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.

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

NOTES
Table 2. Nutrient Content of Sample Diets Without Added Supplementation

<table>
<thead>
<tr>
<th>ING</th>
<th>NRC</th>
<th>PP</th>
<th>%NRC</th>
<th>D</th>
<th>%NRC</th>
<th>G</th>
<th>%NRC</th>
<th>VP</th>
<th>%NRC</th>
<th>VFA</th>
<th>%NRC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lysine</td>
<td>30</td>
<td>0.41%</td>
<td>1.81</td>
<td>g</td>
<td>6.03</td>
<td>0.87%</td>
<td>61.1 g</td>
<td>203.66</td>
<td>0.25%</td>
<td>22.75 g</td>
<td>75.85</td>
</tr>
<tr>
<td>Ca</td>
<td>30</td>
<td>0.13%</td>
<td>0.589</td>
<td>g</td>
<td>6.03</td>
<td>1.535%</td>
<td>107.55 g</td>
<td>358.5</td>
<td>0.513%</td>
<td>46.68 g</td>
<td>155.6</td>
</tr>
<tr>
<td>P</td>
<td>18</td>
<td>0.41%</td>
<td>1.86</td>
<td>g</td>
<td>10.33</td>
<td>0.275%</td>
<td>19.33 g</td>
<td>107.38</td>
<td>0.24%</td>
<td>21.84 g</td>
<td>121.33</td>
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<tr>
<td>Na</td>
<td>13.9</td>
<td>0.03%</td>
<td>0.14</td>
<td>g</td>
<td>0.1</td>
<td>0.02%</td>
<td>1.406 g</td>
<td>10.11</td>
<td>0.02%</td>
<td>1.82</td>
<td>13.09</td>
</tr>
<tr>
<td>Cl</td>
<td>46.6</td>
<td>0.14%</td>
<td>0.63</td>
<td>g</td>
<td>0.3</td>
<td>0.48%</td>
<td>33.74 g</td>
<td>72.4</td>
<td>0.616%</td>
<td>56.05 g</td>
<td>120.27</td>
</tr>
<tr>
<td>K</td>
<td>28.5</td>
<td>0.54%</td>
<td>2.45</td>
<td>g</td>
<td>8.59</td>
<td>2.384%</td>
<td>167.5 g</td>
<td>587.71</td>
<td>1.877%</td>
<td>170.80 g</td>
<td>599.29</td>
</tr>
<tr>
<td>Mg</td>
<td>9.5</td>
<td>0.15%</td>
<td>0.68</td>
<td>g</td>
<td>7.15</td>
<td>0.307%</td>
<td>21.58 g</td>
<td>227.15</td>
<td>0.203%</td>
<td>18.473 g</td>
<td>194.45</td>
</tr>
<tr>
<td>S</td>
<td>15</td>
<td>0.17%</td>
<td>0.77</td>
<td>g</td>
<td>5.13</td>
<td>0.271%</td>
<td>19.05 g</td>
<td>127</td>
<td>0.173%</td>
<td>15.74 g</td>
<td>104.93</td>
</tr>
<tr>
<td>Co</td>
<td>0.5 mg</td>
<td>0.423 ppm</td>
<td>0.19</td>
<td>mg</td>
<td>38</td>
<td>0.65 ppm</td>
<td>4.57 mg</td>
<td>914</td>
<td>0.65 ppm</td>
<td>5.91 mg</td>
<td>1182</td>
</tr>
<tr>
<td>Cu</td>
<td>100 mg</td>
<td>7.409 ppm</td>
<td>3.37</td>
