

## **The Effects of Caffeine on Shooting Performance**

By Bianca Share, Nick Sanders and Justin Kemp

In June/July 2006, Australian Catholic University (ACU) in conjunction with the Australian International Shooting Ltd (AISL) and the Victorian Institute of Sport (VIS) conducted a research project investigating the effects of caffeine ingestion on shooting performance in the Olympic doubletrap event. The groundings for the research was an Honours thesis completed by Bianca Share under the supervision of Dr Justin Kemp (ACU) and Nick Sanders (AISL).

Caffeine is the most widely consumed psychoactive (nerve affecting) drug in the world, commonly used in sport and military operations for its known stimulatory effects<sup>1</sup>. Previous research in endurance-based activities, such as cycling and running, has suggested that caffeine ingested in tablet form (eg. NO-DOZ™) can act as an ergogenic (enhancing) aid, providing benefits to performance via the increase of time to exhaustion<sup>7</sup>. Caffeine has also been shown to improve skill-based activities including improvements in reaction time<sup>3</sup>, increase target detection speed<sup>2</sup> and enhance shooting accuracy<sup>6</sup>.

### ***Reasons for the research:***

In January 2004, caffeine was one of several substances removed from the Prohibited Substance List by the World Anti-Doping Agency, yet the supplement is still being closely monitored in doping tests. This change in classification now enables the use of caffeine in sporting activities and competition for the specific purpose of performance enhancement, without fear of sanction. There are concerns, however, that some athletes may ingest caffeine in the hope of obtaining a performance edge, with little to no scientific knowledge guiding the dosages used or that the substance will actually provide a performance enhancement. Furthermore, the unrestricted use of caffeine in the sporting world may have adverse implications<sup>4</sup> on the health of caffeine-naïve individuals, particularly from the consumption of extremely high doses.

Several elite shooting athletes had in fact inquired as to what quantity of caffeine ingestion may be classified as safe and appropriate for the sport of clay target shooting. These athletes reported intentional consumption of caffeinated products such as cola, coffee, red bull and caffeine tablets in the quest for a performance edge. It was this scenario that prompted Nick Sanders, the Sports Scientist for the Australian Shooting Team at the time, to conduct the research and publish the findings to provide answers for these athletes.

***Project Aims:***

The purpose of this study was to assess the effects of two different doses of caffeine on shooting performance (score), reaction time and target tracking times in Olympic double-trap. Please note that the aim of the research was not to promote or suggest the use of caffeine as a supplement but rather to establish if positive and/or negative effects may result from its consumption, and deliver this information to athletes.

***Procedures:***

Ten male subjects began the investigation but only five subjects fully completed the study. A further two subjects were present for two of the three testing trials and their data are included in the analysis. The other three participants withdrew from the study due to employment commitments or illness unrelated to the study. The seven shooters were all competitors in the Olympic double-trap at national level and participated in three testing trials at the Werribee International Shooting Complex, where each participant competed in four rounds at each of the three trials.

Three treatment conditions were randomly assigned to participants in a double-blind fashion – this signifies that both the participants and the investigators were unaware of which treatment condition they had been allocated, to prevent bias. The treatment groups were: (i) placebo (no caffeine: this condition was supplemented with a sugar tablet); (ii) 2 mg caffeine per kg of body weight and, (iii) 4 mg caffeine per kg of body weight. To put this into perspective, there is approximately 60 mg of caffeine in 1 cup of instant coffee. If a participant weighed 100kg for example, then 2 mg caffeine per kg of body weight

would be equivalent to consuming approximately 3.5 cups of instant coffee, or 6.5 cups of instant coffee for the 4 mg caffeine per kg of body weight treatment condition.

To ensure consistency during testing, participants were asked to prepare for each trial in the same manner on all three occasions; this included abstaining from all caffeinated food and beverage products in the 24-hours prior to each testing session. On arrival to the shooting range on the day of testing, participants submitted a 5 ml urine sample to the investigators to ensure complete hydration prior to the start of competition and, thus, to guarantee that dehydration was not a factor influencing performance.

Resting heart rate and blood pressure were recorded before the commencement of each round. Likewise, heart rate was recorded during the competition of each round. A psychological questionnaire known as the Competitive State Anxiety Inventory-2 (CSAI-2) was implemented 10 minutes prior to the commencement of competition for each trial. The CSAI-2 is a self-report anxiety questionnaire consisting of 27 sport-related questions about how an individual feels at that very moment in regard to their anxiety and confidence levels<sup>5</sup>

