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RESEARCH ARTICLE

Belief effects concerning equine supplementation for health and performance in recreational to elite equestrians and equine professionals

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Abstract

Equine supplement use is frequently recommended to address common health and performance outcomes. Supplementation is commonly accompanied by belief and placebo effects, which also drive use, but may confer anti-doping and horse welfare risks. An online survey was created to assess supplement belief effects in equestrians and related non-veterinary professions. Topics included participant demographics, and belief effects regarding supplementation for gastrointestinal, joint, exercise performance, temperament and vitamin and mineral outcomes. Participants ranked seven images of supplement forms to reflect perceived efficacy for health/performance outcomes, and reported on current or prior use of supplements for each outcome. Data were analysed by Friedman's and Kendall's W tests for supplement factors; potential differences in perceived efficacy between rider level were assessed by Kruskall Wallis tests with Dunn's post-hoc and Holm-Bonferroni corrections. Participants reported high supplement use across all reasons for supplementation (85.0 to 98.1%), with the exception of exercise performance (61.4%), which elite riders most commonly supplement for compared to other levels (P = 0.014-0.044; d = 0.58-0.99). Despite significant post-hoc differences in supplement form comparisons, Kendall's W values were *trivial* to *small* suggesting a lack of concordance in belief regarding supplements. Current and prior supplement use is high in the equestrian population, irrespective of rationale. Supplement use for joint health and exercise performance vary significantly by participant level. A joined up approach to supplementation testing is required, regardless of form, given the high prevalence of supplement use, varying rationales for supplementation and the potential for adulteration and contamination.

Keywords

supplement – placebo – belief effect – expectancy – subjective – anti-doping – equine

1 Introduction

Supplement provision for horses in both recreational and professional equestrians has been documented as near ubiquitous for approaching two decades, with reported use of up to 98% in prior research conducted in Ireland and the United States (Murray *et al.*, 2018; Swirsley *et al.*, 2017). Various rationales for supplementation are provided, such as alternatives to veterinary treatment, compensate for inadequate grazing quality and addressing performance or temperament issues, with use and rationale varying in accordance with level

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of participation and discipline (Murray *et al.*, 2018; Swirsley *et al.*, 2017; Verhaar *et al.*, 2014); concomitant use of multiple supplements is also reported. Prevalence, rationale and absence of guidance are concerning in equine supplement contexts, as there are no frameworks, regulatory standards or international consensus for safer supplementation practices, unlike human sports nutrition (e.g. (Close *et al.*, 2022; Maughan *et al.*, 2018)).

Irrespective of discipline, onus for consequences related to supplementation lay with the owner/rider of the horse as per relevant governing body regulations (Donnellan, 2020; Fragkaki *et al.*, 2017). Despite anti-doping regulations by national and international governing bodies, there is currently no mandatory third-party testing or industry benchmarking of supplements that takes place. Instead athletes are encouraged to retain samples of supplements used, and product batch numbers, alongside self-funded elective testing (BHA, 2018; FEI, 2024). Supplements can never be guaranteed as safe from an anti-doping perspective and are frequently cited as a potential source of contamination leading to inadvertent doping results (Barker, 2008; Jagim *et al.*, 2023; Sams, 1997). Likewise supplement use is a mediating factor in attitudes towards doping and has been proposed as a gateway to intentional doping behaviour (Chandler *et al.*, 2026; Hurst *et al.*, 2017; Murofushi *et al.*, 2023). Such inappropriate or illicit supplement use presents risks to athlete and horse welfare, and broader industry goals relating to social license to operate and transparency.

Appropriate supplementation has the potential eliminate deficiencies in the main diet, and to enhance horse welfare and performance when considered under both the five freedoms and five domains models and may form part of key transitions in horses' lives e.g. managing gastrointestinal symptoms when transitioning from racing to a second career (Sykes and Lovett, 2025). This suggests a need for understanding factors that influence equine supplement provision. The uniqueness of placebo effects under caregiver circumstances (Conzemius and Evans, 2012; Mills and Cracknell, 2013) should be considered; existing equine evidence suggests that alterations in caregiver behaviour, and their belief in treatment efficacy can alter behavioural and clinical outcomes (Birke *et al.*, 2011; Talbot *et al.*, 2013). With placebo effects documented in both human and animal models when assessing human-animal interactions, the preceding belief effect(s) in humans with regard to supplementation are a potential point of intervention to improve animal health, performance or welfare outcomes, and mitigate anti-doping risks. It should be recognised however, that the placebo effect cannot solve nutrient deficiencies, reinforcing the need to provide balanced forage and feed intakes, alongside appropriate supplementation.

Based upon the issues raised above, the following research aims to:

1. Assess supplement form and intended use/belief of efficacy for meeting of common equine supplement rationales, e.g. gastrointestinal health, joint health, temperament, performance and vitamin and mineral needs:
   a. Partially replicate similar work conducted in human sports nutrition supplementation (Szabo *et al.*, 2013) regarding belief effects.
   b. Assess possible effects of rider level on supplement beliefs.
2. Explore the relationship between expectancy/supplement ranking and use:
   a. Further understand the prevalence of equine supplementation across a broad participant base.

2 Materials and methods

Ethical approval for this study was provided by the WINTEC Human Ethics in Research Group (Approval code: WTLR43240925).

Participants

Participants were recruited by opportunity sampling across social media platforms, relevant lay publications and via personal and professional networks. Participants were required to be participating or have participated in equestrian or equine activities either in personal or professional settings, and be over 16 years old for the purpose of providing informed consent to participate. Incomplete responses were excluded from analyses.

Questionnaire design

The questionnaire was designed to reflect similar work carried out in human sports nutrition research (Szabo *et al.*, 2013), and comprised five demographic and five supplement belief ranking questions. The questionnaire was administered via a specialist online platform (Qualtrics, Seattle, United States), all responses were anonymous.

