opposed to a further back event [7]. Pre testing via a pilot survey was carried out as recommended by Robson [11]. The final survey was a 28 question, multi-part survey and emailed to all participants of the online nutrition course.

2.3 Data Analyses

Data were gathered in the Bristol Online Survey tool and were downloaded into an Excel spread sheet in a coded form with a key. Quantitative data were analysed for descriptive statistics and non-parametric statistical tests using SPSS statistical software. All data were analysed for median and measures of variation.

3. Results

3.1 Response rate and demographics

The survey response rate was 34 ~~percent~~%, with 6538 out of ~~a possible~~the 19,000 course participants responding. The majority of respondents (90 %) were female aged between 25 and 54 (65 %). Respondents were predominantly from the UK ~~(37 %)~~ and the USA ~~(28 %)~~, followed by Canada ~~(8 %)~~ and Australia (Figure 1~~5 %~~). The remaining respondents were from more than 100 countries across the globe. Less than 5 ~~percent~~% of respondents had taken an online course previously, although over 80 % had undertaken either further or higher education since leaving school, with over 50 % having either a graduate or post-graduate degree. The amount of experience of with horses varied from less than one year to over 25 years (Figure 2~~1~~), with over 75 ~~percent~~% of respondents having more than six years' experience and over 30 ~~percent~~% having more than 25 years of experience. Over 80 ~~percent~~% of respondents were horse owners or ~~carers~~caretakers. The majority of horse owners had between one and five horses (75 %) aged 5 and over (74 %). Most horse owners kept their horses for pleasure (54

%), with 33 ~~percent~~% using them mostly for competition and 13 ~~percent~~% using them for an both pleasure and competition.

3.2 Current feeding practices

Over 70 ~~percent~~% of respondents reported that decisions on feeding management were undertaken by the main owner or carer of the horse. Of those that owned horses, 60 ~~percent~~% stated that they regularly monitored their horses' weight. The frequency of weight checks varied, but most reported to monitor weight monthly (Figure 3~~2~~). Of those that selected "other" as their response, further investigation showed that the majority of those respondents only checked weight for medical/deworming purposes. Weight tapes were the most commonly used method of weight determination (62%), although many reported to guess the weight of their horse(s). The use of weight tapes was~~is was~~ higher in competitive riders (28 %) compared to pleasure riders (21 %). Five ~~percent~~% of respondents used livestock weight scales accessed through their veterinary practice or feed retailer.

Less than two ~~percent~~% of respondents reported to use body condition scoring (BCS) as a means of monitoring their horses condition~~weight~~. However, when asked specifically about the use of BCS, 46 ~~percent~~% of respondents stated that they regularly used BCS to monitor their horse's weight, with 24 ~~percent~~% stating that they did not BCS and 10 ~~percent~~% reporting to not know what BCS is. Of those that did use BCS, most (36 %) did this monthly, followed by weekly (25 %). Some reported to BCS daily (14 %) and others when they remembered (15 %).

With regards to fibre in the diet, grass hay and pasture were the most frequently used sources (Figure 4~~3~~). The mean average amount of fibre fed was calculated to be 84 ~~percent~~% with the

majority (58 %) feeding 90% or more. Less than 3% of respondents fed 40 ~~percent~~% or less those who currently own and manage horses 67 % reported that they feed some form of ad-lib forage to their horses. Generally horses at pasture or fed hay/haylage were given ad-lib forage. Bagged forage or fibre based feeds like sugar beet pulp, were generally restricted in some way. Use of the horse did not seem to affect the amount of forage fed; 63% of performance horses, 64% of pleasure horse owners and 61% of those that own both pleasure and performance horses stated that they fed forage on a purely ad-lib basis only. The majority of respondents (70 %) stated that their horses had some access to pasture. Restricted access ranged from hand grazing, limited turnout depending on workload, seasonal restrictions due to diet issues, and then split between 24 hours in the summer and just daylight hours in winter. When specifically asked about slow feeders, 36% of respondents said they used them, with haynets (67%) being the most commonly used. A large number of respondents did not use slow feeders (55%), they fed on the floor or used a hay rack/net, and 9% did not know what slow feeders were.

