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ACUTE EFFECTS OF THEACRINE SUPPLEMENTATION ON MUSCULAR STRENGTH AND MUSCULAR ENDURANCE

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A Research Paper

Submitted in Partial Fulfillment of the Requirements for the

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RESEARCH PAPER APPROVAL

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Approved by:

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AN ABSTRACT OF THE RESEARCH PAPER OF

CALEB J. SNYDER, for the Master of Science in Education degree in KINESIOLOGY, presented on April 11, 2016, at Southern Illinois University Carbondale.

TITLE: ACUTE EFFECTS OF THEACRINE SUPPLEMENTATION ON MUSCULAR STRENGTH AND MUSCULAR ENDURANCE

MAJOR PROFESSOR: Dr. Motier D. Becque

There are many performance-enhancing supplements on the market. Theacrine (1,3,7,9-tetramethyluric acid) is a new product similar to caffeine. Both are purine alkaloids thought to act as adenosine receptor antagonists. It has been reported to increase subjective energy levels among other beneficial effects, but has not yet been tested on muscular strength and muscular endurance. In a randomized, double-blind, placebo controlled study, eleven healthy resistance trained college-aged males received a 200mg dose of theacrine or a placebo. One-repetition max (1RM) and maximal repetition tests were performed after supplementation. A one-way repeated measures analysis of variance was completed between the treatments (placebo, theacrine) to examine mean differences. Means for the placebo (P) versus theacrine (T) treatment for bench press 1RM 125.6 ± 18.3 kg (P) and 125.2 ± 16.8 kg (T). Means for the leg press 1RM were 419.0 ± 62.6 kg (P) and 425.0 ± 72.3 kg (T). Means for the bench press endurance were 12.1 ± 2.3 reps (P) and 12.3 ± 2.0 reps (T). Means for the leg press endurance were 14.8 ± 4.1 reps (P) and 15.5 ± 5.3 reps (T). Results indicate that acute supplementation with theacrine did not significantly improve muscular strength or muscular endurance.

Keywords: theacrine, performance, muscular strength, muscular endurance

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INTRODUCTION

The pursuit of enhanced performance is rampant in the sporting environment. A wealth of pre- and post-workout supplements are available to consumers. Many of these supplements contain ingredients such as caffeine, taurine, beta-alanine, betaine, creatine, citrulline, and others. Ingredients shown to have marked effects on improving performance parameters such as muscular strength and muscular endurance include caffeine (Astorino, Terzi, Roberson, & Burnett 2010; Beck et al., 2006), beta-alanine (Hoffman et al., 2008), creatine monohydrate (Cramer, Stout, Culbertson, Egan, 2007), and L-citrulline (Perez-Guisado & Jakeman, 2010). Recently, a new compound has been uncovered that claims to have benefits such as boosting mental and physical energy (Habowski, Sandrock, Kedia, & Ziegenfuss, 2014), supporting energy without habituation (Feduccia et al., 2012; Taylor et al., 2016), possessing anti-inflammatory properties (Wang et al., 2010), and improving perceived focus and concentration (Habowski et al., 2014). This compound is 1, 3, 7, 9-tetramethyluric acid, a purine alkaloid also known as theacrine. It is derived from the *kucha* variation of the *Camellia assamica* tea plant grown in the Yunnan Province of China (Li et al., 2013).

Feduccia et al. (2012) report that theacrine is thought to be an adenosine receptor antagonist at high doses (combination of A_1 and A_{2A} inhibition) as well as a dopamine receptor antagonist (D_1 and D_2 receptors) and seems to show a dose-dependent increase in locomotor activity in mice. This is similar to the way in which caffeine acts as an adenosine receptor antagonist (Astorino et al., 2010). The question then arises if theacrine would act in a similar manner to caffeine on exercise performance when administered in the dose of 200 mg, which has previously been shown to increase subjective energy levels (Habowski et al., 2014). The purpose

of this study was to determine the acute effects of theacrine supplementation on muscular strength and muscular endurance.

METHODS

Participants

Twelve healthy male participants (age 22.3 ± 1.5 years, height 179.3 ± 5.6 cm, mass 88.0 ± 10.0 kg) from Southern Illinois University Carbondale were recruited for this study. Participants met a minimum requirement of 2 years of consistent resistance training experience. Participants were in good health for the last 30 days, free from orthopedic problems, neurological dysfunction, and reported no previous or present injuries before participating in the study. One participant dropped out after the first testing day due to factors outside of the study. Participants were given an oral explanation of the study, followed by an informed consent document and medical questionnaire. Southern Illinois University Human Subjects Committee approval was obtained prior to the initiation of this study.