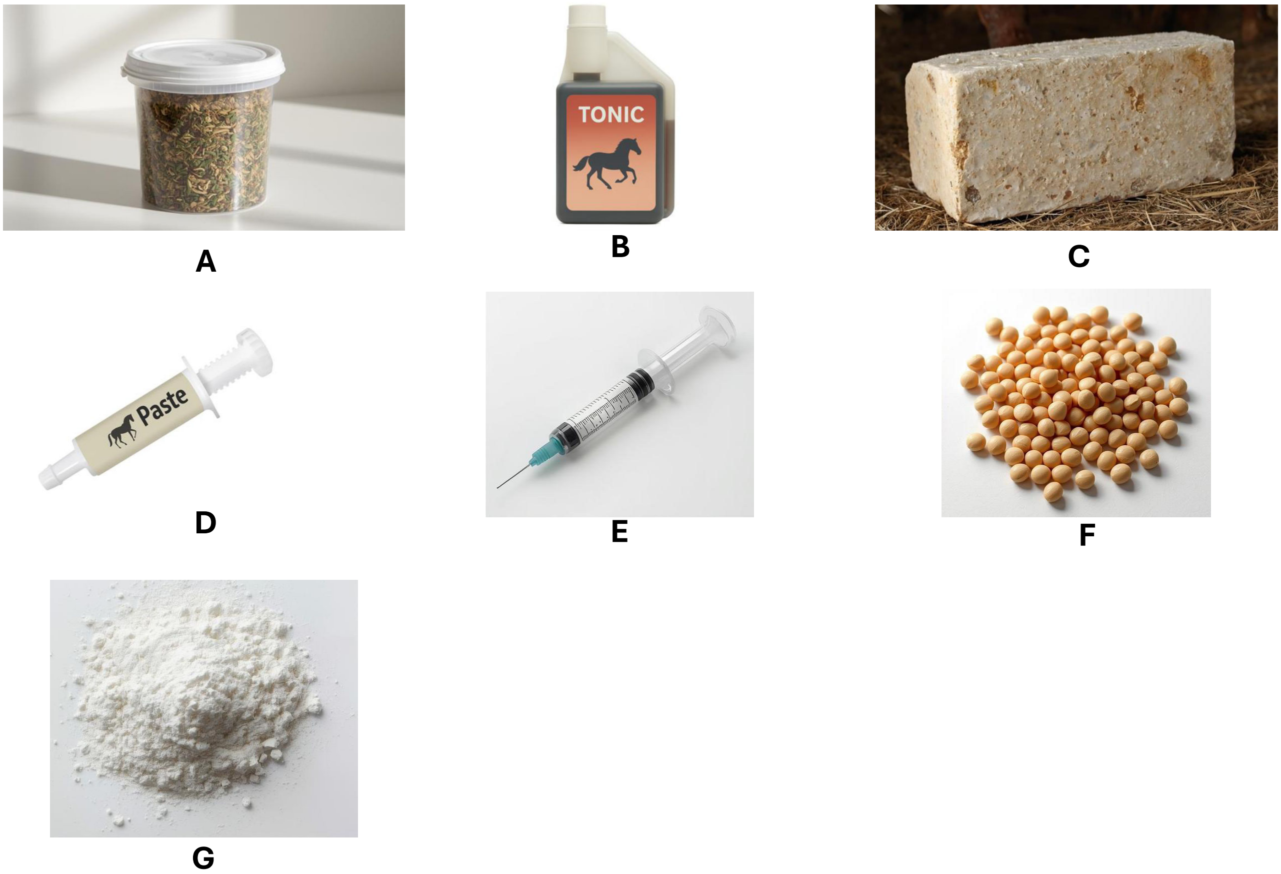

FIGURE 1 Images used throughout the questionnaire: (A) herbal blend, (B) tonic, (C) mineral block, (D) paste, (E) needle and syringe, (F) pellet, (G) powder.

Demographic information

Demographic questions were adapted from previously published research by our group and others (Best and Pearce, 2025; Keener *et al.*, 2023), and comprised participant age, gender, years of riding experience, preferred discipline(s) and level of competition which comprised recreational/ non-competitive, local, regional, national and international. International in this context refers to elite riders who have been identified and or competed for New Zealand as evidenced by selection on appropriate Equestrian Sport New Zealand squads, or equivalent. Participants could select as many disciplines as they felt their riding represented. Disciplines available for selection included: Dressage, Showjumping, Cross-country, Eventing, Western, Reining, Barrel racing, Polo/Polocrosse, Horseball, Driving, Racing (flat or jumps), Harness racing, Endurance, Vaulting, Mounted Games, General Hacking/Schooling, Para discipline, Riding for the disabled (RDA) and Pony Club. Equine professionals were also asked to participate and were categorised as equine professional (e.g. breaker, pre-trainer, trainer), related profession (e.g. coach, trainer, manager) or therapist (e.g. equine massage, RDA coach).

Supplement ranking

Following completion of demographic questions, participants placed in rank-order, on the basis of expected effectiveness – ranging from the most- to the least-effective – seven images of unbranded/fictitious equine nutrition supplements including: herbal supplement, mineral block, powder, pellet, paste (in a plastic syringe), syringe with needle, and tonic. This was completed using a drag and drop rank-order task either via participants' phones or via a computer. Images were generated by a combination of artificial intelligence sources (Canva AI, DALL·E; ChatGPT, Open AI, 2025) to ensure correct supplement form but absence of brand names and logos, and to minimise any effects of product labelling colour upon participants' responses (Figure 1). Images were presented simultaneously to participants using identical neutral plain colour backgrounds, with the exception of mineral block which was presented on a background that represented a typical equine/equestrian environment. Respondents were asked not to associate the supplements with any specific commercially known products and to pay attention only to the perceptual characteristics of supplements. A total of five rankings were performed, in a randomised counterbalanced order, separately for: (1) gastrointestinal health, (2) performance, (3) temperament, (4) joint health and (5) vitamins and minerals. No time restriction was imposed for the performance of the rankings. Participants were then asked to indicate whether they have used a supplement for that purpose in the past, using a multiple-choice response.

