

### Bariatric Nutritional Deficiencies

NUTRIENT	PRE-SURGERY	POST SURGERY	POST SURGERY	POST SURGERY	POST SURGERY
		AGB	VSG/LSG	RYGB/RNY	BPD/DS
Vitamin D	<b>14 - 92.9%</b> 92.9% <sup>21</sup> 89.7% <sup>10</sup> 86% <sup>32</sup> 81% <sup>30</sup> 71.7% <sup>24</sup> 60% <sup>18</sup> 57% <sup>28</sup> 40% <sup>16</sup> 39% <sup>1</sup> 27% <sup>8</sup> 23% <sup>12</sup> 16% <sup>6</sup> 14% <sup>6</sup>	<b>5%</b> 5% <sup>6</sup>	<b>32 – 68%</b> 68% <sup>32</sup> 36% <sup>30</sup> 32% <sup>12</sup> 30.4% <sup>29</sup>	<b>10-52%</b> 52% <sup>12</sup> 45% <sup>32</sup> 21% <sup>16</sup> 10% <sup>6</sup> 8% <sup>31</sup>	<b>22 – 70.6%</b> 60% <sup>15</sup> 57.8 <sup>5</sup> 22 – 70.6% <sup>9</sup>
Iron	<b>3-43%</b> 43% <sup>1</sup> 38% <sup>30</sup> 19% <sup>6</sup> 29% <sup>6</sup> 3% <sup>12</sup> 16% <sup>16</sup> 36.2% <sup>21</sup> 11.5% <sup>30</sup> 7-14% <sup>32</sup> 7.9% <sup>33</sup> 12.6% <sup>24</sup> 29% <sup>8</sup>	<b>14%</b> 14% <sup>6</sup>	<b>5 - 43%</b> 43% <sup>1</sup> 18% <sup>12</sup> 7.5% <sup>23</sup> 18.5% <sup>30</sup> 5% <sup>32</sup> 30% <sup>2</sup>	<b>6 – 36.4%</b> 22% <sup>6</sup> 28% <sup>12</sup> 6% <sup>16</sup> 23% <sup>33</sup> 36.4% <sup>1</sup> 25.4% <sup>31</sup>	<b>11 – 47.1%</b> 42.9% <sup>5</sup> 40% <sup>15</sup> 11.1 – 47.1% <sup>9</sup>
Vitamin B12	<b>2.3 – 18.1%</b> 9% <sup>1</sup> 5 - 10%* <sup>6</sup> 18.1% <sup>10</sup> 10.6% <sup>24</sup> 9% <sup>8</sup> 3% <sup>12</sup> 13% <sup>16</sup> 3.5% <sup>21</sup> 5% <sup>32</sup> 2.3% <sup>33</sup> *depending on procedure	<b>19%</b> 19% <sup>6</sup>	<b>3 – 18%</b> 18% <sup>12</sup> 11.5% <sup>30</sup> 3% <sup>32</sup> 5% <sup>2</sup> 3.2% <sup>29</sup>	<b>3 - 42.1%</b> 12% <sup>6</sup> 58% <sup>12</sup> 3% <sup>16</sup> 14.5% <sup>19</sup> 11% <sup>28</sup> 42.1% <sup>2</sup> 5% <sup>32</sup> 6.5% <sup>33</sup> 14.1% <sup>31</sup>	<b>3.9 – 7%</b> 3.9% <sup>5</sup> 7% <sup>22</sup>
Protein	<b>6 – 27%</b> 15% <sup>1</sup> 12% <sup>10</sup> 6% <sup>12</sup> 27% <sup>32</sup>		<b>2.2 – 39%</b> 4% <sup>12</sup> 16% <sup>32</sup> 18-39% <sup>3</sup> 2.2% <sup>29</sup>	<b>8 – 39%</b> 8% <sup>12</sup> 18-39% <sup>3</sup> 27% <sup>32</sup>	<b>3.4 – 33.3%</b> 3.4 – 18% <sup>4</sup> 5.9 – 33% <sup>9</sup>

