

**Title: SierraSil as an ergogenic aid to performance in athletes**

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**Title: SierraSil as an ergogenic aid to performance in athletes****Abstract**

In order to investigate the ergogenic properties of SierraSil (SS) we studied 10 male, varsity football players in a double-blind, cross-over design. The athletes (age= 22 years; ht= 183.6 cm; wt = 90.3 kg) performed three Wingate cycle ergometer tests 5 minutes apart as a test of peak power, average power and fatigue index. They recorded delayed-onset muscle soreness (DOMS) on a 0-10 visual analogue scale (VAS) at 24, 48 and 72 hours post-exercise. Prior to exercise and 5 minutes following the last Wingate test, blood was taken for analysis of selected cytokines. The athletes were randomly assigned to SS or placebo (P) conditions for three weeks and, following a three-week washout period, the experimental conditions were reversed. All athletes completed the testing and there were no adverse events. Following SS supplementation the peak power increased by 33.8 W (1109.5 -> 1143.3) and mean power by 6.7 W (636.7 -> 643.4). In the P condition the peak power decreased by 11.2 W (1157.2 -> 1146.0) and the mean power by 17.2 W (655.8 -> 638.6). There were no statistically significant changes in the performance measures between conditions ( $p > 0.05$ ). DOMS values on the visual analogue scale were higher in the P condition at 24, 48 and 72 hrs post-exercise ( $P = 3.2, 2.2, 1.3$  vs. SS = 2.5, 1.6, 0.6). There were no significant changes in the cytokine measures following supplementation with either SS or P. SS is safe to use in highly trained athletes and resulted in improvements in anaerobic power and in reducing the level of DOMS post-exercise. These changes did not reach statistical significance in comparison to P.

## **INTRODUCTION**

The ability to generate maximal anaerobic energy is critical to success in power sports. A number of activities require explosive bursts of activity lasting only a few seconds up to 1-2 minutes. Sports such as football, ice hockey and sprinting rely heavily on the anaerobic metabolic pathways such as the intracellular stores of ATP-PC or the ability to generate ATP via glycolysis<sup>1</sup>.

A specific test was required to quantify the contribution from this energy source and the Wingate Anaerobic test (WT) was introduced in 1974 as a method to measure maximal anaerobic power (peak and mean) and anaerobic fatigue. The WT is a 30-second maximal test that requires an athlete to pedal a cycle ergometer against a resistance, which is determined as a fraction of body mass. The test is accepted as the gold standard for the measurement of anaerobic work<sup>2</sup>. It is safe, easy to administer, valid and gives reproducible results. It is a test commonly used in exercise physiology laboratories.

One of the common side effects of maximal exercise is delayed onset muscle soreness (DOMS). High intensity exercise results in injury to the contractile proteins in muscle and induces an inflammatory response, which is associated with the development of DOMS<sup>4,5</sup>. DOMS is a sensation of discomfort associated with movement or palpation usually felt in skeletal muscle 24 -72 hours following unaccustomed exercise. The sensation can be severe<sup>3</sup>.

Regular physical activity, with no tissue damage and adequate recovery, has a measurable anti-inflammatory effect. The marker most commonly used is interleukin-6 (IL-6). IL-6 has been introduced as the first myokine, defined as a cytokine that is produced and released by contracting skeletal muscle fibers, exerting its effects in other organs of the body<sup>7</sup>. IL-6 is involved in mediating the health-beneficial effects of exercise, specifically in the protection against chronic diseases associated with low-grade inflammation.

However, if there is tissue damage or inadequate recovery, pro-inflammatory effects are evident and the cytokine measured to reflect this process is Tumor Necrosis Factor-alpha (TNF- $\alpha$ )<sup>7</sup>. The mode, duration and intensity of physical activity influence whether a single bout of exercise has pro-inflammatory or anti-inflammatory effects.

SierraSil is a natural, mineral supplement that is safe and well tolerated at doses up to 3335 mg/day. It is used to improve joint health and function and has demonstrated early relief of symptoms of osteoarthritis in a randomly controlled trial<sup>6</sup>.