Statistical analyses

Sample size calculation

Sample size was calculated using the following equation:

$$n' = \frac{n}{1 + \frac{z^2 \times \hat{p}(1-\hat{p})}{\varepsilon^2 N}}$$

Where z is the z-score, ϵ is the margin of error, N is the population size and $\hat{p}$ is the population proportion. Previous research has indicated supplementation use ranging from 80%-90% of the equestrian population (Murray *et al.*, 2018; Swirsley *et al.*, 2017), so these values were used as population proportions ($\hat{p}$). Governing body documentation suggests equestrian participation of ~100,000 people in New Zealand (Smartt and Chalmers, 2009), so this value was used as the population size (N). Confidence intervals were set at 95%, margin of error at 5%. This provided a sample size of between 139 and 243 for supplementation prevalence of 90 and 80%, respectively.

Data storage and analysis

The data were stored securely on the online platform and then verified for accuracy and completeness, before export to Excel files. These data were imported into JASP statistical software (version 0.95.3, University of Amsterdam, the Netherlands) for analyses. All variables violated the assumption of sphericity, hence all data were analysed using a non-parametric approach. Rank order and use outcomes are reported as Friedman test results, with accompanying Kendall's W as an assessment of concordance. Significant Conover's post-hoc tests ($P < 0.05$) are reported descriptively, with Holm corrected exact p values for each pairwise comparison and Cohen's d values for between supplement form comparisons in Supplementary materials. Following descriptive statistics and distribution checks, Friedman's and Kendall's W tests were performed for data on supplement factors (GI, Joint, Performance, Temperament, Vitamin and Mineral needs). Kendall's W was interpreted as trivial <0.1, weak >0.1, moderate >0.3, and strong >0.6. This test is an extension of the Friedman Test (c 2) that assesses the concordance (W, or the Kendall's Coefficient of Concordance) in ranking of supplement forms. Association between participant level of competition and use of a supplements was assessed via Spearman's rho correlations, following transformation of descriptors to numerical values, and interpreted as small ≥0.2 to 0.49, moderate ≥0.5 to 0.79, or large ≥0.8. This was not repeated for equine professions. Potential differences in perceived efficacy between level were assessed by Kruskall Wallis tests with Dunn's post-hoc and Holm-Bonferroni corrections; Cohen's d values were also calculated to assess the standardised magnitude of between level mean differences, if any. Effects of participant sex were not assessed due to stark differences between sample sizes in each group. Statistical significance was set at 0.05 for all uncorrected tests.

3 Results

Participant demographics

The majority of participants were female (n = 273; 96.5%), with males (n = 10; 3.5%) a minority of equestrians and one respondent preferring not to self-report their gender. Participants had a mean riding age of 29.5 ± 13.3 years. Participants most frequently reported being between the ages of 40-49 (n = 82; 28.9%), followed by 30-39 (n = 70; 24.7%); additional information regarding participant age can be found in Figure 2A. Most participants reported being recreational/non-competitive riders (n = 78; 27.1%), with numbers decreasing as competition level increased – mirroring a performance pyramid (Local = 53; 18.4%, Regional = 47; 16.3%, National, International = 19; 6.6%); some respondents were also equine professionals e.g. trainer/pre-trainer (13; 4.5%), related professionals e.g. coaches (13; 4.5%) and equine therapist (1; 0.35%). Disciplines respondents participated in are shown in Figure 2C; count values exceed respondent sample size due to participants being able to select more than one discipline.

Supplement use and rank order outcomes

Supplementation for GI health was very high with 97.1% of respondents reporting either currently feeding or having previously fed to support GI health. Similarly, Vitamin and Mineral supplementation was practically ubiquitous, with 98.1% reporting either current or prior use. Supplementation for temperament and joint health was also high, with 85.0 and 86.5% reporting current or prior use, respectively. Finally, supplementation for

