Caffeine supplementation is beneficial for sustained maximal endurance exercise, when it is ingested at moderate doses (3–6 mg/kg body mass). Caffeine is also beneficial for high-intensity exercise, including team sports such as soccer and rugby, both of which are categorized by intermittent activity within a period of prolonged duration. However, when exercise is performed in high ambient temperatures, these effects are less obvious. The literature is equivocal when considering the effects of caffeine supplementation on strength-power performance [1].

The performance-enhancing effect of caffeine is accomplished through the antagonism of the adenosine receptors, influencing the dopaminergic and other neurotransmitter systems. Depending on the neurotransmitter system, caffeine can affect different brain areas with different functions. The most direct ways for caffeine to influence muscular performance is through its influence on the motor pathways. Adenosine and dopamine interact in the brain, and this might be one mechanism to explain how the important components of motivation (i.e. vigor, persistence and work output) and higher-order brain processes are involved in motor control. Caffeine maintains a higher dopamine concentration especially in those brain areas linked with ‘attention’. Through this neurochemical interaction, caffeine improves sustained attention, vigilance, and reduces symptoms of fatigue [2].

Other aspects that are localized in the central nervous system (CNS) are a reduction in skeletal muscle pain and force sensation, leading to a reduction in perception of effort during exercise and therefore influencing the motivational factors to sustain effort during exercise. Caffeine has anti-nociceptive actions. Muscle adenosine concentration is increased with muscle contractions, but whether adenosine plays a role in perceptions of naturally occurring skeletal muscle pain during exercise is unclear. The pain-reducing effect of blocking adenosine can be located both at the peripheral and central level, although the final perception and processing of the pain signal occurs through the CNS. Several studies have demonstrated that ingestion of caffeine significantly reduces muscle
pain intensity ratings in males and females during exercise both in males and females [3]. Although many studies have recently reported significant effects of caffeine on various cognitive and psychomotor tasks, fewer studies have reported the direct effects of caffeine on physiological tremor [4]. This effect has no real importance in endurance sports; however, in sports where accuracy (biathlon, shooting, archery, basketball, etc.) play a role, this CNS side effect of caffeine should be avoided.

Because not all CNS aspects have been examined in detail, one should consider that a placebo effect may also be present. It has also been suggested that beliefs about the effects of caffeine or caffeine expectancies may factor into the performance effects of caffeine. The effects of caffeine dose and/or caffeine instructions on performance (e.g. reaction time) or subjective outcomes (e.g. arousal) are more pronounced among participants who hold expectancies that caffeine produces those effects [5].

Overall, it appears that the performance-enhancing effects of caffeine reside in the brain, although more research is necessary to reveal the exact mechanisms through which the CNS effect is established.

References