

Nutritional Content of Five Equine Nutritional Supplements Relative to a 500-kg Working Horse

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The nutritional content of supplement products fed to horses may contain widely ranging amounts of nutrients compared with established National Research Council (NRC) requirements for horses. This paper documents a wide range of individual nutrient dosages relative to the NRC requirements based on label information of five equine nutritional supplements. Some nutrient levels are in excess of NRC requirements for individual nutrients, whereas others are far below NRC. These variations were found in each of the five supplements studied. Practitioners may use this information to recommend whether or not a particular supplement is indicated. Authors' addresses: PO Box 4768, Sunland, CA 91401-4768 (Ramey); and 967 Haas Road, Weiser, ID 83672 (Duren); e-mail: ponydoc@pacbell.net. *Corresponding author. © 2011 AAEP.

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1. Introduction

The supplement business in the United States is a hugely profitable enterprise. In 2006, it was estimated that the human dietary supplement industry in the United States directly produced \$22.5 billion dollars, with another \$38 billion dollars produced through indirect and induced effects.¹ Whereas dietary supplementation appears to be widespread in the equine industry, specific data on the economic impact was not available.

Although the selection of various supplement products may be largely driven by the horse-owning public and direct to consumer advertising, equine practitioners may sometimes be asked for advice on the best supplement to feed horses. The NRC guidelines may be used to compare equine nutritional requirements with labeled content of a supplement.

2. Materials and Methods

The daily requirements for 20 nutrients were obtained from a computer program developed from equations and other data presented in the sixth revised edition of the *Nutrient Requirement of Horses* (National Research Council [NRC]).² The program performs some of the procedures necessary for the calculation of the requirements in the NRC.

The program requires that the user give specific information (for example, the current body weight or the month of gestation for pregnant mares). For exercising horses, the user must choose from four levels of work load. The program calculates the requirements for various nutrients in amounts per day measured in milligrams or international units (for vitamins). For the purposes of this study, a 500-kg horse in light exercise was used to make the

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Orig. Op.	OPERATOR:	Session	PROOF:	PE's:	AA's:	COMMENTS	ARTNO:
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Table 1. Nutrient Content of Supplements

ING	NRC	PP	%NRC	D	%NRC	GV	%NRC	VP	%NRC	VFA	%NRC
Lysin	30 g	1122 mg	3.74	540 mg	1.8	1500 mg	5.0	283 mg	0.94	55.90 mg	0.18
Ca	30 g	396 mg	1.32	2.83 g	9.4	2495 mg	8.31	1560 mg	5.2	680.4 mg	2.26
P	18 g	1060 mg	5.89	1.98 g	11	990 mg	5.5	850 mg	4.7	425.26 mg	2.36
Na	13.9 g	130 mg	0.93	249 mg	1.8	Not listed	?	?	?	?	?
Cl	46.6 g	250 mg	0.54	N/A	?	Not listed	?	?	?	?	?
K	28.5 g	1320 mg	4.6	540 mg	1.9	1245 mg	4.37	482 mg	1.69	198.46 mg	0.69
Mg	9.5 g	540 mg	5.6	425 mg	4.47	850 mg	8.94	25 mg	0.26	283.5 mg	2.98
S	15 g	475.2 mg	3.1	522 mg	3.48	227 mg	1.51	?	?	340 mg	2.26
Co	0.5 mg	792 µg	158.4	2.84 mg	568.0	1 mg	200	0.1 mg	20.0	1.24 mg	248.0
Cu	100 mg	13.2 mg	13.2	16.25 mg	16.25	75 mg	75.0	8 mg	8.0	22 mg	22.0
I	3.5 mg	660 µg	18.85	6.25 mg	178.57	1 mg	35.0	2 mg	57.14	2 mg	57.0
Fe	400 mg	264 mg	66.00	437.5 mg	109.37	250 mg	62.5	200 mg	50.0	212 mg	53.0
Mn	400 mg	132 mg	33.0	61.36 mg	15.34	148 mg	37.0	20 mg	50.0	283.5 mg	70.87
Zn	400 mg	132 mg	33.0	137 mg	34.25	200 mg	50.0	40 mg	10.0	72 mg	18.0
Se	1 mg	0.79 mg	79.0	2.27 mg	227.0	1 mg	100.0	20 µg	2.0	0.8 mg	80.0
Vit A	22,500 IU	7500 IU	33.33	59,375 IU	263.88	22,500 IU	100.0	50,000 IU	222.22	12,500 IU	55.55
Vit D	3300 IU	1500 IU	45.45	9375 IU	284.09	32,660 IU	989.69	5000 IU	151.51	2500 IU	75.75
Vit E	800 IU	740 IU	92.5	86.87 IU	10.85	500 IU	62.5	50 IU	6.25	500 IU	62.5
Thiam B1	30 mg	Not listed	?	13.75 mg	45.83	2150 µg	7.1	?	?	28.12 mg	93.73
Ribo B2	20 mg	15.4	77.0	175 mg	875.00	50 mg	250.0	?	?	11.88 mg	59.40