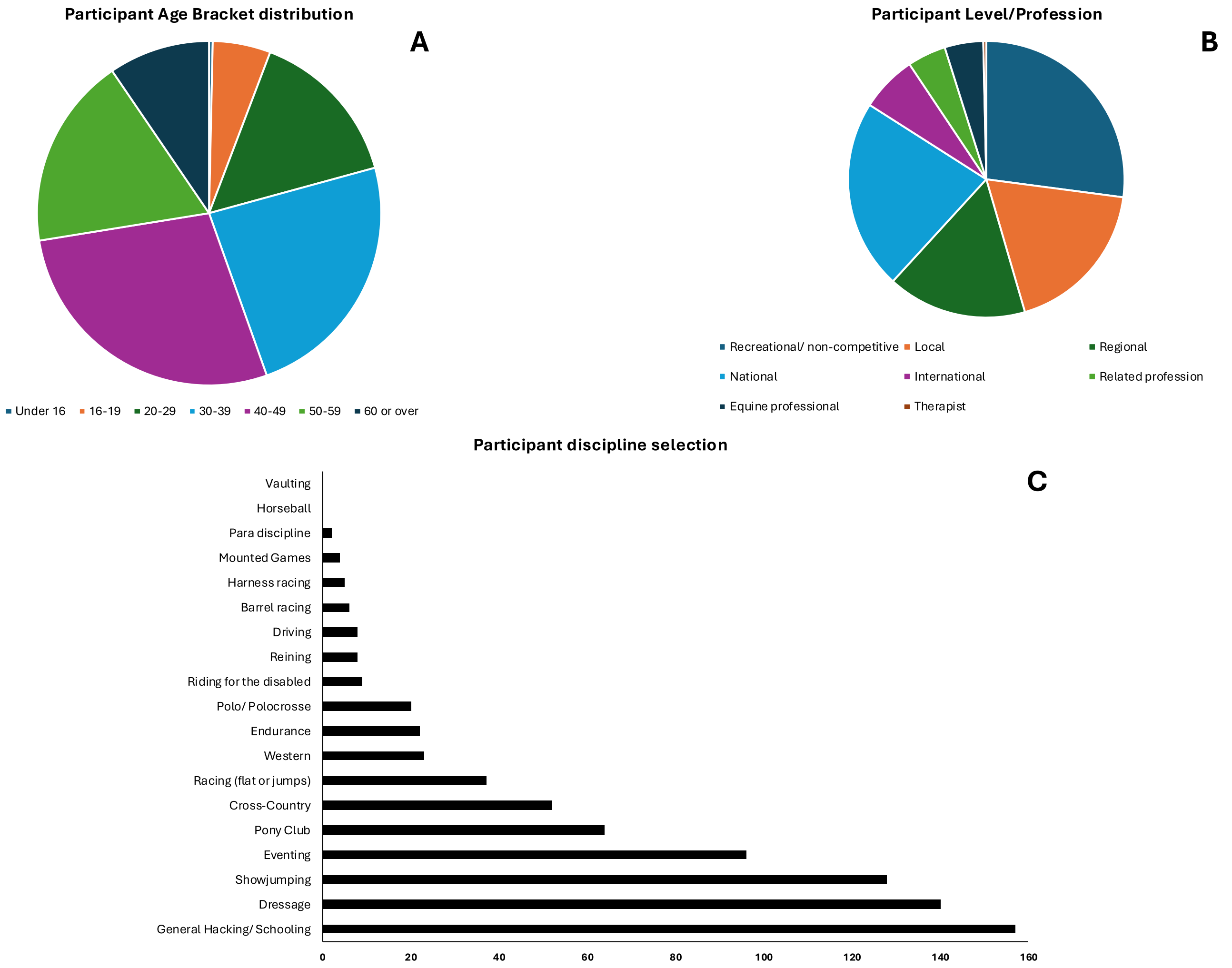

FIGURE 2 Respondent age (A), level (B), and discipline participation (C). Please note that participants could select >1 discipline.

exercise performance was markedly lower with 61.40% reporting current or prior use; interestingly this had both the highest percentage of respondents reporting either no supplementation but aware (29.8%) and not being aware that supplementation was available (4.1%).

Supplement belief for gastrointestinal symptoms showed significant effects of supplement form χ^2_F (6) = 76.14, P < 0.001; Kendall's W = 0.062. The lowest ranked, indicating most belief, supplement was tonic (3.45 ± 1.70), and the highest ranked, indicating least belief, was syringe (4.68 ± 2.33). Conover's test results showed that for belief concerning gastrointestinal symptoms herbal blend differed significantly compared to tonic, mineral block, paste and syringe; tonic differed significantly to syringe, mineral block and pellet; mineral block differed significantly to paste and powder, paste differed significantly to syringe and pellet, and syringe and powder differed significantly to pellet.

Supplement belief for joint health showed significant effects of supplement form χ^2_F (6) = 112.50, P < 0.001; Kendall's W = 0.101. The lowest ranked supplement was syringe (3.24 ± 2.56), and the highest ranked was mineral block (5.29 ± 2.24). Conover's test results showed that for belief concerning joint health herbal blend differed significantly to mineral block, syringe and powder; tonic differed significantly to mineral block and pellet; mineral block differed significantly to all supplement forms; paste and syringe both differed significantly to pellet, and pellet differed significantly to powder.

Supplement belief for supporting exercise performance showed significant effects of supplement form χ^2_F (6) = 73.96, P < 0.001; Kendall's W = 0.072. The lowest ranked supplement was tonic (3.40 ± 1.62), and the highest ranked was mineral block (4.85 ± 2.21). Conover's test results for belief concerning exercise performance showed that herbal blend differed significantly to tonic, paste, and powder; tonic differed significantly to mineral block and syringe; mineral block differed significantly to paste, pellet and powder, and syringe differed significantly to paste, pellet and powder.

Supplement belief for temperament showed significant effects of supplement form χ^2_F (6) = 124.0, P <

