

# Electrolyte Forte

Formulated to Support Cellular  
Electrolyte Balance

## Clinical Benefits\*

- Supports lipid and carbohydrate metabolism
- Key minerals at doses needed for multiple metabolic and cardiovascular functions, including blood pressure regulation, myocardial metabolism, and effective insulin action
- Taurine provides a beneficial effect associated with "browning" of adipose tissue
- Antioxidants include vitamin C, beetroot juice powder, and pomegranate juice powder
- Provides support for physical activity

**Electrolyte Forte** is a powdered formulation containing key minerals and nutrients that support healthy energy metabolism, muscle function, and a healthy inflammatory response.\* **Electrolyte Forte** provides higher doses of key minerals like magnesium, potassium, and calcium than typically provided in electrolyte formulas, and may also be used to supplement dietary intake. These minerals are essential not only for muscle contraction and recovery, but also for ATP production, and both metabolic and cardiovascular function. Unlike most electrolyte formulas, **Electrolyte Forte** also provides the amino acid taurine, which has been shown to influence energy metabolism in adipose tissue, provide mitochondrial support and improve lipid metabolism, especially when combined with exercise.<sup>1</sup>



**Electrolyte Forte** available in a 5 gram container (#1113)

## Highlights

- Potent doses of minerals typically not found in electrolyte formulas, including 150 mg magnesium and 150 mg calcium per serving
- Lower dose of sodium than most electrolyte formulas
- Sweetened with monk fruit extract (no glucose or fructose); **Electrolyte Forte** does not have added sugars typically found in electrolyte formulas which may impair glycemic control.
- Delicious watermelon flavor



**(905) 476-3554**

Biotics Research Canada  
Box 283 • Keswick ON L4P 3E2  
[orders@bioticscan.com](mailto:orders@bioticscan.com)

\*These statements have not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure, or prevent any disease.

© 2023 Biotics Research Corp., Rosenberg, TX 77471  
LIT-363 Rev. 05/23

## Potent Mineral Doses for Broad Metabolic and Cardiovascular Support

Each serving of **Electrolyte Forte** provides 150 mg of elemental magnesium (as magnesium glycerophosphate), the 2<sup>nd</sup> most common intracellular cation, and a cofactor for at least 300 enzymatic reactions.<sup>2</sup> Magnesium is the rate-limiting factor for many enzymes involved in carbohydrate and energy metabolism, and also plays a key role in cardiovascular function, influencing myocardial metabolism, cardiac output, vascular tone, as well as peripheral vascular resistance. Its effects on cardiovascular function are mediated via the regulation of ion channels in cardiac cells, influences on intracellular calcium mobility, and through anti-inflammatory and vasodilatory effects.<sup>3,4</sup> Magnesium has broad utility for cardiovascular health, with lower intakes associated with both increased risk for atherosclerosis and cardiovascular disease, as well as chronic renal disease.<sup>5</sup>

Given that magnesium has been estimated to be the most underestimated electrolyte deficiency in the US (primarily because of insufficient dietary intake), its role in energy metabolism is critically important, and deficiency has been associated with impaired insulin signaling, low-grade inflammation, and both diabetes and metabolic syndrome as well as obesity.<sup>6</sup> Data from National Health and Nutrition Examination Survey (NHANES) suggests that a magnesium deficit is more likely among participants with an elevated BMI, and the Coronary Artery Risk Development in Young Adults (CARDIA) study found the same association, as well as an inverse correlation with C-reactive protein levels.<sup>7,8</sup> Magnesium is also needed for the conversion of vitamin D to its most active form, which may partly explain the link between low magnesium levels and elevated blood pressure, as magnesium intake appears to modify the association between vitamin D and blood pressure.<sup>9,10</sup> Magnesium also modifies the relationship between vitamin D and risk for type 2 diabetes; among people with a high intake of magnesium, vitamin D is inversely associated with diabetes risk, but in those with low magnesium intake, this apparent protective effect of vitamin D is not present, suggesting magnesium plays a crucial role in vitamin D activation.<sup>11</sup>

Magnesium is also needed by enzymes involved in muscle contraction and relaxation, and neurotransmitters needed for muscle activity, and many ATP-generating reactions. Magnesium's multiple roles in energy production, muscle function, and the body's inflammatory response make it particularly important when considering exercise and physical activity.

Supplementation with magnesium has been shown to limit the inflammatory response to exercise (IL-6), reduce soreness and enhance the recovery of blood glucose levels.<sup>12</sup> Its beneficial role in carbohydrate metabolism has also been demonstrated among participants with metabolic syndrome (Met-S) and low magnesium levels, in whom supplementation reduced blood pressure, hyperglycemia, and hypertriglyceridemia, with similar effects shown in a controlled trial of participants with normal magnesium levels and Met-S.<sup>13,14,15</sup>