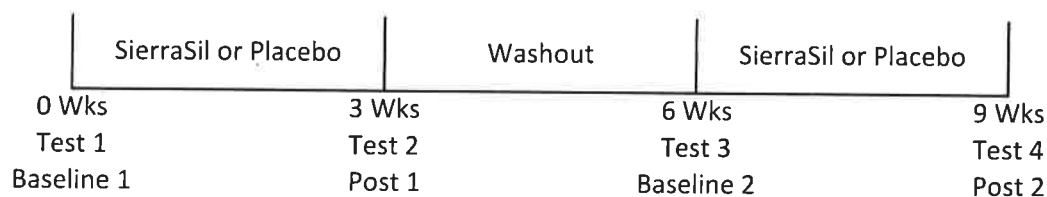
The purpose of this study was to examine whether SierraSil could improve anaerobic power in a group of well-trained athletes.

A secondary purpose is to examine the effect of SierraSil on the severity of DOMS.

### Study design

This was a double blind, crossover, pilot study that examined the effect of SierraSil supplementation on the determinants of human performance. Anaerobic capacity, muscle fatigue, the severity of delayed onset muscle soreness (DOMS) and markers of inflammation were measured before and after 3 weeks of supplementation with SierraSil or placebo. There was a 3-week washout period prior to the crossover to ensure SierraSil supplementation has no residual effect.

Figure 1. Study Design



## METHODS

### Subjects

Ten male varsity athletes, age= 22 years; ht= 183.6 cm; wt = 90.3 kg were recruited for this study. They were healthy and not taking any form of anti-inflammatory or analgesic medication.

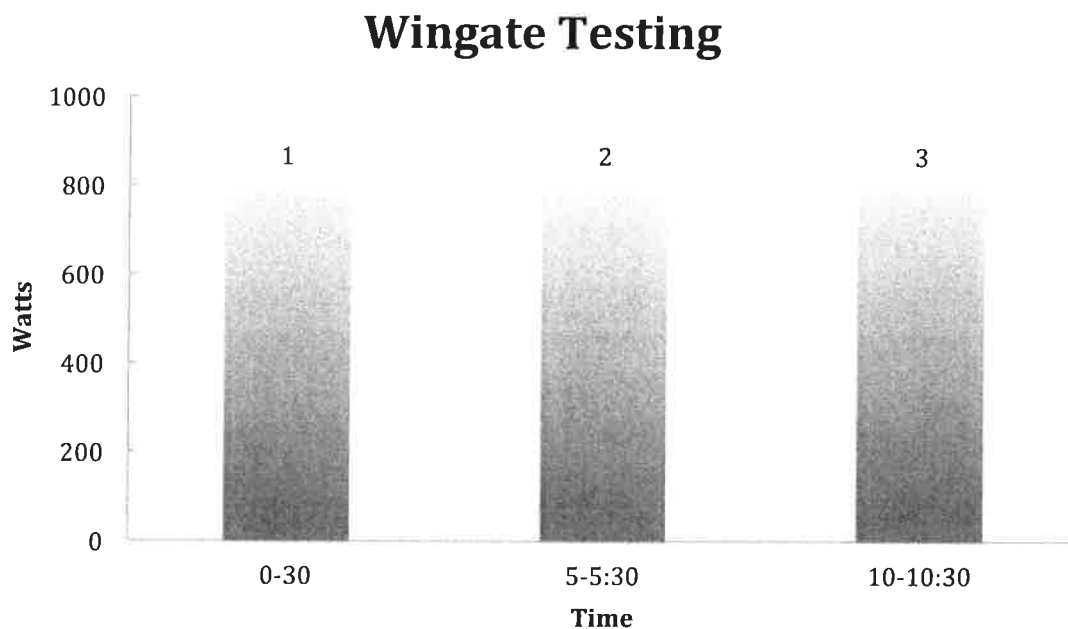
### Laboratory Testing

**Wingate Test:** A Monark 824E cycle ergometer equipped with a 1.0 kg resistance basket and a photoelectric sensor to record the flywheel revolutions was used to measure indices of anaerobic capacity. The resistance for the test was determined for each subject using 7.5% of body mass in kg. Data for each 30s test was collected using Power Software and stored for later analysis.

