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Repository citation: Kloote, Colton; Christensen, Dane; Koran, Tyler; Mitchell, Danielle; and Barrett, Grant, "Effect of Caffeine Supplementation on Tennis Serve Velocity and Accuracy During Simulated Match Play" (2022). *21st Annual Celebration of Undergraduate Research and Creative Activity (2022)*. Paper 19.

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Effect of Caffeine Supplementation on Tennis Serve Velocity and Accuracy During Simulated Match Play

Grant Barrett, Dane Christensen, Colton Kloote, Tyler Koran, and Danielle Mitchell
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Abstract

The purpose of this study is to determine the acute effects of caffeine ingestion on serve velocity and accuracy in collegiate tennis players during simulated match play. Previous research has shown some effect of caffeine on serve performance in later stages of a simulated match, but little research has been completed on the acute effects of caffeine in a shorter match. Further, there is limited research on realistic tennis play involving serves interspersed with rallies. Participants will include 7 male and female tennis players from the Hope College tennis team. The study will incorporate a double-blind design. Each participant will have weight and blood pressure measurements taken and will be familiarized with the protocol on the first visit of three. On the second and third visits, participants will consume either a caffeine or placebo capsule 1 hour prior to the start of the protocol, and the order of capsules will be randomized for each participant. Caffeine capsules will contain 3 mg per kg of body weight and placebo capsules will contain unflavored gelatin. All participants will perform a standardized warm-up before starting the protocol. The protocol will be composed of 7 games, alternating between a serving and returning game. Each serving game will have 6 points, and each point will consist of a first serve, a second serve, and between 4-8 feeds from the ball machine. Each returning game will have 4 points, and each point will consist of between 5-7 feeds from the ball machine. It is hypothesized that accuracy and velocity will be greater in the caffeine trials compared to the placebo trials. Significant results would allow caffeine to be suggested as a way of improving serve performance in Division III tennis athletes.

Introduction

- Serve performance is vital in tennis; it is the one shot that the player has complete control over
- Caffeine has been determined to enhance several performance measures (Astley, 2018)
- Limited research on caffeine and tennis performance
- Increase in serving velocity during a long simulated match (Hornery, 2007) and increase in serving accuracy in a simulated match have been found (Poire, 2019)
- Acute effects of caffeine on volleyball spike velocity (Pérez-López, 2015)