Concentrates were fed by the majority (87 %) of owners. Commercial premixed feed was the main concentrate used (58 %) and 20 % mix their own ration. Of all respondents, 14 % stated they did not feed any concentrate. Of all those who currently feed concentrates (4517) 29 ~~percent~~% weighed their feed or used a manufacturer's level/measure/scoop designed to measure a known amount for that specific feed.. However, 68 ~~percent~~% reported to feed by volume only via scoops, cans, or cups, whilst 3 ~~percent~~% selected the other category and reported 'a handful' or 'by eye'. This would indicate that overall a large amount of horse owners (71 %) are not weighing the amount of concentrates fed. Over 80 ~~percent~~% of owners reported to feed at least one from of supplement to their horse(s) with salt, fats/oil and n~~e~~utraceuticals being the most commonly fed (1712, 1345, 1575 respondents, respectively). Sixty ~~percent~~% reported using supplements because they think their horse(s) needs it, with 24

~~percent~~% doing so on veterinary advice. The remainder of respondents reported using based on their trainer's advice or someone else recommending the supplement.

3.3 Perceptions and knowledge

Ninety ~~percent~~% of respondents stated that nutrition was very important in a horse care plan. Respondents stated that they get their information from a variety of sources (Figure 5~~4~~) with veterinarians (54 %), magazines/reference books (46 %) and other horse owners/friends (40 %) being the most popular. The preferred methods of receiving information (Figure 6~~5~~) ~~appears to be~~ are via reading short articles online (60 %) or in print (54 %). The top five nutritional concerns were reported as hoof condition, joint longevity, colic, care of the senior horse and laminitis. Overall knowledge of nutrition was reported by most as average (median = 3). Average knowledge was also reported by most for digestive anatomy, digestive physiology, nutrition sources, weight and body condition scoring, and feeding seniors and overweight horses (Figure 7~~6~~). However, respondents appeared less knowledgeable (median = 2: below average) on feeding malnourished horses and on a number of nutrition-related disorders such as insulin resistance (IR), equine cushings disease, equine metabolic syndrome (EMS), recurrent equine rhabdomylosis (RER), equine gastric ulcer syndrome (EGUS), and recurrent airway obstruction (RAO) (Figure 8~~7~~). For other conditions: polysaccharide storage myopathy (PSM), developmental orthopaedic disease (DOD) and hyperkalaemic periodic paralysis (HPP) respondents reported to have a poor (median = 1) knowledge of these. Respondents felt most knowledgeable on colic and laminitis (median = 3: average). Of the 419 veterinarians that responded, knowledge of these areas were generally higher, either average (median = 3) or above average (median 4).

4. Discussion

4.1 Response rate and demographics

The overall response rate (RR) to the survey was 34 %, which is better than that reported for other online equine related surveys, such as Wickens *et al* [12] who reported a 20% RR and Bolwell *et al* [13] who reported a 23% RR. The higher number of female respondents concurs with that reported in other equine-related surveys [12] and also relates to the high numbers of females involved in the equine industry generally, which have been reported as over 90 ~~percent~~% [14, 15] [16]. There was a greater age spread of the respondents in this current survey compared to others [15]; however, this may be attributed to the online course and the widespread of demographics accessing the current survey. The finding that 54 ~~percent~~% of horse owners were pleasure riders is similar to the finding of the AHP survey [15] and the number of horses owned reported in this study concurs with the findings of Wickens et al. [12] who reported a median number of horses owned as 4.