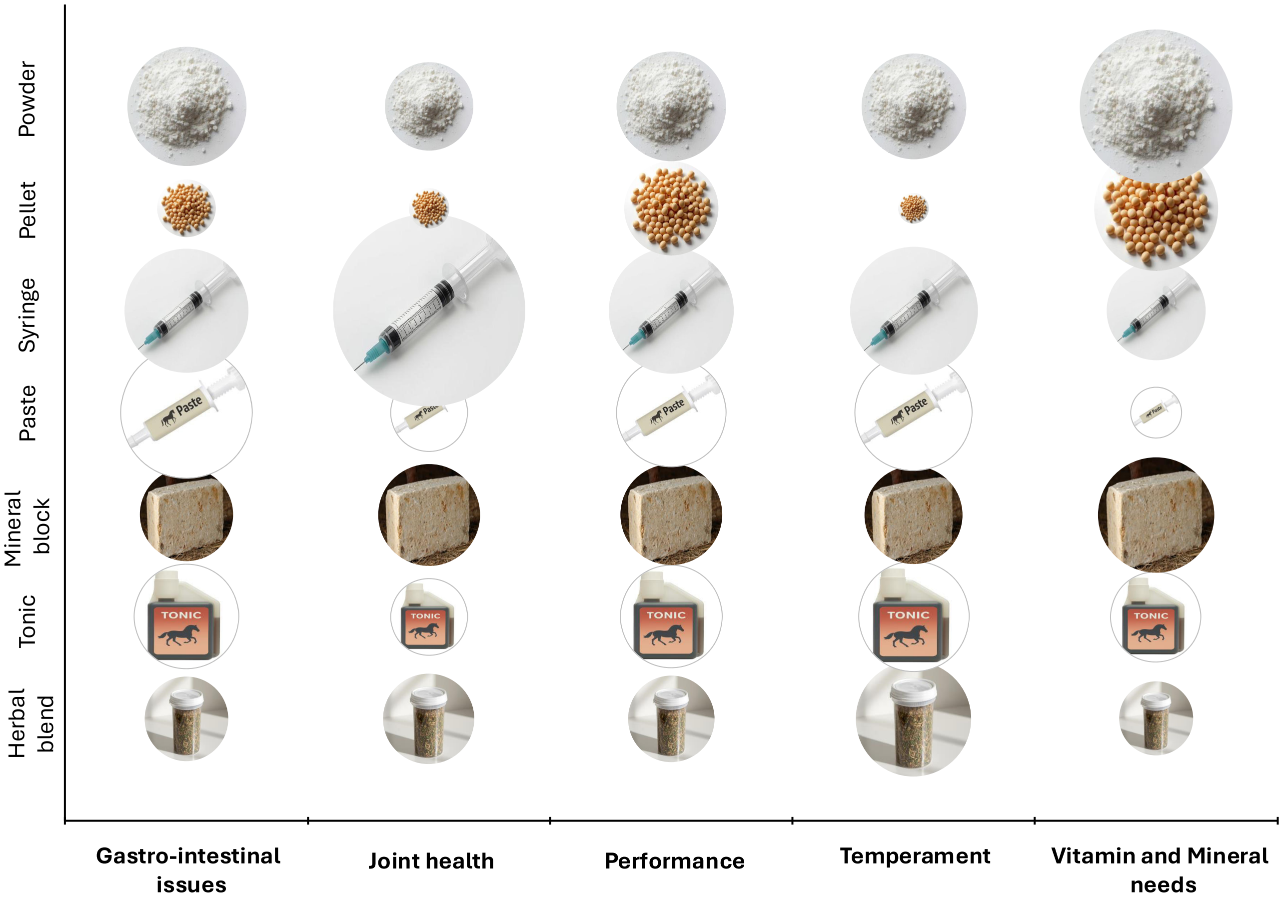

FIGURE 3 Bubble diagram showing supplement ranking as first choice relative to percentage vote obtained for each of the assessed equine health outcomes. A larger bubble represents a higher percentage of respondents selecting that supplement form as first choice for that outcome.

0.001; Kendall's W = 0.129. The lowest ranked supplement was tonic (3.11 ± 1.65), and the highest ranked was mineral block (5.20 ± 2.15). Conover's test results for belief concerning temperament showed that herbal blend differed significantly to mineral block, syringe and pellet; tonic differed significantly to mineral block, syringe and pellet; mineral block differed to paste, pellet and powder; paste differed significantly to syringe and pellet, and syringe and pellet differed significantly to powder.

Supplement belief for vitamin and mineral needs showed significant effects of supplement form χ^2_F (6) = 121.8, $P < 0.001$; Kendall's W = 0.145. The lowest ranked supplement was powder (2.99 ± 2.00), and the highest ranked was syringe (5.51 ± 2.12). Conover's test results for belief concerning meeting vitamin and mineral needs showed that herbal blend differed significantly to syringe, pellet and powder; tonic differed significantly to paste, syringe and powder; mineral block differed significantly to syringe and powder; paste differed to syringe, pellet and powder, similarly syringe differed significantly to pellet and powder.

Figure 3 shows the percentage of respondents that ranked a particular supplement form first, per characteristic. Figure 4 shows descriptive statistics and significant between supplement form differences for each characteristic assessed. Individual ranking values of each supplement form, per characteristic are provided in supplementary materials.

Despite significant effects of supplement form on belief for each condition/outcome and subsequent significant pairwise comparisons, concordance levels as per Kendall's W values range from trivial to weak indicating a high degree of variability/ low agreement in supplement ranking amongst those surveyed.

Multinomial testing showed significant effects between observed and expected count values for supplement use response distributions, across all health/performance outcomes; chi-squared values, significance and observed and expected count values are shown in Table 1.