ING, ingredient; NRC, absolute requirements (500-kg horse at light work); %NRC, percent of NRC values supplied by supplement; PP, Platinum Performance; D, Dynamite; GV, Grand Meadows Grand-Vite; VP, Farnum Vita-Plus; VFA, Vita-Flex Accel.

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calculations. The requirements for each of 20 nutrients were tabulated (Tables 1–4).

The guaranteed analysis of various equine nutritional products intended to be complete supplements was then analyzed on a per dose basis appropriate for a 500-kg horse according to the manufacturer’s label. When reported in amounts of parts per million (ppm) or percentage, we converted those amounts to milligram per dose (ppm is milligrams per kilogram). No attempt was made to an-

alyze the supplement products for content; rather, it was assumed that the label contents were accurate. The nutrients provided by a daily dose of the supplement were compared with established NRC requirements, with the results tabulated as percent of NRC requirements.

To give an idea of the additional effect of adding supplements to a horse’s diet, two sample diets were calculated for the model horse and made in consideration of the fact that supplements are

Table 2. Nutrient Content of Sample Diets Without Added Supplementation

ING	NRC	0.45 kg (1#) oats	%NRC	Legume (7.03 kg)	%NRC	Grass (9.1 kg)	%NRC
Lysine	30 g	0.4% = 1.81 g	6.03	0.87% = 61.1 g	203.66	0.25% = 22.75 g	75.85
Ca	30 g	0.13% = 0.589 g	1.9	1.535% = 107.55 g	358.5	0.513% = 46.68 g	155.6
P	18 g	0.41% = 1.86 g	10.33	0.275% = 19.33 g	107.38	0.24% = 21.84 g	121.33
Na	13.9 g	0.03% = 0.14 g	0.1	0.02% = 1.406 g	10.11	0.02% = 1.82	13.09
Cl	46.6 g	0.14% = 0.63 g	0.3	0.48% = 33.74 g	72.4	0.616% = 56.05 g	120.27
K	28.5 g	0.54% = 2.45 g	8.59	2.384% = 167.5 g	587.71	1.877% = 170.80 g	599.29
Mg	9.5 g	0.15% = 0.68 g	7.15	0.307% = 21.58 g	227.15	0.203% = 18.473 g	194.45
S	15 g	0.17% = 0.77 g	5.13	0.271% = 19.05 g	127	0.173% = 15.74 g	104.93
Co	0.5 mg	0.423 ppm = 0.19 mg	38	0.65 ppm = 4.57 mg	914	0.65 ppm = 5.91 mg	1182
Cu	100 mg	7.409 ppm = 3.37 mg	3.37	8.99 ppm = 63.19 mg	63.19	8.916 ppm = 81.13 mg	81.13
I	3.5 mg	0.1 ppm = 0.045 mg	1.3	0.15 mg/kg = 1.05 mg	30	0.15 ppm = 1.365 mg	39
Fe	400 mg	123.79 ppm = 56.27 mg	14.06	372.795 ppm = 2,620.74 mg	655.18	183.285 ppm = 1667.89 mg	416.97
Mn	400 mg	53.664 ppm = 24.39 mg	6.09	36.201 ppm = 254.49 mg	63.62	73.306 ppm = 667.08 mg	166.77
Zn	400 mg	35.419 ppm = 16.09 mg	4.02	28.25 ppm = 198.59 mg	49.64	25 ppm = 227.5 mg	56.87
Se	1 mg	0.2 ppm = 0.09 mg	9	0.2 mg/kg = 1.406 mg	140.6	0.06 mg/kg = 0.546 mg	54.6
Vit A	22,500 IU	44 IU/kg = 20 IU/lb	0	41,900 IU/kg = 294,557 IU	1309.14	8000 IU/kg = 72,800 IU	323.55
Vit D	3300 IU	0 IU/kg	0	2000 IU/kg = 14,060 IU	426.06	2000 IU/kg = 18,200 IU	551.51
Vit E	800 IU	20 IU/kg = 9.09 IU/lb	1.1	40 IU/kg = 281.2 IU	35.15	30 IU/kg = 273 IU	34.12
Thiam B1	30 mg	6.13 mg/kg = 2.78 mg/lb	9.2	3 mg/kg = 21.09 mg	70.3	3 mg/kg = 27.3 mg	91
Ribo B2	20 mg	1.4 mg/kg = 0.63 mg/lb	3.15	10 mg/kg = 70.3 mg	351.5	10 mg/kg = 91 mg	455

