The use of caffeine and its effects in endurance sports performance

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Running Head: CAFFEINE AND SPORTS The use of caffeine and its effects in endurance sports performance The use of caffeine and its effects in endurance sports performance The use of caffeine for increased endurance during sports performance is a controversial issue that has as many detractors as supporters. One of the primary resources for suggesting that caffeine is a valuable resource for sports performance is through advertising as advertisers use images of athletes to associate their drinks with energy and endurance (Aner & Shiv, 2009). Although advertisers like to create the association between caffeine and increased performance, Sizer, Pliche and Whitney (2011) claim that observationally, sometimes consumption of caffeine an hour before a performance will increase endurance, but at other times it appears to have no effect. On the other hand, according to McDaniel, McIntyre, Streitz, Jackson, & Gaudet, (2010), approximately 25% of all athletes use caffeine as a supplement to their performance and the effects can include increased endurance, clarity in thinking, and a resistance to fatigue. In looking at the use of caffeine both in experimental studies and through the effects that appear to be relevant, the use of caffeine in endurance sports performance can be assessed. Caffeine is a xanthine alkaloid, which means it is a part of a group of chemicals that act as stimulants. The purpose of caffeine in the natural world is to act as a pesticide in seeds, fruits and the leaves of certain plant life. For human beings, the substance acts as a psychoactive drug which stems off fatigue and stimulates alertness as it crosses the blood-brain barrier to act upon the central nervous system. Caffeine can have an effect on hormonal, muscular, metabolic, cardiovascular, renal and pulmonary functions. This means that

its effects can stimulate bronchodilation, vasodilation of blood vessels, lipolysis, blood filtration in the kidneys, neural activation of muscle contraction, peripheral fatigue, and it can lower the respiratory exchange ratio. Although there is a myth that caffeine can cause dehydration, caffeine does not create this effect (Kraemer, Fleck, & Deschenes, 2011). In most mammals, caffeine stimulates the TRPA1 channels which mean that it is recognized as the body as an irritant, as something that will cause pain or function as a stressor. In a study done by Nagatoma and Kubo (2008), mice showed activation of TRPA1 channels while humans did not experience the same activation. In another study done by Lu, Nolan, Lou, Peng, Wagner, and Conney (31 July 2007) mice exhibited a decrease of thickness in the dermal layer, which was shown to be between 38% and 68% after two weeks of receiving caffeine imbued water and allowed to exercise voluntarily. Parametrial fat pads were decreased by 35% to 77%. On the other hand, the increase in the effect of UVB on the epidermis was appreciated at 92% to 382%. Where mice responded differently to caffeine in regard to how the body recognized the substance, the effects were a loss in body fat with an increase in UVB apoptosis, meaning that cell death of the epidermis when exposed to UVB increased by a large margin. What can be deduced from these particular two studies is that where other mammals recognize caffeine as something that is undesired in the body, humans do not react in the same way. However, if the body of the human reacts to the use of caffeine in the same way as the mouse, a reduction in fat can be seen, while sensitivity to UVB can create problems where sun damage and the potential for cancer is concerned. Furthermore, scientists at Coventry University have proven that

caffeine intake in high doses increases muscle power and endurance through tests conducted on mice (Society for Experimental Biology, 2010). If caffeine works similarly in humans as it does in mice, the reduction of fat in the body would act positively towards sports performance as would the increase in muscle power and endurance. Powers (2006) identifies three ways in which caffeine can positively influence performance endurance. The first way is through the metabolic theory in which it is believed that caffeine improves endurance through increasing the utilization of fat as a fuel source and sparing the use of carbohydrates in compensation. The second way it might increase performance is through increasing the calcium content in skeletal muscle and therefore enhancing the strength associated with muscle contraction. The last way in which caffeine is associated to better endurance according to Powers (2006) is through the direct affect on the central nervous system which as previously stated creates stimulation and increased alertness and muscle recruitment. In addition, Beaven, Hopkins, Hansen, Wood, Cronin and Lowe (2008) show that increases of testosterone could be appreciated at 15% while cortisol was increased as much as 52% depending on the dosage of caffeine which would create a decrease in the testosterone to cortisol ratio which is counterproductive to the testosterone increase. The best use of caffeine can be seen if the athlete abstains from caffeine for seven days before performance, thus the body is not used to the substance and can benefit for the greatest amount of effect. Overall, the effect is dependent upon the time that it is ingested, the amount, and the form in which it is consumed (Ganio, Klau, Casa, Armstrong & Maresh, 2009). Caffeine has a high potential for great benefit to the athlete. The various

studies that have been looked at for this review show that decreases in body fat and fatigue can help to enhance the performance of the athlete as they perform. Through the increase in testosterone and the stimulation of the central nervous system, an increase in endurance can be experienced. At least a quarter of all athletes are using caffeine as a supplement to performance, but unfortunately the positive effects of caffeine are not always observationally apparent. Caffeine use is highly dependent upon how the substance is consumed. The time and the form are relevant to the potential benefit as is the dosage amount. As well, abstinence for a time period before performance may contribute to a higher benefit. The use of caffeine on endurance during sports performance is shown to have benefits when used through appropriate ingestion for the athlete. References Aner, S. & Shiv B. (October 2009). Unraveling priming: When does the same prime activate a goal versus a trait? Journal of Consumer Research. 35 (3), 418-421. Beaven, C., Hopkins, W. G., Hansen, K. T., Wood, M. R., Cronin, J. B. & Lowe, T. E. (2008) Dose Effect of Caffeine on Testosterone and Cortisol Responses to Resistance Exercise. International Journal of Sport Nutrition & Exercise Metabolism, 18 (2), 131-141. Ganio M. S., Klau J. F., Casa D. J., Armstrong L. E., & Maresh C. M. (23 January 2009). Effect on caffeine sport-specific endurance performance: A systematic review. Journal of Strength and Conditioning Research. 1, 315-324. Kraemer, W. J., Fleck, S. J., & Deschenes, M. R. (2011). Exercise physiology: Integrated from theory to practical applications. Philadelphia: Wolters Kluwer/Lippincott Williams & Wilkins Health. Lu, Y. P., Nolan, B., Lou, Y. R., Peng, Q. Y., Wagner, G. C, & Conney, A. H. (31 July 2007). Voluntary exercise together with oral caffeine

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