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# **Marketing Information**

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**Calcium Fortification of Soy Milk and Other Dairy Alternative Products**

***GADOCAL K***

**Israeli Patent Pending – Application No. 174477**  
**Global Patent Pending - Application No. 2007/000375**

## **What is *Gadocal K*?**

**Gadocal K** is a new and patented **calcium-potassium citrate compound** ([Ca] min. 15% and [K] min. 6%)

It is specifically designed for the fortification of **Diary Alternative Beverages** (pH 6-8)

- **With** a highly bioavailable form of calcium
- **With** complete dispersion
- **With** an excellent organoleptic profile
- **With** the synergistic effect of the combination of Calcium and Potassium on increased calcium absorption.
- **Without** the addition of any stabilizers to achieve a stable Calcium suspension
- **Without** sedimentation of the Calcium
- **Without** coagulation of proteins

**Gadocal K** can be added to reach 30% of the RDA of calcium (same amount as in cow milk: 300 mg per serving (250ml ~ 8oz.)

# ***Applications***

**Gadocal K** is a perfect Calcium source for products such as:

- soy milk and other soy based products
- rice milk and other dairy alternative beverages.
- milk based beverages
- Yogurt
- Yogurt beverages

## ***Academic support of Kadocal K advantage in dairy:***

Effect of Calcium on the Physical Properties of Stirred Probiotic Yogurt

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The effect of calcium on the viscosity, firmness, and smoothness, as determined by extent of nodulation, of stirred probiotic yogurt produced by bacterial fermentation was investigated. Standardized milk for yogurt manufacture was prepared, and calcium was added or removed from the system. Calcium was added as  $\text{Ca}^{2+}$  in the form of  $\text{CaCl}_2$  (up to 13.6 mM) **or nonionic calcium as Gadocal-K** (calcium potassium citrate; up to 49.8 mM). Calcium was removed by chelating with sodium citrate (up to 16 mM) or by cation exchange with Amberlite IR-120 plus (sodium form) resin (up to 10 g/L). Calcium chloride and sodium citrate were added either before or after heat treatment of milk, and nonionic calcium was added before heat treatment..... **The study identified Gadocal-K as a possible source of calcium fortification of stirred yogurt without loss of texture.**

J. Dairy Sci. 2008. 91:4164-4175. doi:10.3168/jds.2008-1354

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## ***Why Calcium?***

Calcium is the most abundant mineral in our body. It makes up about 2% of the body-weight and about 39% of the total body minerals.

Plays an essential role in:

- Building bone mass and preventing osteoporosis
- The homeostatic maintenance of nerve, muscle and other tissue activity.
- Proper kidney function
- Regulation of blood pressure and blood cholesterol levels
- A wide range of fundamental cellular reactions.
- The activation more than 300 enzymes.

*Although soymilk is recognized as a nutritious beverage, it contains much less calcium than cowmilk (20-30 mg/100 ml vs. 100-120 mg/100 ml), so fortification is essential!*

## ***Why Potassium?***

Potassium, the major intracellular cation in the body, is required for normal cellular function.

Severe potassium deficiency is characterized by hypokalemia.

Moderate potassium deficiency, which typically occurs without hypokalemia, is characterized by increased blood pressure, increased salt sensitivity, an increased risk of kidney stones, and increased bone turnover (as indicated by greater urinary calcium excretion and biochemical evidence of reduced bone formation and increased bone resorption). An inadequate intake of dietary potassium may also increase the risk of cardiovascular disease, particularly stroke.

On the basis of available data, an Adequate Intake (AI) for potassium is set at 4.7 g (120 mmol)/day for all adults. This level of dietary intake (i.e., from foods) should maintain lower blood pressure levels, reduce the adverse effects of sodium chloride intake on blood pressure, reduce the risk of recurrent kidney stones, and possibly decrease bone loss.

### **Article: Effect of Short-Term Supplementation of Potassium Chloride and Potassium Citrate on Blood Pressure in Hypertensive's**

*Feng J He; Nirmala D. Markandu; Rosemary Coltart; Jeffrey Barron; and Graham A. MacGregor\**

*From the Blood Pressure Unit (F.J.H.,N.D.M., G.A.M), St. George's Hospital Medical School, London; and Chemical Pathology (J.B.),St. Helier Hospital, Surrey, United Kingdom.*

Results, in conjunction with the evidence from many previous trials that potassium chloride has a significant blood pressure-lowering effect, suggest that **potassium citrate has a similar effect on blood pressure as potassium chloride**. These results support other evidence for an increase in potassium intake and indicate that **potassium does not need to be given in the form of chloride to lower blood pressure**.