Each subject completed a 10 minute, self-selected warm-up including stretching exercises and cycling on the ergometer. The seat was adjusted to allow ~15 degrees of knee flexion. Toe stirrups were used and subjects were instructed to remain seated for the test. Verbal encouragement was given throughout the test.

At the start of the test, the calculated resistance was added to the basket, which was suspended above the flywheel. Each subject was instructed to begin pedaling so they achieved a maximum rpm at the end of a 5s countdown. The weight was dropped at that time and the data recorded for 30 seconds. There was a 4.5-minute recovery period between intervals, during which the subject pedaled the ergometer at a low velocity with 1 kg of resistance. Water was permitted and the subject could get off the bike to stretch. To test total work, peak anaerobic power and muscle fatigue the Wingate test was repeated 3 times. See Figure 1.

Figure 2. Wingate Testing protocol



### Supplementation

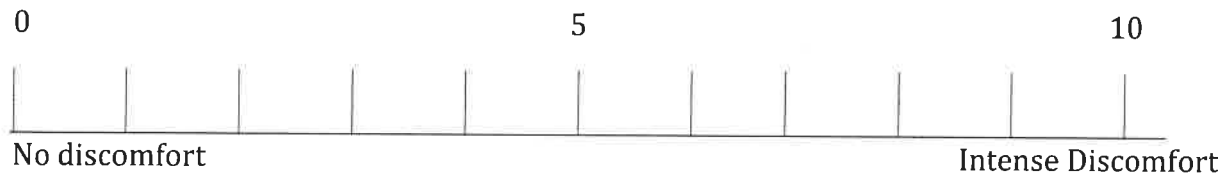
Subjects were randomly assigned to the placebo or SierraSil group and received supplementation for 3 weeks. Post-supplement testing was repeated followed by a 3-week washout period. With the crossover design, all subjects received both SierraSil and placebo. The products were dispensed according to the manufacturer's recommendation.

### DOMS

Delayed onset muscle soreness usually peaks at ~ 24-48 hours post-exercise and each subject was asked to evaluate soreness on a 10cm visual analog scale (VAS) as

outlined below. The subjects were instructed to do 3 deep squats and then record the degree of discomfort on the VAS. Data for DOMS was collected at baseline and at 24, 48, and 72 hours post-exercise.

*Figure 3: DOMS Visual Analogue Scale*



### *Cytokines*

A 5ml blood sample was taken before and after the exercise protocol. Plasma was separated and frozen at -70 degrees for measurement of TNF- $\alpha$ , CR-P and IL-6 (VGH laboratory).

### **Outcome Measures**

Mean anaerobic capacity in all three WT tests was the primary outcome measure. Other outcome variables included peak power and muscle fatigue over the three Wingate tests, the magnitude of DOMS following the anaerobic sessions and the changes in the cytokines TNF- $\alpha$ , CR-P and IL-6.

### **Statistical Analysis**

Analysis of variance (ANOVA) will be used to test the difference between the two experimental conditions in the primary and secondary outcome measures. The significance level was set at  $p < 0.05$ .

## RESULTS

A Summary of the results is presented in Table 1 and 2.

TABLE 1. Performance and DOMS results.

	Pre-Supplementation			Post-Supplementation			Change from pre- to post-supplementation		
	SierraSil	Placebo	p	SierraSil	Placebo	p	SierraSil	Placebo	p
<b>Performance</b>									
<b>Mean Power</b>	636.7 (83.0)	655.8 (71.4)	0.59	643.4 (60.6)	638.6 (61.4)	0.86	+6.63 (38.1)	-17.2 (35.7)	0.17
<b>Peak Power</b>	1109.5 (137.6)	1157.2 (125.2)	0.43	1143.3 (132.4)	1146.0 (92.9)	0.96	+33.1 (11.3)	-11.2 (75.3)	0.16
<b>Min Power</b>	409.8 (49.3)	409.0 (56.3)	0.97	411.8 (46.1)	410.8 (42.6)	0.96	+2.0 (24.8)	+1.7 (46.6)	0.99
<b>DOMS</b>									
<b>Overall</b>	-	-	-	1.6	2.2	.34	-	-	-
<b>After 24hr</b>	-	-	-	2.5	3.2	.44	-	-	-
<b>After 48hr</b>	-	-	-	1.6	2.2	.46	-	-	-
<b>After 72hr</b>	-	-	-	0.6	1.3	.25	-	-	-