Considering the geographical distribution involving respondents from over 100 countries, as well as the variation in the amount of years' experience with horses and level of education, this study demonstrates that nutrition is a subject of great interest, regardless of geographical location, level of education or time spent in the industry. Coupled with ongoing reports of inadequate feeding practices [2] and the ever increasing rates of nutritional-related disorders [2, 6, 17-19], it appears nutrition education is an area that requires concentrated information dissemination from appropriate educational sources.

3.2 Current feeding practices

It would appear that horse owners and ~~carers~~caretakers are making the main decisions relating to the nutritional management of their horses, which concurs with previous findings [15]. Consequently, it would seem pertinent to ensure that this demographic is targeted with relevant

nutritional information. In terms of monitoring their horses weight, a high proportion (over 70 %) of people reported to regularly check the weight of the horses they own or manage. Bodyweight and~~re~~ body condition checks are important to ensure that appropriate dietary rations are developed for maintaining optimal health of the horse. However, it is of concern that a substantial number reported to make these checks far less frequently than the recommended 2 to 4 weeks required to ensure that feeding programmes can be altered appropriately to prevent weight loss or gain that may lead to clinical issues such as laminitis or equine metabolic syndrome [20, 21]. Moreover, many reported to only weigh their horse(s) for medical purposes, which concurs with the findings of Johnson *et al*. [22] who reported that 100 ~~percent~~% of veterinarians and 94 ~~percent~~% of horse owners in their study stated that determining the appropriate dosage of medicines was the most important use of how much a horse weighed. The ease and convenience of weight tapes appears to lead to this being the most commonly used method to monitor weight, although many respondents reported to guess the bodyweight of their horses by eye. However, it has been found that even the most experienced horse owners/trainers routinely underestimate bodyweight [22] and that there is no correlation between accuracy of weight estimation by eye and years of experience. ~~.~~ These tapes have been regarded as inaccurate for determining weight [23, 24]; however, they do serve as a useful tool for monitoring weight changes if they are consistently placed around the horse in the same way [20]. Nevertheless, it is important to note that horse owners may need more education on how to use weight tapes correctly depending on the weigh tape selected for use as there are many available [24].~~.~~

Body condition scoring (BCS) is indicated as being one of the most useful tools for weight management [25]; however, the results of this current study indicate that horse owners do not fully understand what BCS is, with 46% of respondents stating that they used BCS on a regular basis and then stating that they used weight tapes to do this. Moreover, 10 % of respondents

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stated they did not know what BCS was. However, on closer inspection of the results, 95 respondents who did not know what BCS was, stated using eye and feel to assess their horse's condition, which is the basis of BCS [26]. ~~However, it has been found that even the most experienced horse owners/trainers routinely underestimate bodyweight~~ [22]~~ and that there is no correlation between accuracy of weight estimation by eye and years of experience.~~ Therefore, this is another area where further education of owners may~~could~~ benefit the well-being of the equine population as obesity and regional adipose tissue can indicate equine metabolic syndrome and insulin resistance [27, 28]. Moreover, greater consideration needs to be given to natural seasonal fluctuations in BCS that has been recorded in feral [29], native [30] and domesticated, leisure populations [17]. Typically, the management of domestic horses places an emphasis on keeping horses at a 'good' condition (BCS = 5/9) year round [17]. Due to the high prevalence of overweight horses and ponies reported in the UK, Canada and USA [19] owner perception of BCS may have been skewed to tend towards the higher end of the scale [17]. Owners need to be aware that horses ending the summer with an overweight or obese BCS can withstand a much lower plane of nutrition and weight loss through the winter months [17]. Obesity in horses and ponies is rising [17-19] and regular monitoring of weight, taking into account seasonal fluctuations, may help to better manage this growing population of obese animals.

The finding that all horse owners fed horses a ration consisting of over 80 ~~percent~~% fibre was reassuring, since fibre is required to maintain healthy gut function and prevent gastrointestinal disturbance [31-33]. Moreover, almost 60 ~~percent~~% of respondents fed more than 90 ~~percent~~% fibre in the diet of their horses. A small number of respondents (296: 6 %) reported to feed less than 50 ~~percent~~% fibre; however, closer inspection of the data revealed that 155 of those had stated in a previous question that they gave their horse(s) free choice/ad lib forage.