## ***Calcium/Potassium combination***

### **Potassium Citrate may contribute to a higher bioavailability of Calcium**

Observational studies suggest that increased fruit and potassium consumption is associated with increased bone mineral density (BMD). Longitudinal studies have documented that potassium intake was positively associated with BMD at various sites (Macdonald et al., 2004; Tucker et al., 1999).

### **Article: Effect of Potassium Alkali and Calcium Supplementation on Bone Turnover in Postmenopausal Women**

*Khashayar Sakhaee, Naim M. Maalouf, Steven A. Abrams, and Charles Y. C. Pak*

*Center for Mineral Metabolism and Clinical Research (K.S., N.M.M. C.Y.C.P), University of Texas Southwestern Medical Center, Dallas, Texas 75390-8885; and Department of Pediatrics (S.A.A.) Children's Nutrition Research Center, Baylor College O Medicine, Houston, Texas 77030-2600*

The results of this study may not be applied to use of other calcium salts, Calcium citrate alone was recently shown to be significantly more effective than calcium carbonate alone in reducing markers of bone resorption in postmenopausal women.

Potassium Citrate alone conferred an alkali load, thereby reducing urinary calcium and potentially causing calcium retention. Calcium Citrate alone probably suppressed parathyroid function, conferred a mild alkali load, and reduced bone resorption,.

Potassium citrate in a setting of high calcium intake (with calcium citrate) conferred an alkali load but lacked hypocalciuric action. **Calcium Citrate in a setting of high alkali intake (with potassium citrate) suppressed parathyroid function and conferred a slightly greater alkali load.**

## **Reduced risk of kidney stones**

In several studies, an increased dietary intake of potassium has been associated with a reduced risk of kidney stones.

### **Citrate and renal calculi: an update.**

Pak CY.

Miner Electrolyte Metab. 1994;20(6):371-7. Review.

Center on Mineral Metabolism and Clinical Research, University of Texas Southwestern Medical Center at Dallas  
75235-8885, USA.

**Citrate is an inhibitor of the crystallization of stone-forming calcium salts.** Hypocitraturia, frequently encountered in patients with nephrolithiasis, is therefore an important risk factor for stone formation. Potassium citrate provides physiological and physicochemical correction and inhibits new stone formation, not only in hypocitraturic calcium nephrolithiasis but also in uric acid nephrolithiasis. Inhibition of stone recurrence has now been validated by a randomized trial. Ongoing research has disclosed additional causes of hypocitraturia (sodium excess, low intestinal alkali absorption, but not primary citrate malabsorption). Moreover, new insights on potassium citrate action have been shown, notably that some of absorbed citrate escapes oxidation and contributes to the citraturic response, that ingestion with a meal does not sacrifice physiological or physicochemical action, that orange juice mimics but does not completely duplicate its actions, that potassium citrate may have a beneficial bone-sparing effect, that it may reduce stone fragments following ESWL, and that danger of aluminum toxicity is not great in subjects with functioning kidneys.

**Finally, the research on potassium citrate has led to two promising products, calcium citrate as an optimum calcium supplement and potassium-magnesium citrate which may be superior to potassium citrate in the management of stone disease.**

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## Optimal Calcium/Potassium intake

| <i>Age</i>                               | <i>Calcium<br/>RDA mg/day</i> | <i>Potassium<br/>RDA mg/day</i> |
|--|-------------------------------|---------------------------------|
| <i>Less than 6 months</i>                | 400                           | 400                             |
| <i>6-12 months</i>                       | 600                           | 700                             |
| <i>1-3 years</i>                         | 800                           | 3000                            |
| <i>4-8 years</i>                         | 800-1200                      | 3800                            |
| <i>9-13 years</i>                        | 1200-1500                     | 4500                            |
| <i>14-18 years</i>                       | 1200-1500                     | 4700                            |
| <i>19-30</i>                             | 1000                          | 4700                            |
| <i>31-50 years</i>                       | 1000                          | 4700                            |
| <i>51-70 years</i>                       | 1000                          | 4700                            |
| <i>&gt;70 years</i>                      | 1500                          | 4700                            |
| <i>Women Pregnancy or breast feeding</i> | 1200-1500                     | 4700                            |

On the basis of the available data, an Adequate Intake (AI) for potassium is set at 4.7 g/day (120 mmol/day) for all adults. The table in appendix A illustrates that the AI can be achieved by consuming a diet rich in fruits and vegetables.

However, the actual median intake of potassium in the Western World (especially the US) ranges from 2.8 to 3.4 g /day for men and 2.2 to 2.6g/day for women.

Based on the RDA values of Calcium and Potassium, the optimal Ca/K ratio is:

*At least 1 part of Calcium for 1.5 to 2 parts of Potassium.*

## ***How to choose the most suitable Calcium source for Soy milk fortification?***

Properties to be considered:

- Bioavailability
- Calcium content
- Dispersability
- Organoleptic characteristics
- Effect on the stomach
- Effect on kidney stone formation
- Low tendency of coagulation of proteins.