Purpose

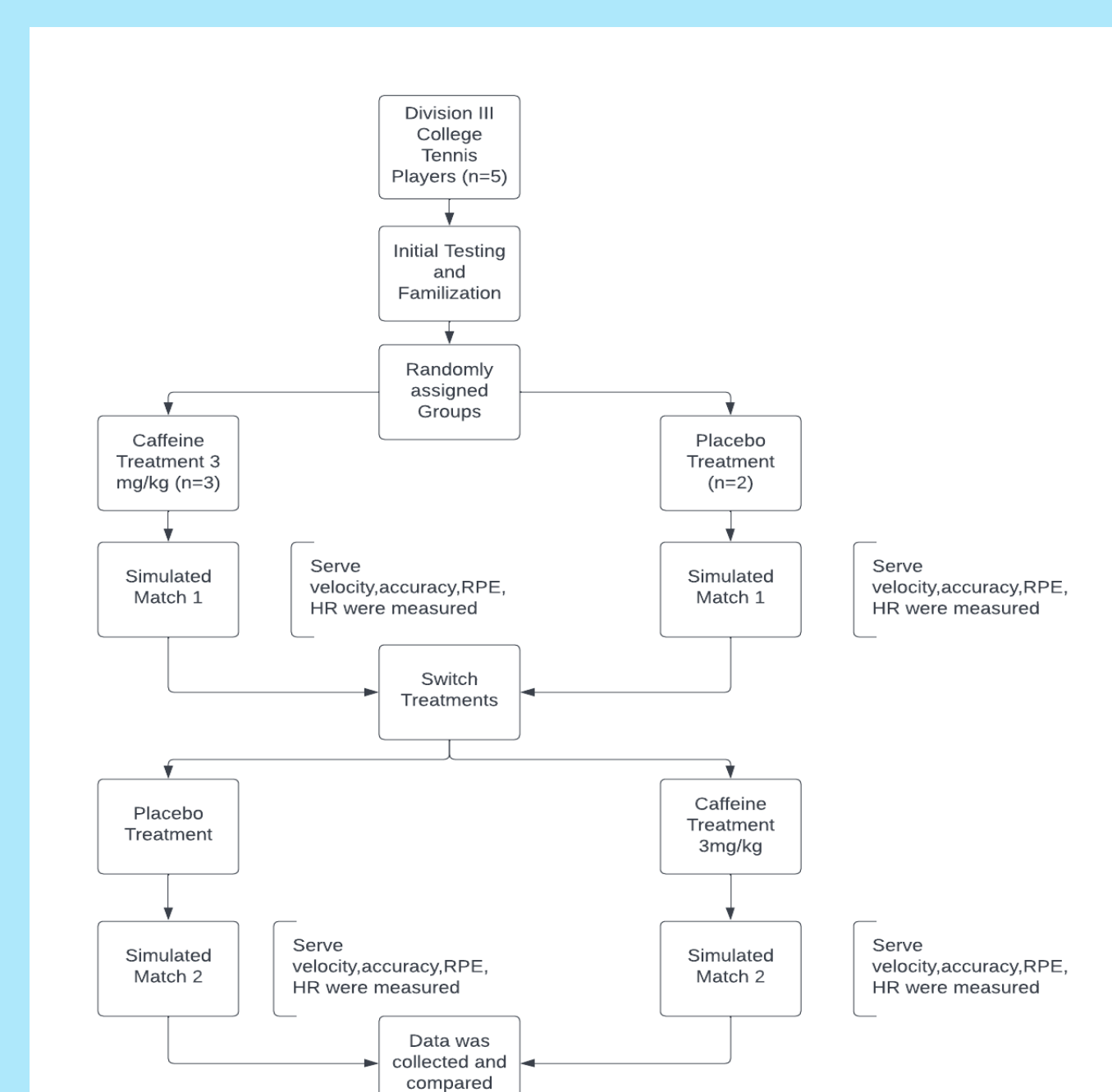
To determine the effect of caffeine on serve velocity, measured with a speed radar, and serve accuracy, using a grid scoring system, during simulated match play in which participants receive groundstroke feeds from a ball machine to simulate fatigue.



Methods

Subjects: 5 (4m, 1f) Hope College tennis players (age 18-23).

Study Design:



- This study took place over 3 visits to the Dewitt Tennis Center
- On Day 1, weight and blood pressure measurements were taken, and participants were familiarized with the testing protocol.
- On Days 2 and 3, participants took either caffeine (3 mg per kg body weight) or placebo capsules prior to performing the testing protocol.

The testing protocol consisted of a seven game simulated match in which participants served and received groundstroke feeds from a ball machine to simulate fatigue. Serve velocity, serve accuracy, heart rate, and RPE were measured.



