SODIUM PHOSPHATE^{TRIBASIC} LOADING IMPROVES CYCLING TIME TRIAL PERFORMANCE

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Introduction

Professor Richard Kreider reported[2] that one of the most promising of all ergogenic substrates is phosphorus[3]. Phosphorus is intimately involved in a number of metabolic pathways. Phosphate is the major anion of intracellular fluids and the proportion of intracellular phosphate available for energy metabolism depends upon the extracellular concentration[4]. Theoretically, oral dosage of Sodium Phosphate significantly contributes to raising extracellular phosphate levels.

Intracellular phosphate is involved in the regulation of energy metabolism and endurance performance in a number of ways[5]:

- **(1) Increases the rate of ATP production**
- **(2) Increases mitochondrion-enzyme activity**
- **(3) Increases Creatine Phosphate resynthesis process**
- **(4) Enhances Acid-Base balance during exercise**
- **(5) Increases cardiac muscle contractility-response to exercise**
- **(6) Stimulates glycolysis and energy metabolism**
- **(7) May enhance psychological responses to exercise**

SODIUM PHOSPHATE LOADING DOSE RATIONALE

Early research reported sodium phosphate loading dose improve aerobic performance[6] [7]. Most recently ergogenic benefits as reported in 1992 by Kreider[8]. In this study, subjects loaded 4 grams Sodium Phosphate per day for 5 days. During a 40K-time trial, mean power output values increased by +17%, oxygen uptake by +17%, netting an 8% improvement in performance time. Sodium Phosphate supplementation at 4-5 grams per day for 4-5 days before an endurance

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[1]Director Research & Product Development E-CAPS & Hammer Nutrition Ltd., Whitefish, Montana, 1-800-336-1977.

[2] Kreider, R.B., a personal communication, (phosphate supplementation for performance gain in exercise or sport), when Professor Kreider was teaching at the University of Memphis 1998, Memphis, Tennessee, USA.

[3] Kreider, R.B., Phosphate loading and Exercise performance, JOURNAL OF APPLIED NUTRITION, 1992;44:29-49.

[4] Brazy, P., Mandel, J., Does the availability of inorganic phosphate regulate cellular oxidative metabolism, NEWS PHYSIOLOGICAL SCIENCE, 1986;1:100-103.

[5] Ibid Kreider, R.B., personal communication.

[6] Lenfant, C., et al., Role of organic phosphates in the adaptation of man to hypoxia, FED PROC., 1970;29:1115-1117.

[7] Lunne, D., et al., Effect of phosphate loading on RBC 2, 3-DPG, cardiac output, and oxygen utilization at rest and during vigorous exercise, CLINICAL RESEARCH, 1990;28:810.

[8] Kreider, R.B., et al., Effects of phosphate loading and myocardial responses to maximal and endurance exercise. INT J SPORT NUTR, 1992;2:20-47.

event increase performance results significantly. This research specifically utilized Tribasic Sodium Phosphate.

METHOD

I therefore wondered if Lenfant's, Lunne's, and Kreider's performance gains could be duplicated as a result of loading a buffered alkaline salt, Sodium Phosphate (Tribasic), during a taper prior to a time trial cycling event. Five fit cyclists volunteered following their racing season. Each rider had previously recorded personal best time trial results on the course selected for an *all-out* time trial test. During a 5-day taper each subject loaded 4 X 1 gram Tribasic Sodium Phosphate (TSP) in a divided dose each day.

The results of their timed trials are shown in Table I & Figure 1:

TABLE I. SODIUM TRIBASIC PHOSPHATE LOADING DOSE RESULTS[9]				
SUBJECT #	**DISTANCE OR TIME**	**PRE-DOSE TIME**	**POST-DOSE TIME**	**GAIN VS LOSS +/-**
#1	**Hill Climb TT**	**7:25**	**6:56**	**6.50% gain[10]**
#2	**Flat TT 3.3 Mile**	**8:06**	**7:36**	**6.17% gain[11]**
#3	**30:00 Flat TT**	**11.76 miles**	**12.26 miles**	**4.25% gain[12]**
#4	**200m TT Track Event**	**12.80**	**12.40**	**3.10% gain[13]**
#4	**500m TT Track Event**	**38.10**	**37.60**	**1.30% gain[14]**
#5	**Hill Climb TT**	**55:20**	**56:40**	**2.40% loss[15]**
6 Tests	**-----**	**-----**	**-----**	**18.92% Gain Total**
Per Subject	**-----**	**-----**	**-----**	**3.15% Average Gain**