# ***Which is preferable? Organic Calcium or Inorganic Calcium?***

## **Bioavailability**

It is generally agreed that the bioavailability of Organic Calcium is much higher than Inorganic Calcium.

From the literature it appears that the bioavailability of Organic Calcium is **2 to 5 times** higher than Calcium Carbonate.

On the other hand, the various organic forms of calcium show more or less the same bioavailability with slight advantage to Calcium Citrate.

In addition, potassium/calcium combination may enhance calcium absorption.

## **Calcium Content**

| <b>Organic Calcium</b>   | <b>Calcium</b> |
|--------------------------|----------------|
| Calcium Citrate          | 21%            |
| Calcium Lactate          | 13%            |
| Calcium Gluconate        | 9%             |
| <b>GADOCAL K</b>         | 15%            |
| <b>Inorganic Calcium</b> |                |
| Calcium Carbonate        | 40%            |
| Tri Calcium Phosphate    | 39%            |
| Di Calcium Phosphate     | 23%            |

## **Mouth-feel & Taste**

### **Organic Calcium**

|                   |                              |
|-------------------|------------------------------|
| Calcium Citrate   | Neutral                      |
| Calcium Lactate   | Slightly bitter              |
| Calcium Gluconate | Dry & Slightly bitter, Bland |

**GADOCAL K** Neutral, Bland

### **Inorganic Calcium**

|                       |                |
|-----------------------|----------------|
| Calcium Carbonate     | Chalky & soapy |
| Tri Calcium Phosphate | Sandy, Bland   |
| Di Calcium Phosphate  | Sandy          |

***Conclusion: Gadocal K provides high bioavailability, high calcium content and excellent organoleptic characteristics.***

# *Gadocal K*

Organic calcium source - Citrate

Calcium Content - 15% min.

Potassium Content - 6% min.

Dispersability - Instant

Taste - Neutral, Bland

## Appendix A

Daily Potassium Intake from a Diet Providing 2,200 kcal total daily **4868 mg**

| Meal      | Food/Beverage Consumed   | Calories (kcal) | Potassium (mg) |
|-----------|--|-----------------|----------------|
| Breakfast | Shredded wheat miniatures (1 cup)  | 183             | 248            |
|           | Cantaloupe, cubed (1/2 cup)  | 27              | 214            |
|           | Milk, 1% (8 oz)  | 102             | 290            |
|           | Orange juice (6 oz)  | 82              | 355            |
|           | White toast (1 slice) with unsalted margarine vegetable oil spread (1 tsp)   | 89              | 30             |
|           | Coffee, black, unsweetened (12 oz)   | 13              | 171            |
|           | <i>Total for meal</i>  | <b>496</b>      | <b>1,278</b>   |
| Snack     | Banana (1 medium)  | 105             | 422            |
|           | Water (1 cup)  | 0               | 0              |
|           | <i>Total for meal</i>  | <b>105</b>      | <b>422</b>     |
| Lunch     | Sandwich with turkey (2 oz), swiss cheese (1 oz), lettuce (2 leaves), tomato (1/4" slice), mayonnaise (1 tbsp) and whole wheat bread | 395             | 499            |
|           | Baby carrots (8)   | 28              | 190            |
|           | Fig bar cookies (2)  | 111             | 66             |
|           | Iced tea, brewed, decaffeinated (16 oz)  | 5               | 176            |
|           | <i>Total for meal</i>  | <b>539</b>      | <b>857</b>     |
| Snack     | Almonds, dry roasted, unsalted (1/4 cup)   | 206             | 257            |
|           | Raisins (1/4 cup)  | 108             | 272            |
|           | Milk, 1% (8 oz)  | 102             | 290            |
|           | Water (12 oz)  | 0               | 0              |
|           | <i>Total for Meal</i>  | <b>416</b>      | <b>819</b>     |
| Dinner    | Baked salmon (3 oz)  | 151             | 257            |
|           | Long-grain brown rice (1/2 cup cooked)   | 108             | 42             |
|           | Tossed salad (1 1/2 cups) with safflower oil and vinegar dressing (2 tbsp)   | 155             | 371            |
|           | Asparagus (6 spears)   | 20              | 202            |
|           | Wheat roll, (1 medium) with unsalted margarine vegetable oil spread (1 tsp)  | 101             | 34             |
|           | Angel food cake (1 slice) with sliced strawberries (1/2 cup) and whipped cream topping (2 tbsp)                                      | 114             | 162            |
|           | Iced tea, brewed, decaffeinated (16 oz)  | 5               | 176            |
|           | Coffee, black, unsweetened, decaffeinated (8 oz)   | 9               | 114            |
|           | <i>Total for meal</i>  | <b>663</b>      | <b>1,492</b>   |