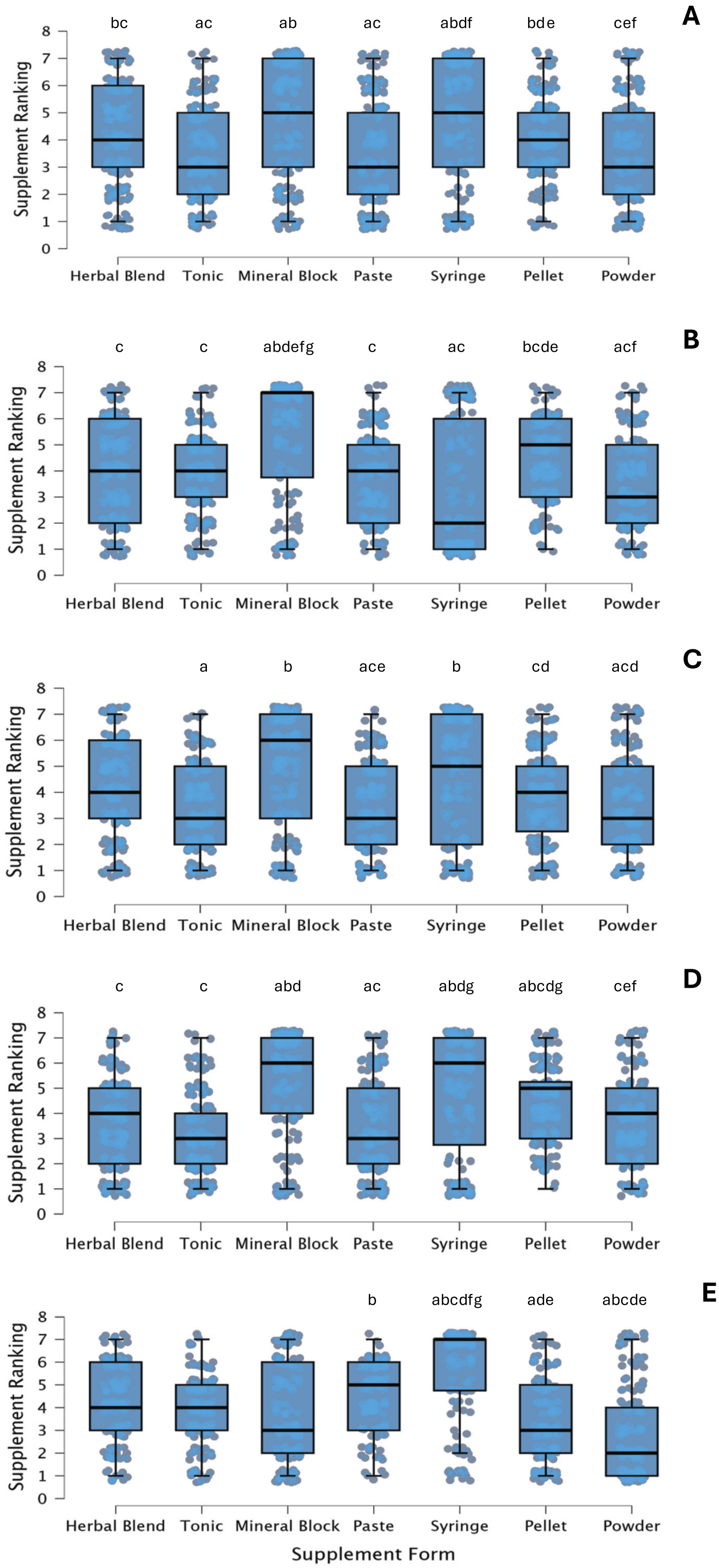

FIGURE 4 Supplement rankings between supplement forms across each assessed use/condition: Gastro-intestinal (A), Joint (B), Performance (C), Temperament (D) and Vitamin and Mineral needs (E). Lowercase letters denote significant difference to herbal blend (a), tonic (b), mineral block (c), paste (d), syringe (e), pellet (f) and powder (g).

TABLE 1 Multinomial test results for supplementation rationales[1]

Rationale	Chi squared	P-value	Response	Observed (95% CI)	Expected
Gastro-intestinal	320.8	$3.47 * 10^{-68}$	Yes, currently feeding	129 (114 to 142)	41
			Yes, previously fed	70 (57 to 84)	41
			Unsure	1 (0 to 6)	41
			No, aware supplements available	4 (1 to 10)	41
			No, not aware supplements are available	1 (0 to 6)	41
Joint health	189.2	$7.92 * 10^{-40}$	Yes, currently feeding	96 (82 to 110)	37
			Yes, previously fed	64 (51 to 78)	37
			Unsure	0 (0 to 4)	37
			No, aware supplements available	23 (15 to 33)	37
			No, not aware supplements are available	2 (0 to 7)	37
Exercise performance	70.26	$2.00 * 10^{-14}$	Yes, currently feeding	49 (38 to 62)	34
			Yes, previously fed	56 (44 to 69)	34
			Unsure	8 (3 to 15)	34
			No, aware supplements available	51 (39 to 64)	34
			No, not aware supplements are available	7 (3 to 14)	34
Temperament	144.3	$3.47 * 10^{-30}$	Yes, currently feeding	67 (55 to 80)	32
			Yes, previously fed	69 (57 to 82)	32
			Unsure	1 (0 to 5)	32
			No, aware supplements available	22 (12 to 32)	32
			No, not aware supplements are available	1 (0 to 5)	32
Vitamin and mineral needs	338.7	$4.82 * 10^{-72}$	Yes, currently feeding	120 (108 to 130)	31
			Yes, previously fed	34 (24 to 45)	31
			Unsure	0 (0 to 4)	31
			No, aware supplements available	3 (1 to 9)	31
			No, not aware supplements are available	0 (0 to 4)	31

1 All tests have 4 degrees of freedom. All count values are reported to the nearest whole number.

Correlations

Significant small correlations were found between participants' competition level and supplement use for gastrointestinal (0.162; 95% confidence interval 0.020 to 0.298; $P = 0.026$), joint (0.233; 95% CI 0.086 to 0.371; $P = 0.002$), and exercise performance (0.297; 95% CI 0.147 to 0.433; $P = 0.0002$). Significant small correlations were also found between supplement use reasons (Supplementary Table S6; P-values ranging from <0.001 to <0.05; r values from 0.225 to 0.346), for all possible pairwise comparisons except joint health and temperament, and exercise performance and vitamin and mineral needs.

Between group effects

Kruskal-Wallis tests showed significant effects of rider level in supplementation for joint health (H(4) = 11.67; $P = 0.020$) and exercise performance (H(4) = 17.68; $P = 0.001$). Post hoc tests showed no significant differences between levels for joint health, however small to moderate standardised mean differences in use were noted when national and international were compared to other levels ($d = 0.294$ to 0.799). Dunn's post hoc tests showed significantly greater use of supplementation for exercise performance in international riders compared to recreational ($P_{Holm} = 0.014$; $d = 0.992$), local ($P_{Holm} = 0.029$; $d = 0.954$) and regional ($P_{Holm} = 0.032$; $d = 0.972$) riders, and in national compared to recreational riders ($P_{Holm} = 0.044$; $d = 0.581$).

