

THE RELATIONSHIP BETWEEN THE USE OF LEGAL DRUGS AND THE PERFORMANCE OF PROFESSIONAL ATHLETES

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ABSTRACT

The use of legal substances by professional athletes is a widespread practice, often driven by the pursuit of improved performance, pain relief, or fatigue management. Caffeine, alcohol, nicotine, and nonsteroidal anti-inflammatory drugs (NSAIDs) are among the most commonly used substances, each with distinct mechanisms and implications. This paper reviews, through a narrative review of the scientific literature, evidence on the relationship between these drugs and athletic performance. Caffeine shows a consistent ergogenic effect on endurance, power, and technical-tactical skills, making it the legal substance with the strongest scientific support. Alcohol demonstrated predominantly detrimental effects on muscle recovery, with no proven performance benefits. Nicotine showed inconsistent results, and NSAIDs showed no ergogenic effect, being associated with gastrointestinal, renal, and cardiovascular risks. It is concluded that these substances have heterogeneous effects on performance, reinforcing the need for individualized professional guidance.

Keywords: Legal drugs; Athletic performance; Caffeine; Alcohol; Anti-inflammatory drugs.

1 INTRODUCTION

Athletic performance in professional athletes results from the interaction of genetic factors, training, nutrition, recovery, and the use of substances that modulate the body's response to exercise. Unlike substances banned by the World Anti-Doping Agency (WADA), there are legal drugs, available without prescription or restricted sale, that are widely consumed by athletes to improve performance, control pain, or reduce fatigue — notably caffeine, alcohol, nicotine, and NSAIDs.

Caffeine is recognized as one of the most studied ergogenic substances in sport, acting as an adenosine receptor antagonist in the central nervous system (CNS), which delays fatigue and favors performance in endurance and power activities¹. Ganio et al.¹ observed an average 3.2% improvement in endurance performance following caffeine ingestion.

Unlike caffeine, alcohol has no ergogenic purpose, but its consumption is associated with team social life. Nicotine, despite its association with smoking, has been used in smokeless

forms — gum, patches, and oral pouches. NSAIDs, meanwhile, are among the most widely used medications in sport, employed prophylactically and therapeutically for musculoskeletal pain, often without proper medical guidance. Given the relevance of the topic, this paper reviews the relationship between these four classes of legal drugs and athletic performance.

2 OBJECTIVE

To review the scientific evidence available in the literature on the effects of caffeine, alcohol, nicotine, and nonsteroidal anti-inflammatory drugs on the physical and athletic performance of professional athletes.

3 METHODOLOGY

This is a narrative literature review conducted using the PubMed/MEDLINE, Scopus, Web of Science, and SciELO databases, with the descriptors “caffeine”, “alcohol”, “nicotine”, “NSAID”, and “athletic performance”. Priority was given to systematic reviews, meta-analyses, and controlled studies relating these substances to parameters of performance, strength, or recovery. Studies on illicit substances and articles without full-text access were excluded.

4 DEVELOPMENT

4.1 Caffeine and athletic performance

Caffeine (1,3,7-trimethylxanthine) is the most widely used and studied legal ergogenic substance in sport, found in coffee, tea, and energy drinks. Its mechanism involves blocking adenosine receptors in the CNS, reducing the subjective perception of effort and fatigue¹.

Systematic reviews indicate a consistent ergogenic effect of caffeine on endurance. Ganio et al.¹ observed, across 21 studies, an average 3.2% improvement in performance, with greater consistency at doses of 3 to 6 mg/kg before exercise. Wang et al.², in a meta-analysis, confirmed caffeine's ergogenic effect on endurance running.

The benefits are not limited to endurance disciplines: in team sports such as basketball, Tan et al.³ report improvements in physical variables — vertical jump, sprint, and agility — and technical skills, such as shooting accuracy, although with notable heterogeneity among studies.

Despite these well-documented effects, individual response to caffeine is highly variable, influenced by genetic factors, sex, and consumption habits, reinforcing the need to individualize dose and timing of intake.

4.2 Alcohol and athletic performance

Unlike caffeine, alcohol (ethanol) has no ergogenic properties and is associated with detrimental effects on recovery. Vella and Cameron-Smith⁴ point out that alcohol consumption after exercise impairs glycogen resynthesis, reduces protein synthesis, and alters neuromuscular function, impairing recovery between sessions.

Barnes⁵ notes that acute consumption of high doses is associated with immunoendocrine changes and impaired protein synthesis, compromising tissue repair. Low doses (around 0.5 g/kg) appear to have limited impact, though they are not routinely recommended.

Among the deleterious effects of alcohol are: diuretic action, promoting dehydration; interference with thermoregulation; and impaired sleep quality. These effects make its consumption, especially in binge drinking patterns, incompatible with optimizing athletic performance.

4.3 Nicotine and athletic performance

Nicotine is the second most commonly used legal psychoactive substance in sport, used by athletes in American football, ice hockey, rugby, and combat sports, in smokeless forms — gum, patches, and oral pouches⁶. It is not on WADA's prohibited list but has been included in its monitoring program since 2012.

Mündel⁶ analyzed ten studies on the effects of nicotine on strength, power, and endurance: two found an ergogenic effect, one found an ergolytic effect, and seven found no significant change, attributed to methodological limitations and lack of experimental standardization.

Among the proposed mechanisms is the stimulation of nicotinic receptors in the CNS, increasing alertness and reducing pain perception. These effects coexist with risks, such as dependence potential, impaired thermoregulation, and the well-established adverse effects of tobacco on cardiovascular and respiratory health.

4.4 Nonsteroidal anti-inflammatory drugs (NSAIDs) and athletic performance

NSAIDs are widely used by athletes to control musculoskeletal pain, often prophylactically. Pedersen et al.⁷, in a meta-analysis of more than 44,000 young athletes, found a usage prevalence of 48% at a given time and up to 92% over the course of a season.

Despite their widespread use, the literature does not support an ergogenic effect of NSAIDs. Pham and Spaniol⁸ concluded that these substances control acute pain but do not benefit performance, and may even impair recovery and training adaptations, since inhibition of prostaglandin synthesis interferes with collagen synthesis and satellite cell activation.

Fitzpatrick et al.⁹ warn of the association between frequent NSAID use and adverse gastrointestinal, renal, and cardiovascular effects, especially in long-duration events. By masking pain, NSAIDs may also encourage continued participation despite injury, increasing the risk of aggravation.

5 CONCLUDING REMARKS

This review shows that the legal drugs most commonly used by athletes have heterogeneous effects on performance. Caffeine stands out as the only substance with consistent scientific support as an ergogenic aid. Alcohol offers no benefits and impairs muscle recovery. Nicotine shows inconsistent evidence, warranting caution, and NSAIDs, while not posing a doping risk, are likewise not an ergogenic resource and are associated with relevant health risks when used indiscriminately. This underscores the importance of multidisciplinary support — physicians, nutritionists, and physical education professionals — to guide the rational use of these substances.

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