

ABSTRACT

Caffeine is a stimulant drug that is found in products such as coffee, chocolate, painkillers, and colas. Caffeine activates the pleasure centers in the brain, increases heart rate and causes arterial constriction, which are hypothesized to be the cause of the ergogenic effects observed. Studies on resistance training remain scarce and more clarity is required due to both significant and not significant results. The literature for caffeine and high intensity exercise are limited as well; however, it currently shows a strong correlation between caffeine intake and improved performance. Research on caffeine in sport has mostly been conducted on endurance-based exercise and has shown significant increases in performance. Lastly, caffeine has shown to be ergogenic in maintenance of skill and cognitive function following fatiguing protocols. The doses found to produce ergogenic effects for resistance and high-intensity exercise have the potential of producing side effects such as insomnia, jitters, and nausea, which is why caution is advised for high intakes. Caffeine capsules, gum, and powder have shown to produce significant effects on performance, while caffeinated mouthwash, coffee, and energy shots have conflicting results. To address the gaps in the literature, future research should focus on resistance training, effects of various modes of caffeine supplementation and reaction time/skill maintenance.

OBJECTIVES

- To evaluate the effects of caffeine on Resistance, High-Intensity, and Endurance exercise, as well as Cognitive/Skill maintenance
- To evaluate the different doses of caffeine and determine if there is a dose-response relationship
- To evaluate if there was a difference between different forms of caffeine and their effects on exercise

METHODS

In order to evaluate the research on caffeine, a literature review was completed and sorted via the use of Mendeley. Inclusion criteria were recent (2010 onwards) primary research articles/reviews. Below is a list of databases used:

- PubMed
- Scopus
- Medline (OVID)
- Scholars Portal eJournals
- Web of Science
- Google Scholar
- RACER (service provided by York University Libraries)

Caffeine: Just a buzz or a great performance enhancer?