Study design

A randomized, double-blind, placebo-controlled design was employed for this study. Testing for each participant was performed on 2 separate days, one week apart, and at the same time of day. All testing procedures were the same on both days. Participants selected the time that they wished to perform the tests. To control for dietary effects, all participants were asked to abstain from caffeine and pre-workout supplements from 6 pm on the previous day of testing. They were also required to turn in a 2-day dietary recall, and match meals for the day before testing and the day of testing. The principal investigator as well as the participants were blind to the contents of the capsules. Randomization involved assigning the capsules containing the treatments to plastic bags with labels for testing day 1 and day 2. After ingesting the randomized

capsules with 8 oz water, the participants sat quietly for 30 minutes. All participants then completed a 3-minute warm-up on a SciFit Pro 2 total body ergometer (Tulsa, OK). The principal investigator spotted each participant one at a time for max testing. All participants began bench max testing on a standard Nautilus bench press (Vancouver, WA) with a warm up of 10 repetitions at their choice of weight. Weight was then added incrementally until a true 1-rep max was achieved. The last weight successfully lifted before a failed attempt was recorded as the 1RM. Two minutes of rest were allowed between each max attempt. After completing the bench max testing, participants performed a warm up of 10 repetitions at their choice of weight on a standard Nautilus leg press machine (Vancouver, WA). Weight was then added incrementally until a true 1-rep max was achieved. The last weight successfully lifted before a failed attempt was recorded as the 1RM. Two minutes of rest were allowed between each max attempt. Following bench and leg press max testing, participants returned to the bench press and performed a single, maximal repetition attempt using 70% of the weight achieved in the bench press 1-rep max test. After a two-minute rest, participants performed a single, maximal repetition attempt using 70% of the weight achieved in the leg press 1-rep max test. The number of repetitions successfully completed for the bench press and the leg press were recorded as muscular endurance. Participants were then asked whether they thought they received the placebo or theacrine treatment.

Independent variables

Theacrine was provided in the form of TeaCrine™ (Compound Solutions, Inc., Carlsbad, CA) in capsulated doses of 200mg. Cellulose was employed as the placebo treatment in capsules identical to the TeaCrine™ capsules in size and color. Neither treatment holds nutritional value.

Dependent variables

Bench Press 1-rep max. The amount of weight lifted one time before a failed attempt was recorded as the 1 repetition max for the bench press. In order for a lift to be counted, the bar must have been lowered to the level of the chest, paused, and lifted to full elbow extension with no assistance from the principal investigator.

Leg Press 1-rep max. The amount of weight lifted one time before a failed attempt was recorded as the 1 repetition max for the leg press. In order for a lift to be counted, the sled must have been lowered to a level just past 90 degrees of knee flexion, paused, and lifted to full knee extension with no assistance from the principal investigator.

Bench Press endurance. A maximal repetition attempt was performed using 70% of the weight that each participant achieved during the max testing on that day. In order for a repetition to be counted, the bar must have been lowered to the level of the chest, paused, and lifted to full elbow extension with no assistance from the principal investigator.

Leg Press endurance. A maximal repetition attempt was performed using 70% of the weight that each participant achieved during the max testing on that day. In order for a repetition to be counted, the sled must have been lowered to a level just past 90 degrees of knee flexion, paused, and lifted to full knee extension with no assistance from the principal investigator.

Statistical Analyses

All statistical data were analyzed with SuperANOVA (Abacus Concepts, Inc., Berkeley, CA). A one-way repeated measures analysis of variance (ANOVA) was completed between the treatments (placebo, theacrine) to examine mean differences. Descriptive statistics are presented with mean ± SD. The significance level was set at $\alpha = .05$.

RESULTS

Bench press 1-rep max

The mean for the placebo treatment was 125.6 ± 18.3 kilograms. The mean for the theacrine treatment was 125.2 ± 16.8 kilograms. No significant differences were found ($p = .6400$, $F(1,10) = .233$) in bench press max between the placebo and theacrine treatments. Four out of 11 participants increased their bench press 1-rep max after theacrine supplementation compared to placebo by an average of 2.8 kilograms (Appendix A, Table 1).

Leg press 1-rep max

The mean for the placebo treatment was 419.0 ± 62.6 kilograms. The mean for the theacrine treatment was 425.0 ± 72.3 kilograms. No significant differences were found ($p = .3765$, $F(1,10) = .857$) in leg press max between the placebo and theacrine treatments. Six out of 11 participants increased their leg press 1-rep max after theacrine supplementation compared to placebo by an average of 22.3 kilograms (Appendix A, Table 2).