Note: values presented are means; standard deviations are provided in brackets; p-values reflect differences between conditions on each measure.

Table 2. Cytokine values.

Blood Test	Condition	T1 Pre-exercise	T1 Post-exercise	T2 Pre-exercise	T2 Post-exercise
<b>CRP</b>	SierraSil	2885.38 (1458.46)	3550.30 (1930.32)	3530.32 (3394.38)	4172.02 (4196.12)
	Placebo	2331.35 (1004.24)	2450.78 (1166.57)	6537.05 (8657.05)	5050.80 (8225.21)
<b>IL6</b>	SierraSil	.76 (.25)	.95 (.20)	.98 (.51)	1.28 (.94)
	Placebo	1.05 (.67)	1.07 (.37)	.73 (.25)	.91 (.26)
<b>TNF<math>\alpha</math></b>	SierraSil	1.93 (.39)	2.28 (.37)	1.99 (.32)	2.16 (.80)
	Placebo	2.68 (2.12)	3.06 (2.59)	2.02 (.66)	2.39 (.52)

Values presented are means; standard deviations are provided in brackets. There were no statistically significant differences between conditions.

Figure 1. Changes in peak power and mean power with supplementation (Watts)

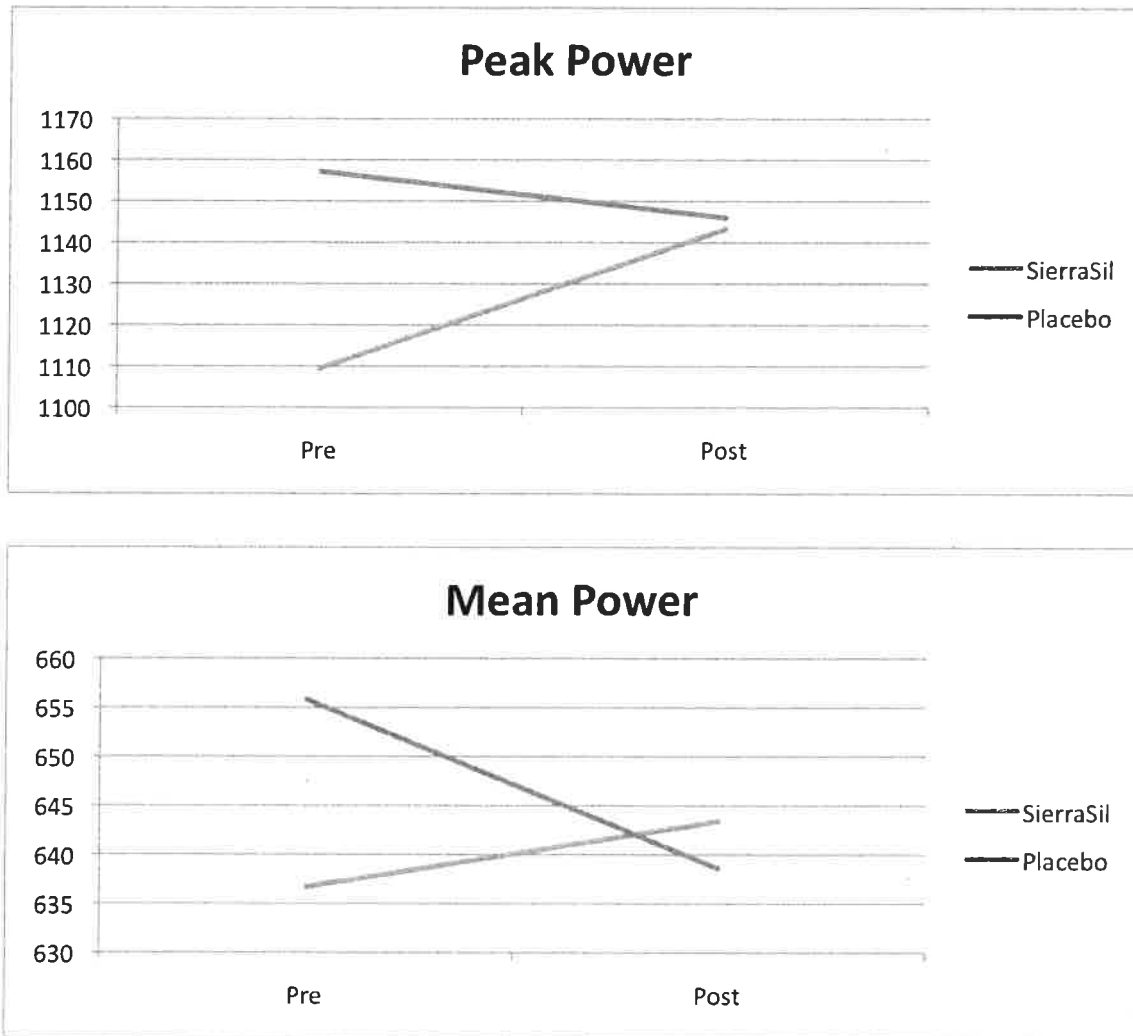
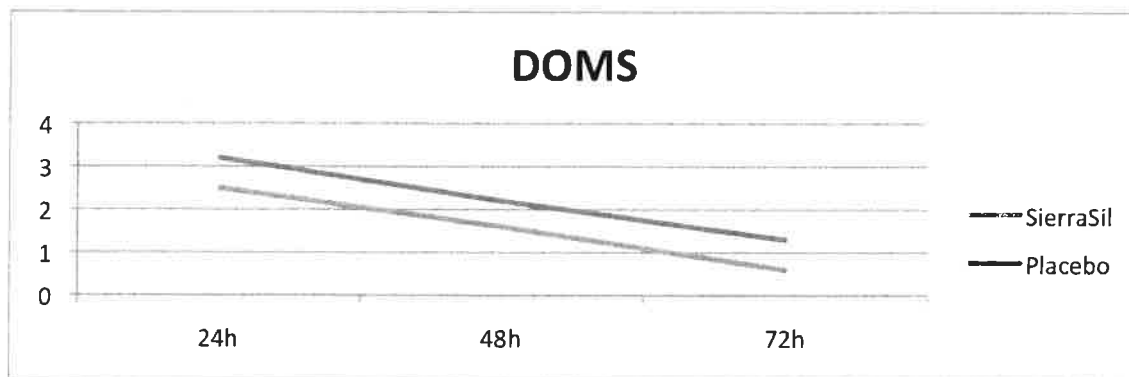


Figure 2. Changes in delayed-onset muscle soreness with SierraSil supplementation





## Discussion Points

SierraSil is well tolerated by highly trained male athletes. There were no adverse effects reported.

Following appropriate research methodology and statistical analyses, there were no significant changes in anaerobic power, DOMS or the blood parameters. There was no statistical significance in any measurement in comparing SierraSil to Placebo. That is the take-home message according to traditional research.

Nevertheless, despite the fact that there were no statistically significant differences between the SierraSil and Placebo conditions for all variables, the results followed the expected outcome for both the performance and DOMS data. There was a small increase in both peak (3%) and mean (1%) power after supplementing with SierraSil and a small decrease in the Placebo condition (-2.6 and -1%, respectively). Although these differences were not statistically significant, to the high performance athlete a 3% increase in performance is certainly sport significant.

SierraSil has anti-inflammatory properties and this may be the reason for the differences in the DOMS scores. Although the scores were not high, the pattern of decline is linear and the values were lower at each time period, after taking SS.

The cytokine values were disappointing. There is a large variability in these young men and the effect of SierraSil was lost in this variability.

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