<td>mg</td>
<td>3.37</td>
<td>8.99 ppm</td>
<td>63.19 mg</td>
<td>63.19</td>
<td>8.916 ppm</td>
<td>81.13 mg</td>
<td>81.13</td>
</tr>
<tr>
<td>I</td>
<td>3.5 mg</td>
<td>0.1 ppm</td>
<td>0.045 mg</td>
<td>g</td>
<td>0.3</td>
<td>0.15 mg/kg</td>
<td>1.05 mg</td>
<td>30</td>
<td>0.15 ppm</td>
<td>1.365 mg</td>
<td>39</td>
</tr>
<tr>
<td>Fe</td>
<td>400 mg</td>
<td>123.79 ppm</td>
<td>56.27</td>
<td>mg</td>
<td>14.06</td>
<td>372.756 ppm</td>
<td>2,620.74 mg</td>
<td>655.18</td>
<td>183.285 ppm</td>
<td>1667.89 mg</td>
<td>416.97</td>
</tr>
<tr>
<td>Mn</td>
<td>400 mg</td>
<td>53.664 ppm</td>
<td>24.39</td>
<td>mg</td>
<td>6.09</td>
<td>36.201 ppm</td>
<td>254.49 mg</td>
<td>63.62</td>
<td>73.306 ppm</td>
<td>667.08 mg</td>
<td>166.77</td>
</tr>
<tr>
<td>Zn</td>
<td>400 mg</td>
<td>35.419 ppm</td>
<td>16.09</td>
<td>mg</td>
<td>4.02</td>
<td>28.25 ppm</td>
<td>198.59 mg</td>
<td>49.64</td>
<td>25 ppm</td>
<td>227.5 mg</td>
<td>56.87</td>
</tr>
<tr>
<td>Se</td>
<td>1 mg</td>
<td>0.2 ppm</td>
<td>0.09</td>
<td>mg</td>
<td>9</td>
<td>0.2 mg/kg</td>
<td>1.406 mg</td>
<td>140.6</td>
<td>0.06 mg/kg</td>
<td>0.546 mg</td>
<td>54.6</td>
</tr>
<tr>
<td>Vit A</td>
<td>22,500 IU</td>
<td>44 IU/kg</td>
<td>20 IU/lb</td>
<td>0</td>
<td>41,900 IU/kg</td>
<td>294,557 IU</td>
<td>1309.14</td>
<td>800 IU/kg</td>
<td>72,800 IU</td>
<td>323.55</td>
<td></td>
</tr>
<tr>
<td>Vit D</td>
<td>3300 IU</td>
<td>0 IU/kg</td>
<td>0</td>
<td>2000 IU/kg</td>
<td>14,060 IU</td>
<td>426.06</td>
<td>2000 IU/kg</td>
<td>18,200 IU</td>
<td>551.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vit E</td>
<td>800 IU</td>
<td>20 IU/kg</td>
<td>9.09 IU/lb</td>
<td>1.1</td>
<td>40 IU/kg</td>
<td>281.2 IU</td>
<td>35.15</td>
<td>30 IU/kg</td>
<td>273 IU</td>
<td>34.12</td>
<td></td>
</tr>
<tr>
<td>Thiam B1</td>
<td>30 mg</td>
<td>6.13 mg/kg</td>
<td>2.78</td>
<td>mg</td>
<td>9.2</td>
<td>3 mg/kg</td>
<td>21.09 mg</td>
<td>70.3</td>
<td>3 mg/kg</td>
<td>27.3 mg</td>
<td>91</td>
</tr>
<tr>
<td>Ribo B2</td>
<td>20 mg</td>
<td>1.4 mg/kg</td>
<td>0.63</td>
<td>mg/lb</td>
<td>3.15</td>
<td>10 mg/kg</td>
<td>70.3 g</td>
<td>351.5</td>
<td>10 mg/kg</td>
<td>91 mg</td>
<td>455</td>
</tr>
</tbody>
</table>