Table 3. Sample Legume Hay + Oats Diet ± Supplements as Percentage of NRC Requirement

ING	Legume + oats (%NRC)	+ PP	+ D	+ GV	+ GP	+ GFA
Lysine	209.69	213.43	211.49	214.69	210.63	209.87
Ca	360.4	361.72	369.8	368.71	365.6	362.66
P	117.71	123.6	128.71	123.21	122.41	120.07
Na	10.11	11.04	11.91	?	?	?
Cl	111.33	111.87	?	?	?	?
K	596.3	600.7		598.2	600.67	596.99
Mg	234.30	239.9	238.77	243.24	234.56	237.28
S	132.13	135.23	135.61	133.64	?	134.39
Co	914.0	1072.4	1482.0	1114.0	934.00	1162.0
Cu	66.56	79.76	82.81	141.56	74.56	88.56
I	31.3	50.15	209.87	76.3	88.44	88.3
Fe	669.24	735.24	778.61	731.74	719.24	722.24
Mn	69.71	102.71	85.05	106.71	119.71	140.58
Zn	53.66	88.66	89.19	103.66	66.66	71.66
Se	140.6	219.6	267.6	240.6	142.6	220.6
Vit A	1309.14	1342.14	1573.02	1409.14	1531.36	1364.69
Vit D	426.06	471.51	710.15	1415.75	577.57	501.81
Vit E	36.26	128.76	47.11	92.76	42.51	92.76
Thiam B1	79.5	?	125.33	86.6	?	173.23
Ribo B2	354.65	431.65	1229.65	604.65	?	414.05

ING, ingredient; NRC, absolute requirements (500-kg horse at light work); %NRC, percent of NRC values supplied by supplement; PP, Platinum Performance; D, Dynamite; GV, Grand Meadows Grand-Vite; VP, Farnum Vita-Plus; VFA, Vita-Flex Accel.

given in addition to a horse's normal diet. These diets were formulated using either legume or grass hay, with the addition of 0.45 kg (1 lb) of dry oats; in this model, the oats are used as a carrier for the supplement, because supplements cannot be effectively top-dressed on hay. The dietary energy (DR) requirements for a 500-kg horse in light

work is reported by the NRC program to be 19.98 Megacalories (Mcal). Using the average nutrient content of common feed profiles established by Equi-Analytical Laboratories³ for oats, legume hays, and grass hays, a diet satisfying the DE requirements for the model horse was established. Using these parameters, the sample diets comprised 0.45 kg oats

Table 4. Sample Grass Hay + Oats Diet ± Supplements as Percent of NRC Requirement