Bench press endurance

The mean for the placebo treatment was 12.1 ± 2.3 reps. The mean for the theacrine treatment was 12.3 ± 2.0 reps. No significant differences were found ($p = .7787$, $F(1,10) = .083$) in bench press maximal repetitions between the placebo and theacrine treatments. Five out of 11 participants increased their bench press repetition maximum after theacrine supplementation compared to placebo by an average of 1.8 reps (Appendix A, Table 3).

Leg press endurance

The mean for the placebo treatment was 14.8 ± 4.1 reps. The mean for the theacrine treatment was 15.5 ± 5.3 reps. No significant differences were found ($p = .5286$, $F(1,10) = .426$) in leg press maximal repetitions between the placebo and theacrine treatments. Five out of 11

participants increased their leg press repetition maximum after theacrine supplementation compared to placebo by an average of 3.2 reps (Appendix A, Table 4).

Dietary compliance

Review of 2-day dietary recalls showed compliance for all participants. Many participants matched meals, while the remaining matched calories and macronutrients in the day preceding and day of individual testing. All participants abstained from caffeine and any other stimulant-containing pre-workout supplements from 6 pm on the previous day of individual testing.

DISCUSSION

The major finding of this study is that theacrine does not acutely enhance muscular strength nor muscular endurance. To the best of our knowledge, all participants complied with every instruction, yet no marked effects were felt either during the study, or at any time after the study. Participants were instructed to continue their normal lifting routines throughout the week, as long as they did not complete a maximum lift within 48 hours before testing days. No participants completed a maximum lift in between testing days. Additionally, no participant was sore on the day of testing for both days.

Previous studies have shown theacrine to be effective after an ingestion period of 90 minutes. This study used an ingestion period of 30 minutes, with total test time for each participant averaging approximately 90 minutes for both testing days across participants. Participants were accustomed to pre-workout supplements and were aware of the typical effects felt by taking ergogenic aids. No participant reported feeling any obvious marked effects for the duration of the test or the remainder of the day following testing. Interviewing upon cessation of each test day revealed that participants correctly guessed the theacrine treatment only 54% of the

time. Some faint effects of increased focus, subtle bump in energy, and increased body temperature were reported by a small number of participants. Effects such as boosting mental and physical energy, supporting energy without jitters, irritability, or habituation, supporting a positive mood, increased motivation to exercise, and improved perceived focus and concentration were scarcely reported.

With only four of eleven participants increasing bench 1RM, five of eleven increasing bench press endurance, and five of eleven increasing leg press endurance, theacrine seems to be ineffective as an ergogenic aid. However, six of eleven participants increased their leg press 1RM by an average of 22.3 kilograms. This increase appears interesting when compared to the other dependent variables, but is small and only a five percent increase. Given these factors, it appears in this study that theacrine was ineffective at enhancing muscular strength or muscular endurance.

CONCLUSION

Theacrine has several positive effects on mood, energy, motivation, and focus as an apparent adenosine receptor antagonist. The results of this study suggest that theacrine is not an effective acute aide for improving either muscular strength or muscular endurance.

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APPENDIX A

Table 1

Bench Press 1RM (kg)		
Subject	Placebo	Theacrine
1	122.7	122.7
2	127.3	125
3	118.2	122.7
4	136.4	134.1
5	93.2	95.5
6	136.4	138.6
7	127.3	125
8	129.5	125
9	95.5	97.7
10	140.9	138.6
11	154.5	152.3

Table 2

Leg Press 1RM (kg)		
Subject	Placebo	Theacrine
1	377.3	390.9
2	431.8	418.2
3	431.8	404.5
4	459.1	486.4
5	327.3	318.2
6	545.5	590.9
7	400	390.9
8	350	370.5
9	368.2	386.4
10	468.2	459.1
11	450	459.1

Table 3

Bench Press Endurance (reps)		
Subject	Placebo	Theacrine
1	13	11
2	9	8
3	7	12
4	12	13
5	13	13
6	15	16
7	12	13
8	12	13
9	15	12
10	12	11
11	13	13

Table 4

Leg Press Endurance (reps)		
Subject	Placebo	Theacrine
1	14	14
2	10	9
3	13	15
4	11	10
5	12	13
6	20	22
7	20	14
8	11	16
9	22	28
10	15	14
11	15	15

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