**Electrolyte Forte** also provides clinically beneficial amounts of other key minerals, including 150 mg calcium, 315 mg phosphorus, 320 mg potassium, and 350 mg chloride, while limiting sodium to only 160 mg per serving. Similar to magnesium, these minerals have diverse roles in human physiology, including those related to metabolism, cardiovascular and renal health, muscle function and ATP generation.<sup>16</sup> For example, dietary potassium intake has a well-established inverse correlation with blood pressure, and has been associated with a lower risk of chronic renal disease and eGFR decline among people with hypertension.<sup>17</sup> In addition, perhaps due to enhanced ATP generation and support for muscle function, endurance runners supplemented with potassium phosphate were shown to have lower ratings of perceived exertion during equivalent exercise intensities than those receiving placebo, suggesting it may reduce perceived exertion with moderate exercise.<sup>18</sup> Electrolyte supplementation (with sodium and potassium) has been shown to attenuate the reduction in exercise capacity that occurs while limiting caloric intake, potentially allowing for greater activity levels while simultaneously restricting energy intake.<sup>19</sup>

Given that phosphorus is needed for ATP synthesis, low dietary intake of phosphorus has been associated with decreased ATP production, which promotes both hyperphagia and decreased thermogenesis, suggesting a possible link to both obesity and metabolic syndrome.<sup>20</sup> Even among healthy subjects, low serum phosphate levels have been associated with reduced insulin sensitivity and higher blood glucose levels following an oral glucose tolerance challenge.<sup>21</sup>

## Antioxidants

In addition, **Electrolyte Forte** provides 90 mg of vitamin C per serving, also important for exercise capacity. A low blood level of vitamin C has been associated with increased oxidative stress and decreased physical performance, both of which improve with supplementation.<sup>22</sup> Vitamin C supplementation has also been shown to reduce oxidative stress and improve blood pressure after exercise in participants with type 2 diabetes, potentially by mitigating oxidative damage and/or improving endothelial function.<sup>23</sup> Vitamin C may also influence perceived exertion, at least in some populations; in a randomized and controlled trial, supplementation with vitamin C reduced fatigue and rating of perceived exertion among study participants with an elevated BMI.<sup>24</sup>

Additionally, **Electrolyte Forte** contains pomegranate and beet juice powders, both of which have been shown to provide antioxidant support, which may be particularly important during exercise.<sup>25,26</sup> Beetroot specifically has been associated with improved heart rate variability recovery, and supplies nitrate which increases nitric oxide bioavailability, important to many physiological processes, including vasodilation and blood pressure regulation.<sup>27,28</sup>

## Regulation of Adipose Metabolism

Unlike most common electrolyte formulas, **Electrolyte Forte** also provides 300 mg taurine per serving. Taurine is a naturally occurring amino acid derived from the metabolism of methionine and cysteine, with a role in energy metabolism (including in skeletal muscle and adipose tissue), cellular osmolality, hydration, and exercise performance.<sup>29</sup> A number of recent studies suggest that taurine plays a unique role in regulating cellular homeostasis, at least in part by reducing inflammation in adipose cells. Animal studies indicate that taurine upregulates energy expenditure in adipose cells, including fatty acid  $\beta$ -oxidation, and shifts the macrophage population to the M2 phenotype, associated with an anti-inflammatory effect.<sup>30</sup> Supplementation in controlled human trials indicates that it may increase adiponectin levels (associated with satiety), and decrease markers of inflammation (C-reactive protein) and lipid peroxidation among people with an elevated BMI.<sup>31</sup> When combined with exercise, taurine supplementation was also shown to modulate genes related to lipid oxidation and mitochondrial function, associated with an adipose “browning” effect (indicative of healthier adipose tissue) among women with an elevated BMI.<sup>1</sup> Controlled trials with taurine have also found improvements in  $\text{VO}_{2\text{max}}$ , anaerobic performance, recovery, and other indicators of reduced metabolic function.<sup>32</sup>