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RESULTS

Resistance Exercise

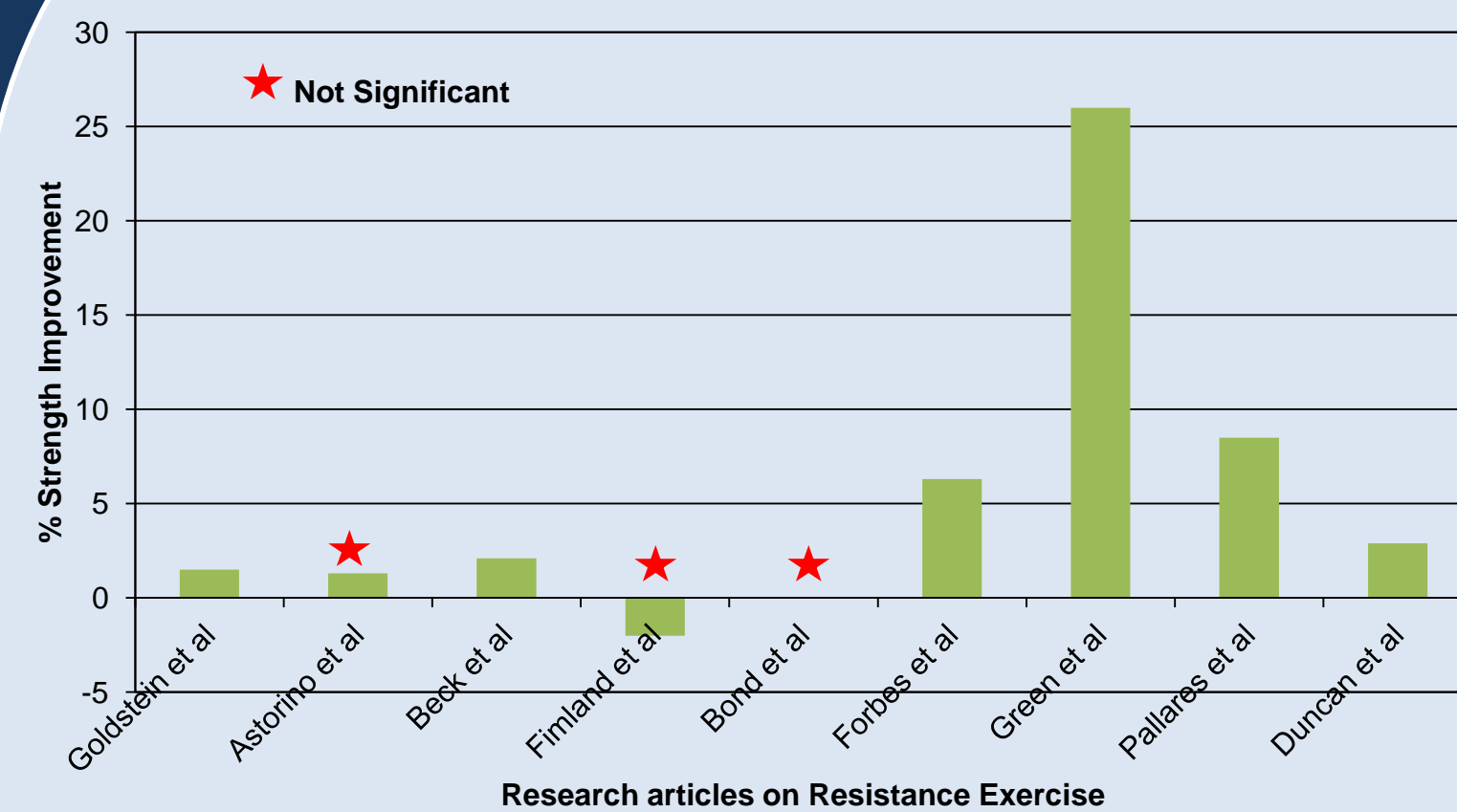


Figure 1: Caffeine improved resistance exercise performance by 1.5 – 26%. Red stars indicate research that found no significance after caffeine ingestion, in mostly 1 RM exercises, while muscular endurance improvements were consistent.