Results

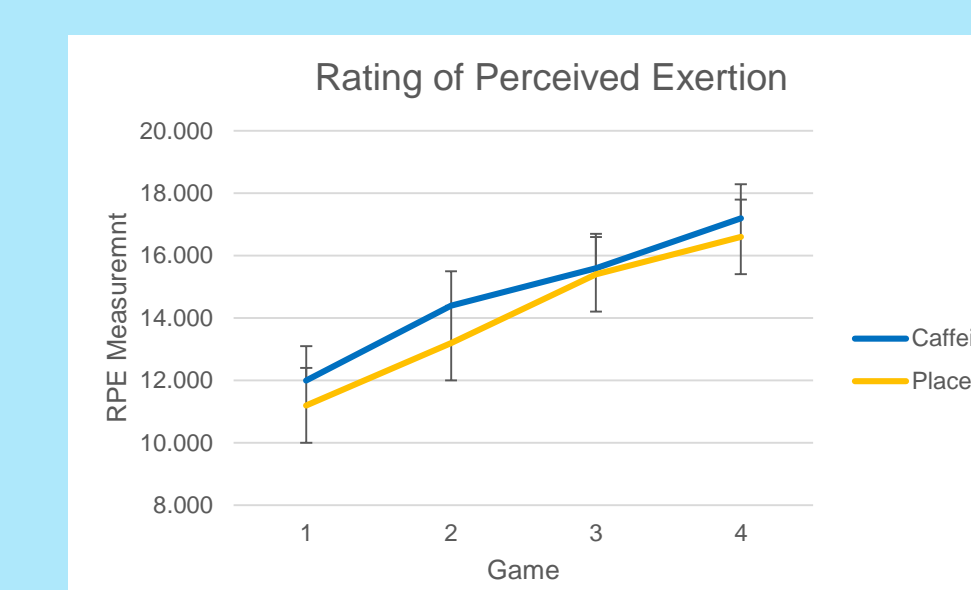


Figure 1. Mean RPE measurements during caffeine and placebo trials in relation to game played. RPE increased over time for both trials. RPE for the caffeine trials trended toward being significantly greater than placebo. (p=0.14)

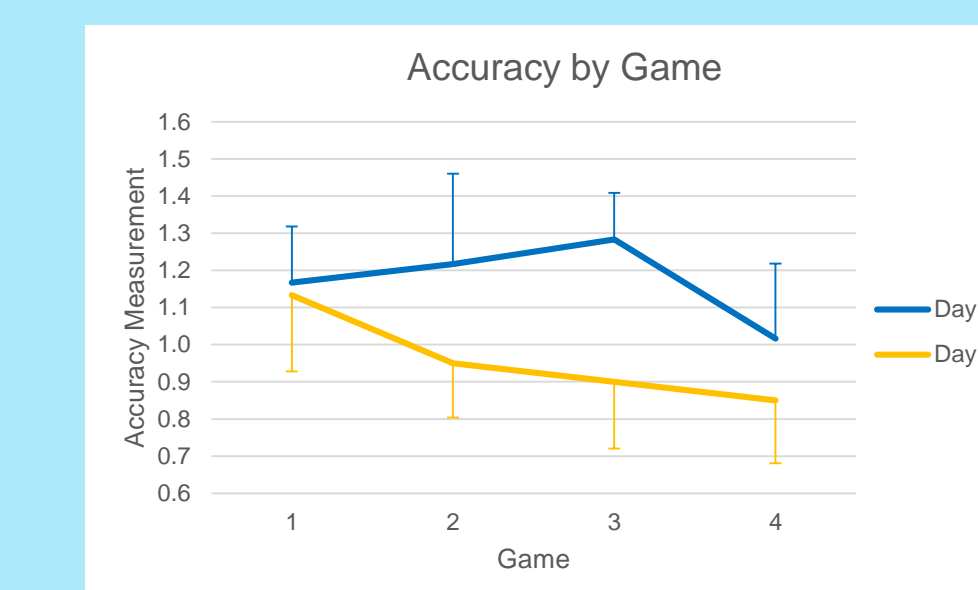


Figure 2. Accuracy scores from Day 1 to Day 2 by Game. Serves were more accurate on Day 1 compared to Day 2 (p=0.043)