## References

- De Carvalho FG, Brandao CFC, et al. Taurine supplementation associated with exercise increases mitochondrial activity and fatty acid oxidation gene expression in the subcutaneous white adipose tissue of obese women. Clin Nutr. 2021 Apr;40(4):2180-2187
- Jahnen-Dechent W, Ketteler M. Magnesium basics. Clin Kidney J. 2012 Feb;5(Suppl 1):i3-i14.
- de Baaij JH, Hoenderop JG, Bindels RJ. Magnesium in man: implications for health and disease. Physiol Rev. 2015 Jan;95(1):1-46.
- Mubagwa K, Gwanyanya A, Zakharov S, et al. Regulation of cation channels in cardiac and smooth muscle cells by intracellular magnesium. Arch Biochem Biophys. 2007 Feb 1;458(1):73-89.
- Sakaguchi Y, Hamano T, Isaka Y. Magnesium and Progression of Chronic Kidney Disease: Benefits Beyond Cardiovascular Protection? Adv Chronic Kidney Dis. 2018 May;25(3):274-280.
- Piuri G, Zocchi M, Della Porta M, et al. Magnesium in Obesity, Metabolic Syndrome, and Type 2 Diabetes. Nutrients. 2021 Jan 22;13(2):320.
- Jiang S, Ma X, Li M, et al. Association between dietary mineral nutrient intake, body mass index, and waist circumference in U.S. adults using quantile regression analysis NHANES 2007-2014. PeerJ. 2020 May 4;8:e9127.
- Lu L, Chen C, Yang K et al. Magnesium intake is inversely associated with risk of obesity in a 30-year prospective follow-up study among American young adults. Eur J Nutr. 2020 Dec;59(8):3745-3753.
- Dai Q, Zhu X, Manson JE, et al. Magnesium status and supplementation influence vitamin D status and metabolism: results from a randomized trial. Am J Clin Nutr. 2018 Dec 1;108(6):1249-1258.
- Huang W, Ma X, Chen Y, et al. Dietary Magnesium Intake Modifies the Association Between Vitamin D and Systolic Blood Pressure: Results From NHANES 2007-2014. Front Nutr. 2022 Feb 24;9:829857.
- Huang W, Ma X, Liang H, Li H, et al. Dietary Magnesium Intake Affects the Association Between Serum Vitamin D and Type 2 Diabetes: A Cross-Sectional Study. Front Nutr. 2021 Nov 25;8:763076.
- Steward CJ, Zhou Y, Keane G, et al. One week of magnesium supplementation lowers IL-6, muscle soreness and increases post-exercise blood glucose in response to downhill running. Eur J Appl Physiol. 2019 Dec;119(11-12):2617-2627.
- Rodríguez-Morán M, Simental-Mendía LE, Gamboa-Gómez CI, et al. Oral Magnesium Supplementation and Metabolic Syndrome: A Randomized Double-Blind Placebo-Controlled Clinical Trial. Adv Chronic Kidney Dis. 2018 May;25(3):261-266.
- Rodríguez-Morán M, Guerrero-Romero F. Oral magnesium supplementation improves the metabolic profile of metabolically obese, normal-weight individuals: a randomized double-blind placebo-controlled trial. Arch Med Res. 2014 Jul;45(5):388-93.
- Aftskaa K, Clavel J, Kisters K, et al. Magnesium citrate supplementation decreased blood pressure and HbA1c in normomagnesemic subjects with metabolic syndrome: a 12-week, placebo-controlled, double-blinded pilot trial. Magnes Res. 2021 Aug 1;34(3):130-139.
- Shrimanker I, Bhattarai S. Electrolytes. 2022 Jul 25. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan--.
- Mun KH, Yu GI, Choi BY, et al. Association of Dietary Potassium Intake with the Development of Chronic Kidney Disease and Renal Function in Patients with Mildly Decreased Kidney Function: The Korean Multi-Rural Communities Cohort Study. Med Sci Monit. 2019 Feb 8;25:1061-1070.
- Goss F, Robertson R, Riechman S, et al. Effect of potassium phosphate supplementation on perceptual and physiological responses to maximal graded exercise. Int J Sport Nutr Exerc Metab. 2001 Mar;11(1):53-62.
- James LJ, Mears SA, Shirreffs SM. Electrolyte supplementation during severe energy restriction increases exercise capacity in the heat. Eur J Appl Physiol. 2015 Dec;115(12):2621-9.
- Wong SK. A Review of Current Evidence on the Relationship between Phosphate Metabolism and Metabolic Syndrome. Nutrients. 2022 Oct 27;14(21):4525.
- Haap M, Heller E, Thamer C, et al. Association of serum phosphate levels with glucose tolerance, insulin sensitivity and insulin secretion in non-diabetic subjects. Eur J Clin Nutr. 2006 Jun;60(6):734-9.
- Paschalis V, Theodorou AA, Kyparos A, et al. Low vitamin C values are linked with decreased physical performance and increased oxidative stress: reversal by vitamin C supplementation. Eur J Nutr. 2016 Feb;55(1):45-53.

## Supplement Facts

Serving Size: 5 g (1 level scoop)

Serving per Container: 30

	Amount Per Serving	% Daily Value †
<b>Calories</b>	<5 g	
<b>Total Fat</b>	0 g	0%
<b>Sodium</b>	160 mg	7%
<b>Total Carbohydrates</b>	<1 g	<1%
Vitamin C	90 mg	100%
Calcium	150 mg	12%
Phosphorus	315 mg	25%
Magnesium	150 mg	36%
Chloride	350 mg	15%
Potassium	320 mg	7%
Taurine	300 mg	*

† % Daily Value based on a 2,000 calorie diet

**Ingredients:** Magnesium glycerophosphate, calcium lactate, watermelon powder, potassium phosphate, sodium chloride, taurine, potassium chloride, pomegranate juice powder, non-GM ascorbic acid, beet juice powder, and monk fruit extract (Lou Han Guo).

**This product is gluten and dairy free.**

**RECOMMENDATION:** One (1) scoop mixed with twelve (12) ounces of water, or beverage of your choice, each day as a dietary supplement or as otherwise directed by your healthcare professional.

**KEEP OUT OF REACH OF CHILDREN**

Store in a cool, dry area. Sealed with imprinted safety seal for your protection.

Product # 1113 Rev. 03/23



**(905) 476-3554**

Biotics Research Canada Box 283  
• Keswick ON L4P 3E2  
orders@bioticscan.com

\*These statements have not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure, or prevent any disease.

© 2023 Biotics Research Corp., Rosenberg, TX 77471  
LIT-363 Rev. 05/23