Consequently, it would appear that there is some misunderstanding around the terminology and the types of feedstuffs that are regarded as fibrous feeds. As fibre is such a critical component of the horse's diet this highlights an important area to direct future educational resources.

Although over half of respondents reported to use their horses for pleasure riding, almost 90 ~~percent~~% of people reported to feed concentrates, which is slightly lower that than the 96 % reported by Hoffman et al. [2]. This difference may be attributable to sample size (n = 6538 versus n = 67, respectively). Nevertheless, what was apparent from the findings of this current study is that many people seem unclear of what constitutes a feedstuff being regarded as a concentrate; for example, fibre replacers were commonly reported as concentrate feeds. This does not pose an issue nutritionally and indeed may satisfy an owner's need to reward the horse for work done, which was the main reason given by owners for feeding concentrates. However, it does highlight a lack of knowledge regarding nutrients in the diet, particularly with regard to excess energy and is another area where horse owners would benefit from further education. The other issue related to feed measurements, was that~~ith~~ almost 70 ~~percent~~% of respondents reported feeding by volume and not weight. A similar observation has been reported in competition horses [34] with 100 ~~percent~~% of horses, in varying disciplines, being fed by volume and not by weight. With the ever increasing rates of equine obesity and the metabolic issues [17-19]~~(Giles *et* al, 2014; Robin *et al*, 2014; Slater, 2014~~, particularly in leisure horses, that are considered a direct result of inappropriate feeding practices, this should be an area of horse owner education that is given priority.

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~~Overfeeding and nutritional mismanagement not only have implications for equine health and digestive or nutritional imbalances, but they are also the main cause of environmental loss of nutrients~~ [35]~~. Diet composition influences the amount and composition of waste~~ [36, 37]~~and~~

~~overfeeding can lead to a concentration of nutrients in manure. In particular, phosphate can~~ Dietary supplements were fed by 82 ~~percent~~% of respondents, which again concurs with the findings of Hoffman et al. [2] (84 %). The most commonly used supplements were reported as salt, joint supplements and fat/oils. Joint support was also cited as the mostly commonly used supplement by Hoffman [2], Burk [4] and by the AHP survey 2012 [15]. Similar results were reported by Martin [34] with the most common supplements used for hoof quality and joint health. The use of supplements appears to be related to a desire for improved health or performance; however, the efficacy of many supplements remains unproven [38-40]. Moreover, many respondents reported that they often fed without ~~the~~ first determining the horse's nutrient requirement needs or the potential impact of the supplement on the overall nutrient intake. As a result, certain nutrients can be over supplemented and interfere with the interaction and absorption of others [4]. Honore and Uhlinger [3] found that horses fed supplements were twice as likely to have some form of dietary excess compared to those receiving no supplements in their diet. The majority of supplements (60 %) were selected by horse owners, with 24 % consulting their veterinarian on this decision. This is an important finding as recent research has shown that veterinarians generally do not feel confident in giving sound nutritional advice and often lack the necessary training required to advi~~s~~e horse owners appropriately [5]. Therefore, it would seem pertinent to provide advice and training on the use of supplements to both horse owners and veterinarians. In contrast to other studies concerning sources of nutritional advice, Burk and Williams (2008) reported trainers and feed dealers as the most important sources. While this may be due in part to the small, targeted sample size of n=12 riders in a New Jersey Fresh 3 Day event, it nonetheless again highlights the multi-source approach to sourcing nutritional advice and gives further insight into the potential targets for nutrition information dissemination.