4 Discussion

This study aimed to assess supplement form and intended use/belief of efficacy for meeting of common equine supplement rationales by partially replicating previous research in human sports nutrition supplementation (Szabo *et al.*, 2013). We found that there is high supplement use across all reasons for supplementation (85.0 to 98.1%), with the exception of exercise performance (61.4%), which is most commonly supplemented for by elite riders.

Despite significant post-hoc differences in supplement form comparisons (Figure 4; Supplementary Tables S1 to S5), Kendall's W values were all *trivial* to *small* suggesting that there is a high-degree of variability or a lack of concordance in belief regarding supplements.

Many participants reported feeding supplements for multiple issues concomitantly, irrespective of level of participation. This 'polypharmacy' highlights a number of key risk factors for horses, namely the potential for interaction effects between supplements, or possible toxicity particularly if elevated levels of substances that are slow to metabolise occurs; likewise some competitive horses may be at risk of attaining anti-doping threshold values, either through similar cumulative effects or through increased exposure to possible contaminants simply through a higher incidence of supplementation i.e. the more one supplements (either through frequency or range of supplements used), the greater the chances of contamination.

What does this mean for horse welfare?

The high prevalence of current or former supplementation, irrespective of condition, clearly suggests that people are aware of issues that have potential horse health and welfare implications, but are not necessarily seeking professional or veterinary advice to address these issues, with the possible exception of joint health given the highest ranked supplement form. Similar findings are noted in equestrians and racing staff who more frequently use over the counter medications to manage pain and occupational injury, sometimes on a daily basis, than seeking professional advice regarding rehabilitation and or taking time off work; prevalence increased in accordance with rider level (Davies *et al.*, 2022; Lewis *et al.*, 2023; Lewis and Kennerley, 2017).

Taken together this suggests that there may be a culture in equestrian sports, irrespective of horse/human condition, that providing 'care' in a timely and accessible manner is preferred to seeking professional advice. Alternatively, marketing of supplements as meeting a range of needs as opposed to addressing single (clinical) issues may also partially explain this phenomenon (Garthe and Maughan, 2018), likely assisted by social media and influencer effects as per human supplement behaviours (Catalani *et al.*, 2021; Wang, 2025), and incidences within equestrian influencers (Radmann *et al.*, 2021).

Joint health and exercise performance are supplemented for at higher competitive levels to a significantly greater extent than in lower level competition or recreational riders, this is likely indicative of horses' greater training and competition loads (Verhaar *et al.*, 2014). To better understand this relationship, we suggest education and investigation into equine supplement periodisation at national and international levels, alongside quantification of horses' training loads (and possibly competitive results) (Verhaar *et al.*, 2014). This targeted approach to supplementation may better support horses' welfare and performance, and minimise inadvertent doping risk by reducing polypharmacy and improving supplement traceability.

Similarly we need to consider why reported supplementation for gastrointestinal health is so high across all levels of rider (and disciplines). This may be due to a widespread belief that the majority of behavioural or performance issues stem from equine gastric ulcers (Sykes and Lovett, 2025), an issue commonly reported in both standardbreds and thoroughbreds retiring from racing (Begg and O'Sullivan, 2003). Whilst not directly captured in the survey retired racehorses are expected to make up a relatively large proportion of respondents' horses given the increased attention being paid to rehoming racehorses into other disciplines (Hockenhull *et al.*, 2024); this may also contribute to the relatively high prevalence of current or prior supplementation for joint health (86.5%). Unfortunately, we did not capture horse age so this cannot be attributed to either an age or exercise-induced decline in joint health.

It is unclear whether vitamin and mineral supplementation occurs as part of other supplements or is included in 'complete' hard or fortified fibre feeds; the high belief rankings for pellet and powdered supplement forms and current or former use responses for vitamin and mineral needs suggests separate supplementation is highly likely, potentially increasing horses' risk of contamination or toxicity. Vitamin and mineral requirements are genuine dietary and welfare needs for horses, intakes should align with recommended daily intakes and diets should be designed in accordance with forage intakes, living conditions and other feeding strategies. This is not to say that vitamin and mineral supplementation isn't warranted in some cases, and indeed may be encouraged e.g. Selenium to make up pasture shortfalls in New Zealand (Grace *et al.*, 2002; Hoskin and Gee, 2004), or magnesium for prevention of ryegrass staggers (Verhaar *et al.*, 2014). In these system level instances we encourage feed and forage testing, and soil testing followed by proper consultation with a qualified equine nutritionist, vet or agronomist as appropriate.

What does this mean to the industry?

We studied a breadth of supplement forms to try and capture differing mechanisms of action, as well as to allow for any regional variation in supplement type (belief and or preference/availability) for the same condition(s).

Whilst the present study explicitly focusses upon supplement forms and associated beliefs (and use), the line between a supplement and medication appears blurred due to high ranking of syringe, especially with respect to joint health (48.1% ranked first) and to a lesser extent for exercise performance (20.5% respondents ranked first) and temperament (21.3% ranked first; Figure 3). The role of veterinary involvement in equine nutrition and supplementation decisions by horse owners is well established, despite a self-reported lack of confidence in nutritional knowledge within the veterinary field (Pratt-Phillips and Liburt, 2024; Roberts and Murray, 2014). The importance of vets to horse owners is especially evident in colic scenarios, where they are considered the first point of contact in 92% of cases (Elte *et al.*, 2024). More widespread access and use of qualified equine nutritionists is encouraged to decrease the burden placed upon the veterinary profession (Pratt-Phillips and Liburt, 2024; Roberts and Murray, 2014), but given the breadth of health issues equine caregivers are currently or have previously supplemented for, we suggest that some responsibility for duty of care and knowledge transfer should fall to feed and supplement manufacturers too e.g. manufacturer of supplements that aim to address targeted issues, contain appropriate active ingredients in doses that facilitate optimal and safe feeding. Testing for common contaminants/ atypical results at hard and fibre feed levels, and banned substances/ adverse analytical findings at the supplement level should also be encouraged if the equestrian community is to have access to a trustworthy nutrition industry.