ING	Grass + oats (%NRC)	+ PP	+ D	+ GV	+ GP	+ GFA
Lysine	81.88	85.62	83.68	86.88	82.82	82.06
Ca	157.5	158.82	167.1	165.81	162.7	159.76
P	131.66	137.55	142.66	137.16	136.36	134.02
Na	13.09	14.02	15.1	?	?	?
Cl	72.4	72.94	?	?	?	?
K	607.85	612.45	609.75	612.22	609.54	608.54
Mg	201.6	207.2	206.07	210.54	201.86	204.58
S	110.06	113.16	113.54	111.57	?	112.32
Co	1182.0	1340.4	1750.0	1382.0	1202.0	1350.0
Cu	84.5	97.7	100.75	159.5	92.5	106.5
I	40.3	59.15	218.87	75.3	97.44	97.3
Fe	431.03	497.03	540.4	493.53	481.03	484.03
Mn	172.86	205.86	188.2	209.86	222.86	243.73
Zn	86.04	119.04	120.29	136.04	96.04	104.04
Se	54.6	133.6	281.6	154.6	56.6	134.6
Vit A	323.55	356.88	587.43	423.55	545.77	379.1
Vit D	551.51	596.96	835.6	1541.2	703.02	627.26
Vit E	35.22	128.02	46.07	97.7	41.47	97.72
Thiam B1	100.2	?	146.03	107.3	?	193.93
Ribo B2	458.15	535.15	1333.15	708.15	?	517.55

ING, ingredient; NRC, absolute requirements (500-kg horse at light work); %NRC, percent of NRC values supplied by supplement; PP, Platinum Performance; D, Dynamite; GV, Grand Meadows Grand-Vite; VP, Farnum Vita-Plus; VFA, Vita-Flex Accel.

Orig. Op.	OPERATOR:	Session	PROOF:	PE's:	AA's:	COMMENTS	ARTNO:
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and either 7.03 kg (15.47 lb) legume hay or 9.1 kg (20.03 lb) grass hay.

The amounts of the various nutrients in each of the two diets were calculated using nutrient composition tables published in the NRC as well as nutrient content tables in an equine nutrition book.⁴ Then, the amounts were tabulated as percent of NRC requirements. Finally, the effect of the addition of each supplement product to the nutrient content of each of the sample diets was analyzed by adding the calculated percent of NRC requirements of each supplement to each diet.

3. Results

The results of the analyses of each of the respective products are contained in Table 1. Table 2 shows the results of the analyses of each of the two sample diets. Table 3 shows the total contribution of the diet to satisfying NRC requirements with the sample diet of oats and legume hay when each supplement is added. Table 4 shows the total contribution of the diet to satisfying NRC requirements with the sample diet of oats and grass hay when each supplement is added.

4. Discussion

The claims made for the various supplement products, as advertised on their respective websites, suggest that each product may be necessary, important, popular, and/or supported by research.

- Platinum Performance^a: “addresses equine health at the cellular level, providing a special blend of more than 55 natural ingredients that support the fundamental health of each of your horse’s 12 trillion cells.”⁵
- Grand Meadows Grand Vite^b: “you won’t find a product that offers a more comprehensive range of the most important nutrients.”⁶
- Dynamite^c: “reflects decades of research, development and use by the top trainers in the country.”⁷
- Vita-Plus^d: “contains virtually every beneficial nutritional ingredient an equine supplement can provide to improve a horse’s condition and performance.”⁸
- Vita Flex Accel^e: “comprehensive multi-vitamin and mineral supplement: an exclusive blend of balanced nutrients like no other.”⁹

The data calculated for both sample diets indicate that they are, in general, more than adequate in providing for the nutritional needs of a 500-kg horse in light work. Adding nutritional supplements to the sample diets seems to be largely irrelevant in terms of nutritional content. When the diet provides amounts of ingredients equal to or in excess of NRC requirements, supplements providing extra amounts of these ingredients would seem superfluous. In fact, given that diets often provide levels of nutrients far in excess of dietary requirements

(e.g., Co and vitamin D), it is good that such nutrients are rarely toxic, especially when large amounts of these ingredients are provided in some of the supplements. However, when diets may be deficient in certain nutrients (e.g, lysine, Na, Cu, I, and vitamin E), the supplements generally do not correct for those deficiencies, with certain individual exceptions. There would seem to be no apparent reason to supplement for any of the B vitamins, because the microflora of the horse’s large intestines provide ample quantities; additionally, dietary deficiencies of B vitamins are unknown. Problems related to dietary deficiencies of B vitamins in horses, although theoretically possible in individual situations, were not identified in a literature search.

