PROJECT REVIEW

"The Dose of Inhaled Beta2-Agonists on Athletic Performance in Non-Asthmatic Elite Athletes: Competitive or Statistical Significance?"

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The purpose of this study is to determine the dose-response effects of inhaled B_2-agonists on exercise performance in elite non-asthmatic athletes using a sport specific test of performance.

To investigate the dose-response effect of inhaled B_2-agonists (IBA) on athletic performance elite, male, non-asthmatic cyclists will volunteer to participate in this randomized, double-blind repeated measures study. The sample size will be determined following a pilot study to determine the within-subject variability in a simulated 20km time trial. The minimum worthwhile difference in performance will be equivalent to 0.5-0.7 of the within-subject coefficient of variance.

Subjects will be screened for asthma using a eucapneic voluntary hyperpnea test with positive responders excluded from the study. Following baseline measurements, height, weight, $V0_2$, average performance velocity, average performance in watts, and 20km time trial performance will be measured in the laboratory during each of 4 testing sessions.

The order of treatment will be randomized among placebo, 200~.tg, 400~.ig, and 800~.tg of salbutamol administered by inhaler. The results of this study will determine whether the administration of BA influences performance in elite cyclists from competitive and statistically significant perspectives. Additionally, this study will determine if there is a dose response relationship between IBA, exercise performance and the appearance of salbutamol in the urine.

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Results and Conclusions

The intention of this project was to address two questions: what are the relationships between SAL dose and exercise performance in a simulated cycling time-trail, and what are the effects of dose on cSAL as used in doping control?

Two studies were used to demonstrate that inhaled SAL does not enhance endurance performance in non-asthmatic athletes when using a highly reproducible and sport-specific test. This is the first examination of the dose-response effect of inhaled salbutamol using a sport-specific performance evaluation and used a substantially larger sample size (n=27) compared to most previous work. The lack of a dose-response relationship further supports previous findings that acute SAL inhalation does not enhance exercise performance in non-asthmatics.

Furthermore, the short duration of the time trial may not have provided sufficient stimulus for changes in hydration status that can accompany longer duration exercise. Even though most urine samples generally fell well below the WADA limit of 1000 ng/mL, the possibility exists for individuals to exceed this value following inhaled administration. A significant relationship between cSAL and urine SG was observed at higher doses, signifying the potential impact of hydration on values observed in doping control. As with exercise, the role of hydration and individual differences in absorption, metabolism, and excretion on cSAL require further investigation.

It is also noted that the finding of SAL to be non-ergogenic cannot preclude the possibility that continued, short-term (2-3 weeks) use of inhaled SAL would not be performance enhancing. Regular use of SAL during both training and competition would be expected and I is possible that continued elevated plasma levels following inhalation may increase ergogenic properties of SAL. Future research needs to be conducted to eliminate this possibility.

Lastly, it was observed that a large portion (~19%) of the cyclists/triathletes tested were susceptible to airway hyperresponsiveness. Although a small number of cyclists and triathletes were recruited for these studies, the possibility exists that there is a significant portion of this athlete population competing with impaired airway function unbeknownst to them. Although potential mechanisms for increased airway hyperresponsiveness in certain athletes have been postulated, longitudinal research is required to track changes in airway function with length of time in specific sports.

In conclusion, this project demonstrated a lack of dose-response in relationship with SAL and exercise performance in non-asthmatic athletes and that urine cSAL following exercise are highly variable and dose-dependent.

Publications:

1. Sporer, B.C., and D.C. McKenzie. (in press) Indoor time-trial reliability using the Velotron. International Journal of Sports Medicine. (accepted August 2006).

2. Sporer, B.C., A.W. Sheel, J. Taunton, J.L. Rupert, & D.C. McKenzie. Urine concentrations of salbutamol and doping control. (Submitted August 2006).

Presentations:

1. Sporer, B.C. & D.C. McKenzie (2006). B.C. Sporer and D.C. McKenzie. Variability in urine concentrations of salbutamol: implications for doping control. Applied Physiology, Nutrition, and Metabolism 31:S80. Presented at Canadian Society of Exercise Physiology Annual Conference, Halifax, NS, Canada, November 2006.

2. Sporer, B.C. and D.C. McKenzie (2005). Reproducibility of a 20 km laboratory-based cycling time-trial in competitive cyclists using the Velotron Pro cycle ergometer. Medicine and Science in Sports and Exercise 37(5S), S76-S77. Presented at the American College of Sports Medicine Annual Conference, Nashville, TN, USA, June 2005.

3. Sporer, B.C., J. Brooks, & D.C. McKenzie (2006). The dose-response of inhaled B2-agonists on athletic performance in non-asthmatic competitive athletes. European College of Sport Science. Presented at European College of Sport Science Annual Conference, Lausanne, Switzerland, July 2006.