***Data Analysis:***

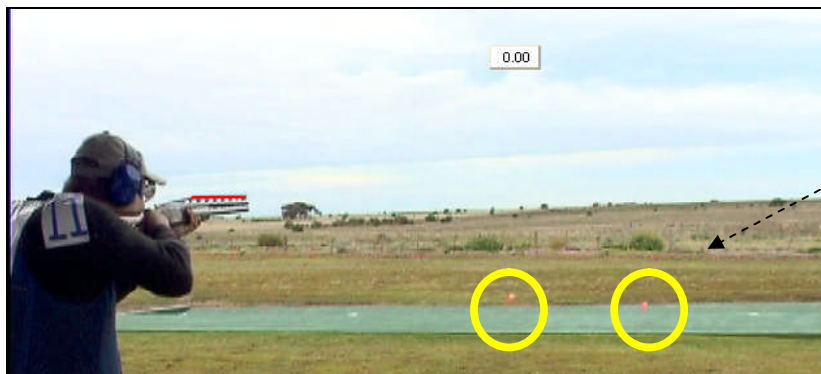
Three digital video cameras were mounted behind the five shooting stations to capture each participant during competition (refer to *Figure 1*).



*Figure 1.* Experimental set-up: placement of the digital video camera behind the shooter during competition.

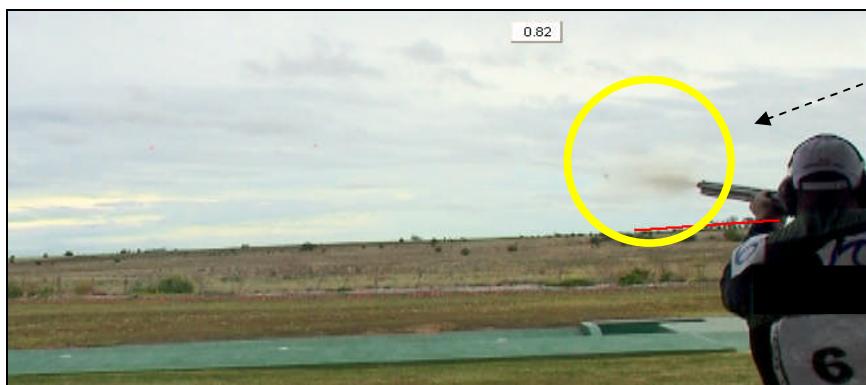
Digital video footage was analysed for any differences in:

- performance score/accuracy: recorded as a hit or miss for each of the 50 clay targets per round
- Reaction time: defined as the first initiated movement by the shooter after the release of the targets from the trench (refer to *Figure 2*)
- Tracking time of target one and target two: the time elapsed from clay target release to first and second cartridge discharge respectively (refer to *Figure 3*)



Time zero:  
Vision of the  
two clay targets  
from the trench.

*Figure 2:* Reaction time. The establishment of time zero was determined when the two clay targets were visible to the camera after release. A red line was drawn along the shaft of the shotgun as a visual reference for movement.



Grey smoke is  
visible from  
the end of the  
barrel of the  
shotgun when  
a cartridge is  
discharged

*Figure 3:* Tracking times of target one and target two were determined by vision of the clay target and then the visible puff of grey smoke emitted from the end on the shotgun barrel upon cartridge discharge.

***Findings:***

Statistically, the findings of this study suggest that caffeine provides no ergogenic benefit with respect to reaction time, target tracking times and, importantly, performance scores in the Olympic double-trap. Despite no statistical difference, there was a *trend* for participants to produce an improved reaction time; however, this was accompanied by a reduction in shooting accuracy (i.e. total score).

Despite previous research specific to shooting and target sports establishing a performance-enhancing effect from caffeine, such studies were conducted in a controlled laboratory based environment. The purpose of this study was aimed at practical application and, thus, all testing procedures were conducted in the field at an outdoor shooting range during a competition situation. Similar investigations to this study, where the effects of caffeine on target detection time and/or performance measures were assessed in a field situation or competition setting, also found caffeine to produce no significant effects on performance.

For complete results please refer to: Share, B., Sanders, N., & Kemp., J. (2009). Caffeine and performance in clay target shooting. *Journal of sports sciences*, 27(6), 661-666.

***Conclusion:***

Future studies with greater numbers of participants are required before a moderate dose of caffeine can be recommended for elite clay target shooting. Furthermore, this study tested a specific population of elite athletes and it is therefore recommended that recreational athletes take this into consideration.

***Recommendations:***

It is recommended that shooters investigate other avenues of their athletic performance for an enhancement before considering the use of caffeine as a supplementation. However, if you are contemplating using caffeine during competition or training, please do so under medical supervision to ensure the levels of consumption are safe and

appropriate. It is understood that some athletes experience a perceived or psychological benefit from the ingestion of caffeine; similarly, some individuals may be 'caffeine responders' while others experience no effects ('non-responders') with caffeine consumption. For both cases, our advice is once again to seek a medical opinion before use.

### ***Acknowledgements:***

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All testing procedures were conducted in accordance with the shotgun safety regulations stipulated by the International Shooting Sport Federation [ISSF] (2005); *Official Statutes, Rules and Regulations Document, section 9.2.2.*

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