3.3 Perceptions and knowledge

Ninety five ~~percent~~% of respondents reported equine nutrition as very important in relation to horse care, with over 50 ~~percent~~% relying on their veterinarian for nutritional advice. As mentioned previously, veterinarians may not always be the most knowledgeable on equine nutrition. Veterinarians~~as they~~ have a wide range of species/conditions to keep up to date with and often do not have the time to keep abreast of the latest developments in equine feeding and some feel it is not important for them to do so [5]. Many veterinarians do not have a nutritional background [5]. ~~and~~ nutrition plays a very minor part in the veterinary curriculum and many new graduates have reported to have low confidence in giving nutritional advice to clients [5, 41]. Despite recommendations to improve this [42], there is little evidence to support an improvement in the area of equine nutrition [5]. After veterinarians, magazines and other horse owners/friends were most often consulted for horse care advice, which supports the findings of previous studies [2, 13, 15, 43]. For receiving nutritional information, almost 60 % of respondents stated they would prefer reading short articles online, which again concurs with the findings~~s~~ of others [14, 43]. Given that it appears that veterinarians and the internet are the most widely used support for equine nutrition advice it would seem advantageous for veterinarians to be aware of appropriate web resources in order to direct their clients to evidence-based information for guidance. Moreover, electronic newsletters have been found to be a very useful way of horse owners obtaining information in relation to nutritional advice [44] and there is evidence to suggest that horse owners modify their feeding regimes as a result of these types of communications [43]. Although the emphasis on some sources of information has changed with the introduction of the web what is clear is that horse owners obtain their advice from a number of sources, which concurs with other reports [2, 43]. This multisource approach can lead to horse owners becoming overloaded with a variety of recommendations,

many of which may not be based on scientific fact and therefore the dietary management of horses may suffer [5]. Given that veterinarians do not appear to have the necessary nutritional background or the time to stay up to date with nutritional recommendations, it would appear timely to shift the sole responsibility away from the veterinarian to other well-informed sources of nutritional advice, such as the equine nutritionist, equine scientist or extension agent. However, inIn a survey by Roberts and Murray [5], the majority of veterinarians (80 %) placed a strong emphasis on the importance of the equine nutritionist as a source of information, ~~yet they still~~but when asked about their use of an equine nutrition referall service most stated that they were reluctant to use this. ~~were reluctant to use such a referral equine nutrition service.~~ The reluctance to make use of such a valuable and readily available source of equine nutrition information warrants further investigation.

The main nutritional issues reported in this study concur with others [2, 15, 43], with hoof care, joint longevity, care of the senior horse and colic highlighted as the top areas of concern. This may be due to these conditions being some of the most common ailments seen by clinicians and it is of note that these are also the same conditions that some veterinarians are most confident discussing as reported by Roberts [5]. When responding to questions regarding level of knowledge of specific ailments/issues, many respondents reported their knowledge of this as~~this was~~ poor (median = 1: poor) for several conditions, including development orthopedic disease and polysaccharide storage myopathy. Knowledge was below average (median = 2: below average) for insulin resistance, EMS and equine gastric ulcer syndrome, which is of concern as these are conditions that are commonly seen in horses and ponies [18, 45, 46]. Conversely, respondents appeared more knowledgeable (median = 3: average)~~,~~ on other conditions such as colic and laminitis. Considering that the main areas of nutritional concern, reported in this study and others [2, 15, 43] are influenced by current feeding and management

practices, it may be time to start focusing on a more preventative approach with an emphasis on better meeting the basic nutritional needs of the horse in the domesticated setting.

Assessing the knowledge and feeding practices of a large global population of horses owners and caretakers has provided a unique insight into the nutritional management of horses across the globe. It would appear that there are a variety of methods used to create suitable feeding regimes for horses, many with no scientific basis. Many respondents had a lack of understanding of monitoring body weight and condition, and thus further education in this area is required. Many respondents reported a preference for receiving this information via short articles online and therefore online courses such as the one reported in this paper appear to be valuable for educating horse owners and caretakers.

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