[9] Date of time trial reports were collected at the end of cycling season 10-27-99 in the Pacific Northwest USA.
[10] Betters personal best.
[11] Betters personal best.
[12] Betters personal best.
[13] Betters World Age Group Record & personal best.
[14] Betters World Age Group Record & personal best.
[15] Slower than personal best by 1:20.

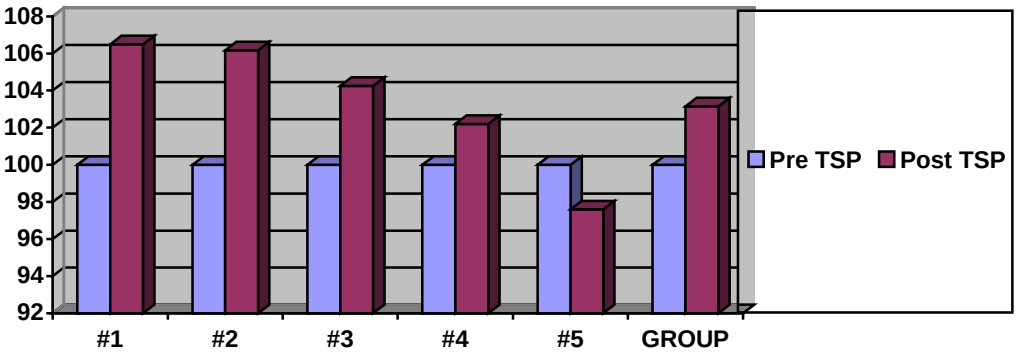

FIGURE 1. ***PERFORMANCE % GAIN 5-DAY TRIBASIC SODIUM PHOSPHATE***

IMPROVED GLYCOGEN STORE WITHOUT CARBOHYDRATE OVERDOSE
Prior to endurance events during a taper, modest storage of glycogen in muscle without excessive carbohydrate calories contributing to fat weight is rational. It has been shown that oral glutamine alone promotes storage of muscle glycogen to an extent similar to oral glucose polymer. Ingestion of glutamine and glucose polymer together promoted the storage of carbohydrate outside of skeletal muscle, the most feasible site being the liver[16].

The effect of preloading maltodextrin on appetite is to reduce the appetite desire to carbohydrate calorie excess. The use of maltodextrin during a loading dose protocol is a positive effectual glycogen loading without over-eating[17].

RACE DAY BOOST (RDB) was subsequently formulated for a pre-race loading dose protocol containing:

1. **Amino acid, L-Glutamine**
2. **Long-chain carbohydrate, Maltodextrin**
3. **Phosphate salt buffering compound, Tribasic Sodium Phosphate**

These exogenous substances when consumed as directed during a taper prior to a competitive event may improve performance.

Furthermore this experimental research suggests that performance gain from a single day's 4 x 1 gram dose loading is less likely than a 5-day loading application. However, a number of athletes report utilizing RDB 2-24 hours between events. They report a performance-enhancing effect, though our field research neither examined nor concluded an effectual ergogenic property from less than a 5-day loading protocol. Loading a buffered phosphate moiety into muscle cell sites requires both time and frequent dose.

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[16] J. L. Bowtell, K. Gelly, M. L. Jackman, A. Patel, M. Simeoni, and M. J. Rennie, Effect of oral glutamine on whole body carbohydrate storage during recovery from exhaustive exercise, Journal of Applied Physiology, June 1999; 86; 6: 1770-1777.

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PRECAUTION: This ergogenic loading protocol should be tested in training prior to racing to confirm its compatibility with your individual biochemistry. Not all athletes (as shown in our field research) may benefit from a buffered loading dose protocol.

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