It remains to be seen whether our results would change in a concentrated sample of participants competing at a high level. Not simply due to the higher levels of supplementation reported in our data, but because of the ethical challenges alluded to in previous reviews of high-level equestrian sport (Campbell, 2013), access to support personnel (Best and Pearce, 2025) and the potential for interactions between supplement use/beliefs and doping (Garthe and Maughan, 2018). Further work is required in this group to elucidate possible differences or nuance in a relatively small but celebrated group of equestrians. Low elite participation in this study may be attributed to reluctance to give away real or perceived competitive advantage, or a reluctance to scrutinise their own supplementation provision in a manner that may challenge thoughts regarding supplement efficacy (and safety). A final consideration within the New Zealand context is that elite athletes may have been participating in Northern hemisphere competitive campaigns at the time the research was conducted.

Ultimately, there is a need and our data provide support for a wider supplement framework within equine feed settings, acknowledging varying degrees of accountability of equine care givers, veterinary personnel and feed and supplement manufacturers.

Limitations

The questionnaire did not include any baseline knowledge test(s) or additional text-based knowledge/validation options for respondents. This would have led to a greater understanding of baseline supplement knowledge, alongside belief, and may have allowed us to develop a supplement knowledge score which could be correlated to use and belief ranking across each category. The reason for knowledge exclusion was to specifically assess supplement beliefs in isolation, and avoid any false characterisation of supplement use (e.g. high knowledge/low knowledge) which may potentially further blur the line between supplementation and medication in equine supplement users. Similarly, we did not ask whether participants had calculated their horses' dietary intake(s). This would have provided further insight into supplementation knowledge and motivations within the participant group(s). We recommended that future work include this as a demographic question, even as a simple binary yes/no response. A related limitation, and possible source of bias, is that we may have inadvertently captured responses from those who are 'supplement believers'; or at least those who are particularly interested in supplementation especially for the health and performance outcomes assessed in the present study. This is somewhat countered by a small pool of respondents who were either unaware of or had not fed supplements for certain reasons, regardless of supplement form.

Several vets raised that they felt they could not complete the survey due to lack of knowledge regarding to active ingredients, within the fictitious supplements. This suggests that in order to best capture veterinary perspectives, the survey needs to be repeated with appropriate wording to reflect equal dosing of active ingredients. However, we are somewhat reluctant to do so as this then leads the survey to become a test of pharmacokinetic, clinical and research knowledge as opposed to an assessment of belief effects. Instead, we suggest a case study approach which perhaps reflects clinical practice e.g. 'Assuming active ingredients are the same, which of the following are you most/least likely to recommend if a horse were presenting with gastrointestinal symptoms? Please rank accordingly (1-7)'.

The user interface of ranking question styles for those participating on mobile phones was also reported as challenging by some participants. Neither drag and drop nor 'radio buttons' seem entirely user friendly, but are potentially better for accessibility than text based options that would have further increased participant burden and required greater participant literacy than an image based approach. It is unclear if this affected those who completed the survey, but is likely a reason why we experienced a high degree of attrition following the demographic questions in the total participant pool. Finally, the survey employed a forced choice as a result of ranking, which may lead to different results/outcomes compared to if supplements could be ranked equally on a Likert scale (Szabo *et al.*, 2013).

5 Conclusions

Current and prior supplement use is high in the equestrian population, irrespective of supplementation purpose. Supplement use for joint health and exercise performance vary significantly by participant level, especially when international riders are compared to other levels. There is variability within supplement form belief across different conditions with small to moderate differences noted as per pairwise comparisons, however variability in belief of efficacy between participants likely exceeds agreement, as evidenced by a low level of concordance. A joined up approach to supplementation testing is required, regardless of form, given the high prevalence of supplement use, varying rationales for supplement and the potential for adulteration and contamination. Possible calls for no needles policies beyond current governing body requirements are not necessarily supported due to the relatively low ranking of syringes beyond joint supplementation (Figure 4).

Supplementary materials

Data is available on https://doi.org/10.1163/17552559-bja10088 under Supplementary Materials.

Figure S1. Individual data plots for Supplement rankings between supplement forms across each assessed use/condition: gastro-intestinal, joint, performance, temperament and vitamin and mineral needs.

Table S1. Conover's test results for between supplement form comparisons for gastrointestinal issues.

Table S2. Conover's test results for between supplement form comparisons for joint issues.

Table S3. Conover's test results for between supplement form comparisons for exercise performance.

Table S4. Conover's test results for between supplement form comparisons for temperament.

Table S5. Conover's test results for between supplement form comparisons for vitamin and mineral needs.

Table S6. Correlation matrix for supplement use between conditions across all levels.

Authors' contributions

Conceptualization, RB, AD, AB and JP; methodology, RB and AD; validation, RB, AD and AB; formal analysis, RB; resources, RB, AD and AB; writing-original draft preparation, RB and JP; writing-review and editing, RB, JP and JW; visualization, RB, JP and JW; project administration, RB; funding acquisition, RB. All authors have read and agreed to the published version of the manuscript.

Conflict of interest

The authors declare no conflicts of interest.

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