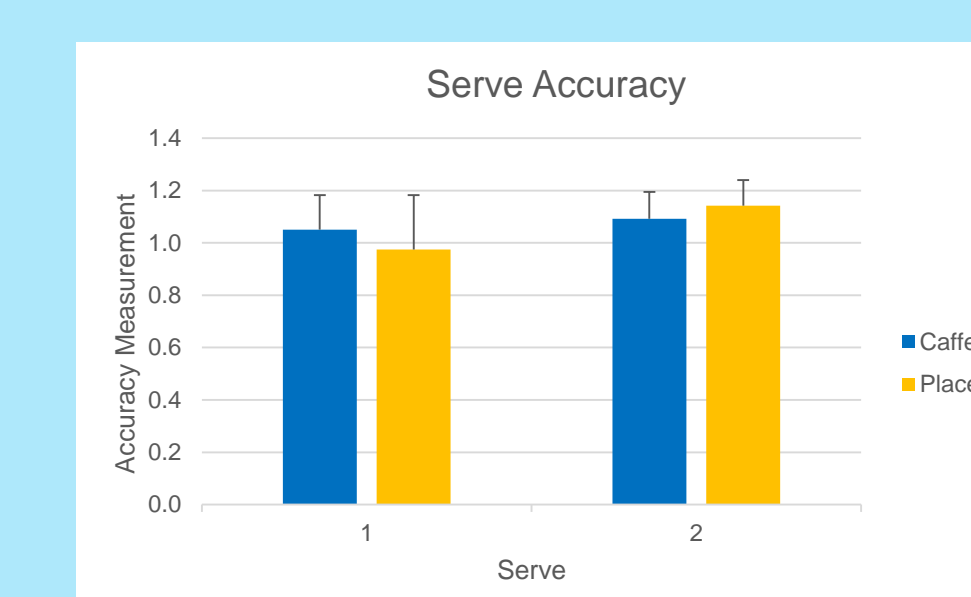


Figure 3. The relationship between serving accuracy and trial. There was no effect of caffeine on serving accuracy. Accuracy was also not different between the first serve and the second serve

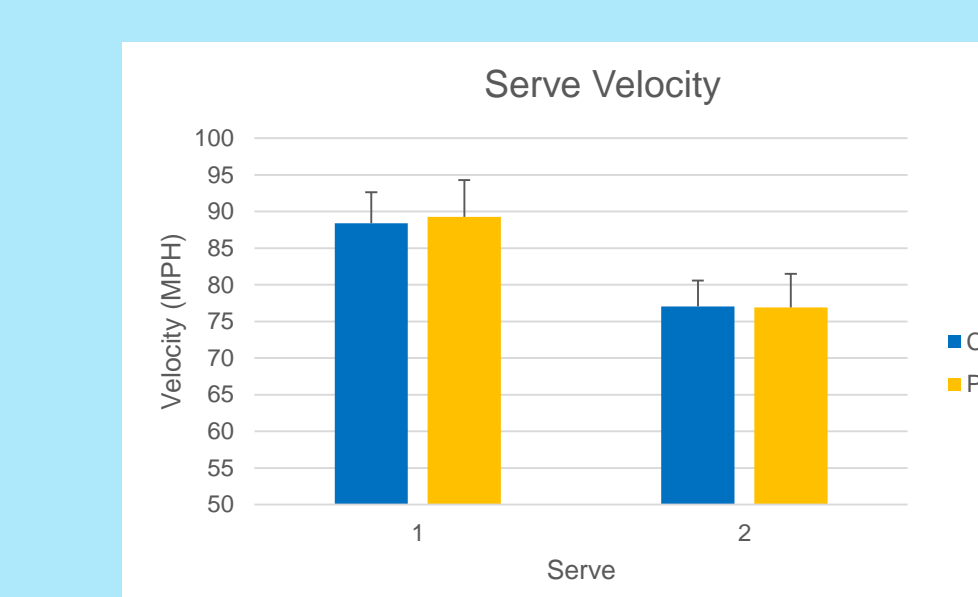


Figure 4. Serve velocity by treatment. There was no difference in serve velocity between treatments. The first serve was significantly faster than the second serve (p = 0.013)

Discussion

Conclusions

1. Heart rate and RPE increased over the course of the testing protocol.
2. RPE did not differ between the caffeine and placebo trials but was trending towards being higher with caffeine.
3. Accuracy and velocity did not differ between caffeine and placebo trials.
4. Accuracy performance decreased on day 2 compared to day 1
5. No difference in accuracy from serve 1 compared to serve 2

Limitations

- Limited sample size
- Dropouts
- Unregulated string tension
- Participants' motivation and effort during testing

Implications

1. A simulated match with ball machine feeds is able to produce fatigue.
2. Caffeine may not have an acute effect on tennis performance
3. Further research should be conducted with a similar protocol performed over a match-like duration with more participants

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