Based on these results, veterinarians should be able to advise clients that most equine diets supply ample amounts of necessary nutrients, assuming that dietary energy requirements are met. Furthermore, they can advise them that the equine nutritional supplements evaluated in this study seem to not be formulated with any particular nutritional goal in mind. If supplementation for sodium is desired, a simple salt block or the addition of trace mineral salt to the diet would be more effective and much cheaper. In areas where specific nutritional supplementation is needed (e.g., in selenium-deficient areas like parts of the Pacific Northwest, from the Great Lakes region to the New England states, and along the Eastern Seaboard into Florida), veterinarians and horse owners would be well-advised to select nutritional supplements for specific deficiencies rather than to rely on a complete product.

These data pertain to a 500-kg horse in light work. Veterinarians should also be aware that the data would not be applicable to other classes of horses, where nutritional needs might be greater (e.g., in late-term pregnancy or in growing horses). However, the increased nutritional needs of these horses would also not be satisfied by the nutritional supplements analyzed in this study at the doses studied.

References and Footnotes

1. Dobson DaVanzano Associates, LLC. The economic impact of the dietary supplement industry. Available online at <http://naturalproductsfoundation.org/clientuploads/NPF%20-%20Economic%20Impact%20Study.pdf>. Accessed March 5, 2011.
2. *Nutrient requirement of horses*, 6th revised ed. Washington, DC: The National Academies Press, 2007; http://www.agmodels.com/Demos/NRC_Equine89/Equine_Model_2006.asp. **AQ: 2**
3. Available online at <http://www.equi-analytical.com/>. Accessed March 12, 2011. **AQ: 3**
4. Lewis LD. *Feeding and care of the horse*, 2nd ed. Ames, IA: Blackwell Publishing, 2005.
5. Available online at <http://www.platinumperformance.com/Nutritional-Foundation/products/18/>. Accessed on March 10, 2011. **AQ: 4**
6. Available online at http://www.grandmeadows.com/products_grandVite.html. Accessed on March 10, 2011.

Orig. Op.	OPERATOR:	Session	PROOF:	PE's:	AA's:	COMMENTS	ARTNO:
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7. Available online at https://www.securedcontent.net/dynamite/products_horse_07a.html. Accessed on March 10, 2011.
8. Available online at <http://farnamhorse.com/product.php?pid=100092&key=300121#>. Accessed on March 10, 2011.
9. Available online at <http://www.vitaflex.com/product.php?cat=Vitamins%20%20Minerals&pid=91&key=40>. Accessed on March 10, 2011.

^aPlatinum Performance Equine, Platinum Performance, Buellton, CA, 93427.

AQ: 5

^bGrand Meadows Grand Vite, Grand Meadows, Orange, CA 92868.

^cDynamite, Dynamite Marketing, Inc., Meridian, ID 83642.

^dVita-Plus, Farnam, Phoenix, AZ 85013.

^eVita-Flex Accel, Vita-Flex Nutrition, Council Bluffs, IA 51501.

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Equine nutrition is the feeding of horses, ponies, mules, donkeys, and other equines. Correct and balanced nutrition is a critical component of proper horse care. Horses are non-ruminant herbivores of a type known as a "hindgut fermenter." Horses have only one stomach, as do humans. However, unlike humans, they also need to digest plant fiber (largely cellulose) that comes from grass or hay. Ruminants like cattle are foregut fermenters, and digest fiber in plant matter by use of a multi-chambered stomach. The nutritional content of five equine nutritional supplements relative to a 500-kg Working Horse. David W. Ramey, Stephen Duren. The nutritional content of supplement products fed to horses may contain widely ranging amounts of nutrients compared with established National Research Council (NRC) requirements for horses. This paper documents a wide range of individual nutrient dosages relative to the NRC requirements based on label information of five equine nutritional supplements. Some nutrient levels are in excess of NRC [Show full abstract] requirements for individual nutrients, whereas other nutritional supplement use is widespread in the horse industry, with owners adding scoops of products to feed without necessarily understanding how these nutrients fit into a normal equine diet. A veterinarian and an equine nutritionist examined how five general equine dietary supplements stacked up in light of a horse's daily nutrient requirements. David Ramey, DVM, presented the findings at the 2011 American Association of Equine Practitioners convention, held Nov. 18-22 in San Antonio. Ramey started off his presentation remarking that supplement sales are often driven by direct-to-consumer