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.

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 analyze 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...
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 (DE) 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 Laboratories 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 3. Sample Legume Hay + Oats Diet ± Supplements as Percentage of NRC Requirement

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

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.

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

<table>
<thead>
<tr>
<th>ING</th>
<th>Grass + oats (%NRC)</th>
<th>+ PP</th>
<th>+ D</th>
<th>+ GV</th>
<th>+ GP</th>
<th>+ GFA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lysine</td>
<td>81.88</td>
<td>85.62</td>
<td>83.68</td>
<td>86.88</td>
<td>82.82</td>
<td>82.06</td>
</tr>
<tr>
<td>Ca</td>
<td>157.5</td>
<td>158.82</td>
<td>167.1</td>
<td>165.81</td>
<td>162.7</td>
<td>159.76</td>
</tr>
<tr>
<td>P</td>
<td>131.66</td>
<td>137.55</td>
<td>142.66</td>
<td>137.16</td>
<td>136.36</td>
<td>134.02</td>
</tr>
<tr>
<td>Na</td>
<td>13.09</td>
<td>14.02</td>
<td>15.1</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Cl</td>
<td>72.4</td>
<td>72.94</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>K</td>
<td>607.85</td>
<td>612.45</td>
<td>609.75</td>
<td>612.22</td>
<td>609.54</td>
<td>608.54</td>
</tr>
<tr>
<td>Mg</td>
<td>201.6</td>
<td>207.2</td>
<td>206.07</td>
<td>210.54</td>
<td>201.86</td>
<td>204.58</td>
</tr>
<tr>
<td>S</td>
<td>110.06</td>
<td>113.16</td>
<td>113.54</td>
<td>111.57</td>
<td>?</td>
<td>112.32</td>
</tr>
<tr>
<td>Co</td>
<td>1182.0</td>
<td>1340.4</td>
<td>1750.0</td>
<td>1382.0</td>
<td>1202.0</td>
<td>1350.0</td>
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<tr>
<td>Cu</td>
<td>84.3</td>
<td>97.7</td>
<td>100.75</td>
<td>159.5</td>
<td>92.5</td>
<td>106.5</td>
</tr>
<tr>
<td>I</td>
<td>40.3</td>
<td>59.15</td>
<td>218.87</td>
<td>75.3</td>
<td>97.44</td>
<td>97.3</td>
</tr>
<tr>
<td>Fe</td>
<td>431.03</td>
<td>497.03</td>
<td>540.4</td>
<td>493.53</td>
<td>481.03</td>
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</tr>
<tr>
<td>Mn</td>
<td>172.86</td>
<td>205.86</td>
<td>188.2</td>
<td>209.86</td>
<td>222.86</td>
<td>243.73</td>
</tr>
<tr>
<td>Zn</td>
<td>86.04</td>
<td>119.04</td>
<td>120.29</td>
<td>136.04</td>
<td>96.04</td>
<td>104.04</td>
</tr>
<tr>
<td>Se</td>
<td>54.6</td>
<td>133.6</td>
<td>281.6</td>
<td>154.6</td>
<td>56.6</td>
<td>134.6</td>
</tr>
<tr>
<td>Vit A</td>
<td>323.55</td>
<td>356.88</td>
<td>587.43</td>
<td>423.55</td>
<td>545.77</td>
<td>379.1</td>
</tr>
<tr>
<td>Vit D</td>
<td>551.51</td>
<td>596.96</td>
<td>835.6</td>
<td>1541.2</td>
<td>703.02</td>
<td>627.26</td>
</tr>
<tr>
<td>Vit E</td>
<td>35.22</td>
<td>128.02</td>
<td>46.07</td>
<td>97.7</td>
<td>41.47</td>
<td>97.72</td>
</tr>
<tr>
<td>Thiam B1</td>
<td>100.2</td>
<td>?</td>
<td>146.03</td>
<td>107.3</td>
<td>?</td>
<td>193.93</td>
</tr>
<tr>
<td>Ribo B2</td>
<td>458.15</td>
<td>535.15</td>
<td>1333.15</td>
<td>708.15</td>
<td>?</td>
<td>517.55</td>
</tr>
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</table>

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.
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. 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™: “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.”
- Grand Meadows Grand Vite™: “you won’t find a product that offers a more comprehensive range of the most important nutrients.”
- Dynamite™: “reflects decades of research, development and use by the top trainers in the country.”
- Vita-Plus™: “contains virtually every beneficial nutritional ingredient an equine supplement can provide to improve a horse’s condition and performance.”
- Vita Flex Accel™: “comprehensive multi-vitamin and mineral supplement: an exclusive blend of balanced nutrients like no other.”

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


*Platinum Performance Equine, Platinum Performance, Buellton, CA, 93427.
Grand Meadows Grand Vite, Grand Meadows, Orange, CA 92868.
Vita-Plus, Farnam, Phoenix, AZ 85013.
Vita-Flex Accel, Vita-Flex Nutrition, Council Bluffs, IA 51501.