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Calcium	<b>0.5 – 3.3%</b> 0.5% <sup>30</sup> 3.3% <sup>24</sup>		<b>2%</b> 2% <sup>30</sup>		<b>15 – 40%</b> 15 – 40% <sup>27</sup>
Zinc	<b>2.9 – 24.6%</b> 24.6% <sup>10</sup> 14% <sup>12</sup> 30% <sup>16</sup> 2.9% <sup>24</sup>		<b>5 – 34%</b> 5% <sup>30</sup> 34% <sup>12</sup>	<b>36 – 37%</b> 37% <sup>12</sup> 36% <sup>16</sup>	<b>10.5 - 38%</b> 38% <sup>5</sup> 10.5 – 33.3 <sup>9</sup>
Vitamin A	<b>1.7 – 23%</b> 23% <sup>6</sup> 14% <sup>6</sup> 11% <sup>16</sup> 1.7% <sup>21</sup> 7% <sup>22</sup>	<b>10%</b> 10% <sup>6</sup>		<b>4 – 17%</b> 10% <sup>6</sup> 17% <sup>16</sup> 4% <sup>22</sup>	<b>28 – 55.5%</b> 28% <sup>15</sup> 54% <sup>22</sup> 55.5% <sup>5</sup>
Vitamin B1	<b>1.8 – 38%</b> 38% <sup>6</sup> 25% <sup>6</sup> 1.8% <sup>21</sup> 5.5% <sup>30</sup> 9% <sup>32</sup>	<b>57%</b> 57% <sup>6</sup>	<b>9 – 17%</b> 9% <sup>30</sup> 17% <sup>32</sup>	<b>5 – 12%</b> 5% <sup>32</sup> 7% <sup>22</sup> 12% <sup>6</sup>	
Vitamin B6	<b>3 – 28%</b> 5% <sup>6</sup> 14% <sup>6</sup> 16% <sup>22</sup> 28% <sup>22</sup> 3% <sup>30</sup> 11% <sup>8</sup>	<b>14%</b> 14% <sup>6</sup>	<b>4%</b> 4% <sup>30</sup>	<b>14 – 30%</b> 14% <sup>6</sup> 30% <sup>22</sup>	<b>14%</b> 14% <sup>22</sup>
Folate	<b>3.4 – 18%</b> 15% <sup>1</sup> 5% <sup>6</sup> 4% <sup>6</sup> 3.4% <sup>10</sup> 6% <sup>16</sup> 5.3% <sup>21</sup> 18% <sup>32</sup> 6% <sup>8</sup>	<b>10%</b> 10% <sup>6</sup>	<b>2.2 – 22%</b> 22% <sup>12</sup> 12.5% <sup>30</sup> 17% <sup>32</sup> 20% <sup>2</sup> 2.2% <sup>29</sup>	<b>4 – 18.4%</b> 4% <sup>6</sup> 12% <sup>12</sup> 11% <sup>16</sup> 12% <sup>28</sup> 9% <sup>32</sup> 18.4% <sup>2</sup> 6.8% <sup>31</sup>	<b>10.9%</b> 10.9% <sup>5</sup>

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Vitamin C	<b>24 – 63%</b> 43% <sup>6</sup> 47% <sup>6</sup> 63% <sup>22</sup> 50% <sup>22</sup> 24% <sup>30</sup>	<b>48%</b> 48% <sup>6</sup>		<b>10 – 43%</b> 10% <sup>6</sup> 43% <sup>22</sup>	<b>14%</b> 14% <sup>22</sup>
Vitamin E	<b>5.2 – 27%</b> 5.2% <sup>30</sup> 14% <sup>22</sup> 27% <sup>22</sup>				<b>3.9 – 11%</b> 3.9% <sup>5</sup> 11% <sup>22</sup> 10% <sup>15</sup> 5.3 – 5.9% <sup>9</sup>
Vitamin K					<b>44.7 - 60%</b> 60% <sup>15</sup> 44.7 – 58.8% <sup>9</sup>
Magnesium	<b>2 – 4.7%</b> 2% <sup>30</sup> 4.7% <sup>10</sup>		<b>3%</b> 3% <sup>30</sup>		<b>3.1 – 22.2%</b> 3.1% <sup>5</sup> 5.2 – 22.2% <sup>9</sup>
Potassium	<b>7%</b> 7% <sup>8</sup>			<b>2.4 – 5%</b> 2.4% <sup>7</sup> 5% <sup>25</sup>	<b>25.9%</b> 25.9% <sup>20</sup>
Selenium	<b>58%</b> 58% <sup>16</sup>			<b>3%</b> 3% <sup>16</sup>	<b>10.5 – 33.3%</b> 10.5 – 33.3% <sup>9</sup>
Copper				9.6% <sup>13</sup>	

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**FOOTNOTES:** Biochemical deficiencies defined as serum/plasma/RBC levels (nutrient dependent) below the normal reference range. Protein deficiency defined here as albumin or pre-albumin concentrations below the normal reference range. Pre-surgery populations included patients scheduled for any bariatric surgery procedure. Supplementation levels varied across pre and post-surgical cohorts. Post-surgical cohort follow up ranged from 3 months to 5 years.

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