High-Intensity Exercise

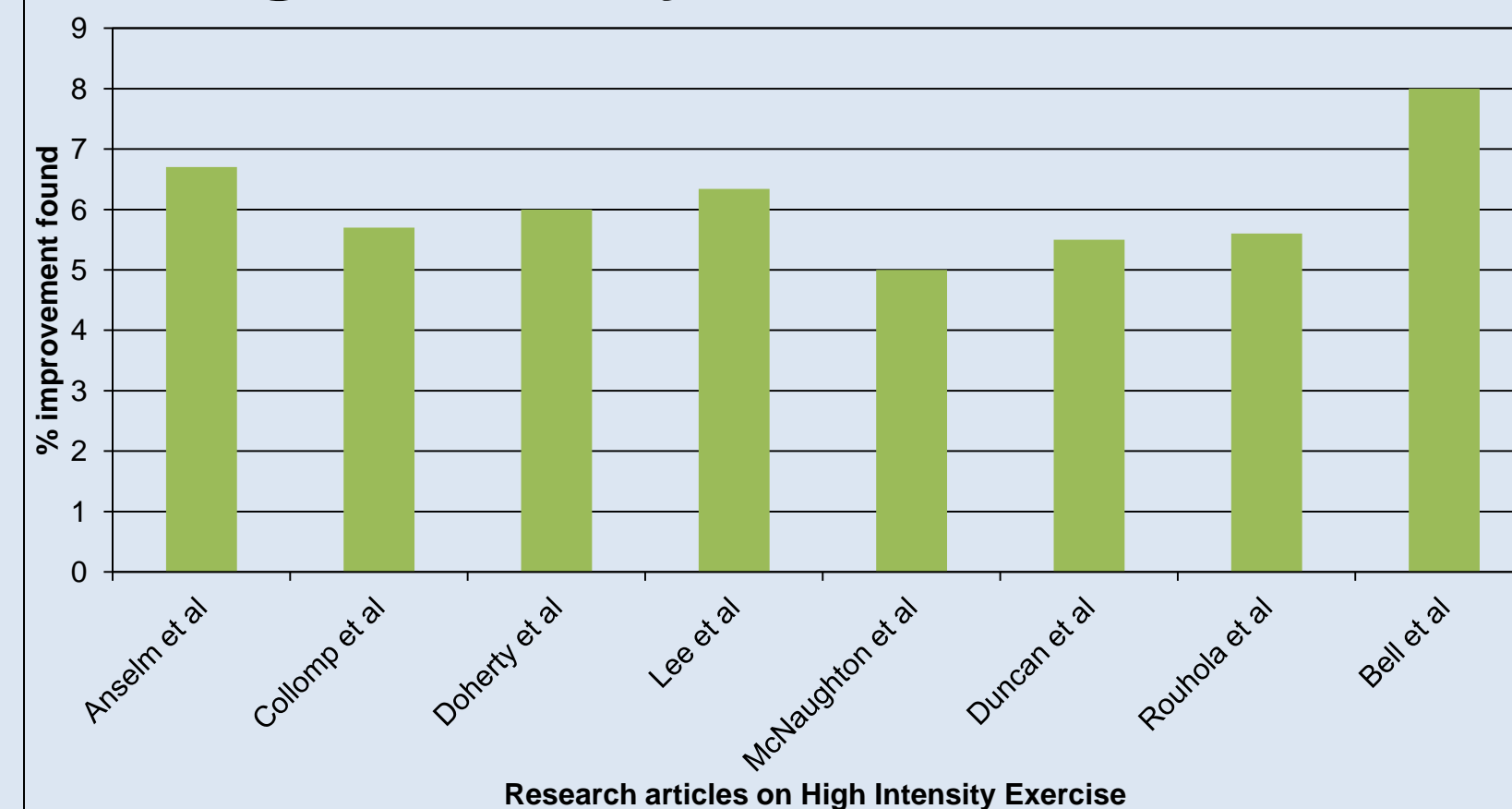


Figure 2: Caffeine improved high-intensity exercise by 5 – 8% (sprints, jumping, etc.) and also lowered RPE. Caffeine might have a heightened effect in trained vs. untrained individuals.

Endurance Exercise



Figure 3: Caffeine improved endurance exercise by 1.2 – 32% in running and cycle ergometer time trials. 2 studies found no significance, which can be attributed to the form of caffeine delivery (mouthwash and energy shots).

Cognitive/Skill maintenance

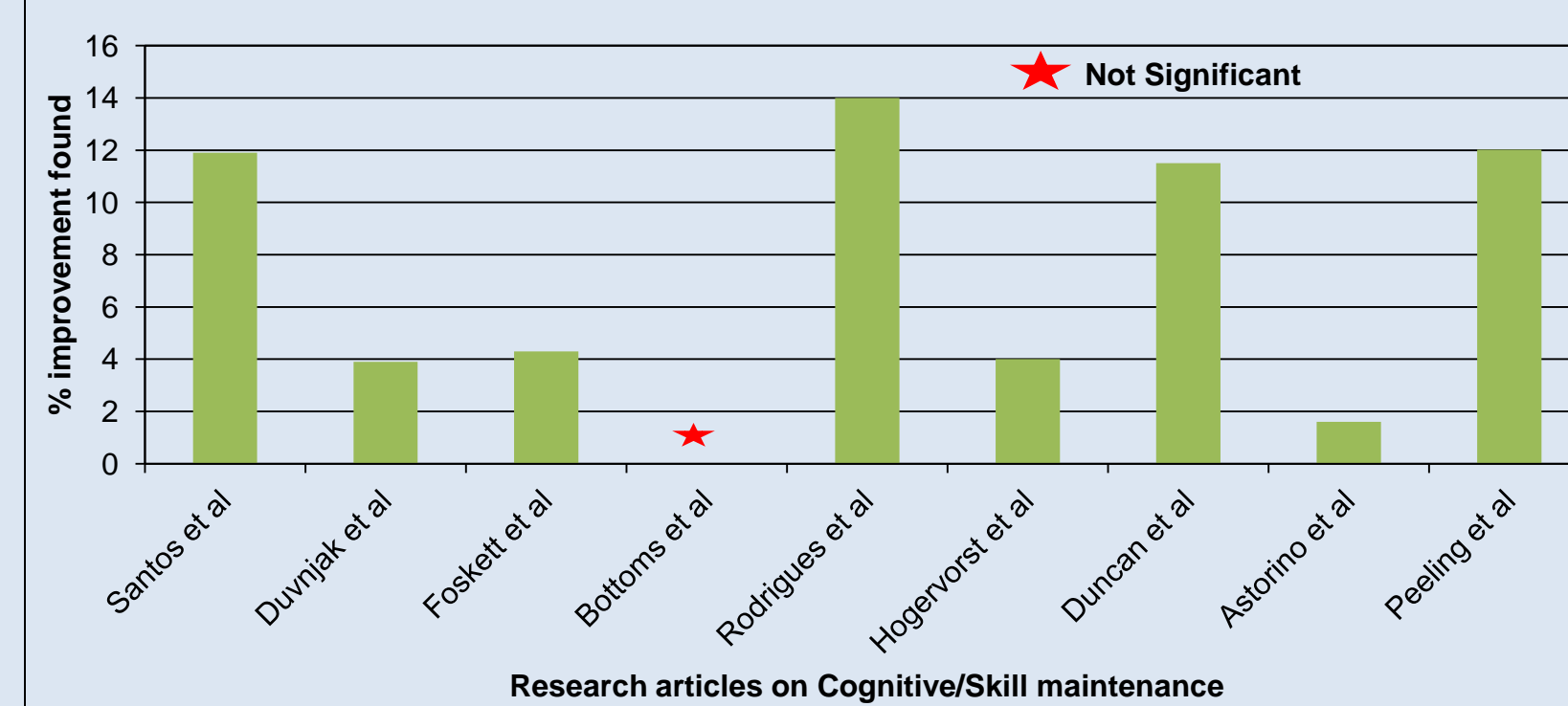


Figure 4: Caffeine improved/maintained cognition/skill by 3.9 – 12% (skill, accuracy, alertness, dribbling, clear-mindedness, etc.) post fatiguing protocols.

Table 1: The effects of different forms of caffeine intake and whether it leads to significant improvements on performance .

Caffeine form	Effect on performance
Caffeine capsule/tablet	Performance enhancing
Caffeine gum	Performance enhancing
Caffeine mouthwash	No effect
Caffeine powder	Performance enhancing
Coffee	Conflicting results
Energy shots	Conflicting results

Table 2: The doses for each exercise mode found to elicit a significant performance improvement. Higher doses may cause serious side effects.

Type of exercise	Dose for performance enhancement
Resistance exercise	2 mg/kg - 9 mg/kg
High-Intensity exercise	3.7 mg/kg - 15 mg/kg
Endurance exercise	2 mg/kg - 13 mg/kg
Cognitive/Skill maintenance	3 mg/kg - 6 mg/kg

DISCUSSION/ CONCLUSIONS

Caffeine and Resistance exercise

• Caffeine does not enhance 1 RM performance, but does have a significant effect increasing muscle endurance and muscle contraction velocity between 2 mg/kg – 9 mg/kg

• Higher doses of caffeine provide significant improvements in 1 RM. More research needs to be conducted

MUSCLE ENDURANCE 1 REP MAXIMUM

Caffeine and High-Intensity exercise

• Caffeine is ergogenic for short duration high-intensity exercise by increasing power output, time to exhaustion, and muscle velocity, while also decreasing RPE

• Doses of 3.7 mg/kg to 15 mg/kg provide significant enhancements in performance

• Possibly effective for trained vs. untrained athletes

POWER OUTPUT MUSCLE VELOCITY

Caffeine and Endurance exercise

• Caffeine enhances endurance performance, such as long distance cycling, running, rowing, and in soccer games

• Doses of 2 mg/kg – 13 mg/kg, 1 – 6 hours prior to exercise provide significant ergogenic effects in users and non-users

• There was no difference between lower and higher doses of caffeine on performance

LONG DISTANCE CYCLING RUNNING
ROWING TEAM SPORTS

Caffeine and Cognitive/Skill maintenance

• Caffeine supplementation aids in maintaining skills like passing and fencing accuracy, dribbling and stick handling

• Caffeine enhances cognitive attributes such as wakefulness, alertness, clear-mindedness, and energy levels

• Effective doses range between 3 mg/kg to 6 mg/kg

PASSING FENCING ACCURACY
STICK HANDLING DRIBBLING
ENERGY LEVEL ALERT CLEAR-MINDED

ACKNOWLEDGEMENTS

Thanks to Dr. Mazen Hamadeh for the great support and help provided throughout and after the course, and for providing countless opportunities to pursue this topic further.